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WALTER D. CROSMAN, EDITOR.

EDWIN N. LEWIS, MANAGER.

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WASHING OUT locomotive boilers with cold water is valuably treated of in another page of this issue by a contributor, Mr. Edward Grafstrom. The article is particularly valuable in that it gives some exact data, based on careful experiment, which should result in a considerable economy when properly applied. It upsets the old theory that hot water is necessary for washing out, and shows that it is *safe* to use cold water. The attempt to use hot water has usually resulted in a reduced pressure of the impinging jet—as it was found impossible to heat water by steam when it flowed at a high velocity. It is much more important to use a jet at high velocity for washing off mud or scale than one at a high temperature; and when the attempt to heat the water is abandoned the high pressure is easily available with a good pump. It is rather surprising to find how low the temperature of the firebox sheet is when washing commences, and this fact explains why it is not injured when washed with cold water. At a temperature of  $260^{\circ}$  firebox steel is not in a critical condition, and the tests Mr. Grafstrom has made show that it is not injured in the least by sudden cooling.

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## The Friction of Locomotive Slide Valves and Valve Rods.

A number of attempts have been made to measure the friction of locomotive slide valves, but it has always been found a difficult subject for exact experimental work, and the conditions under which each set of tests were made are so different that they are hardly comparable one with the other. The last effort in this direction was made at the Rose Polytechnic Institute, Terre Haute, Ind., by Professor Frank C. Wagner, and is described in a paper before the last meeting of the American Society of Mechanical Engineers.

Mr. Wagner's method of measuring the power required to drive the valve is new and ingenious. It is also more accurate than the liquid

dynamometers which have been used in all previous experiments. The locomotive was arranged so that the back-up eccentric rod was driven by an electric motor with a crank attached to its shaft. The power used to drive the valve was then obtained by measuring the electric power delivered to the motor, and making suitable allowances for the efficiency of the motor and the friction of the transmitting mechanism. The valve was 17 inches by  $9\frac{1}{4}$  inches, its total area was  $157\frac{1}{4}$  square inches, and the balance portion was  $54\frac{1}{2}$  square inches, or 34 per cent. The per cent balance is unusually small and only about one-half that found in good practice at the present time. Only two tests are reported; each of them at a speed of about 400 revolutions per minute. One test was made with a steam chest pressure of 42 pounds and the other with a pressure of 122 pounds. Under the light pressure the horse-power required to drive the valve was 1.55, and the coefficient of friction was 5 per cent. Under the higher steam chest pressure of 122 pounds, it required 3.31 horse-power to drive the valve and the coefficient of friction was 3.6 per cent. These are the principal results obtained from the experiments, and it is unfortunate that a larger number of tests were not made under conditions of speed and pressure corresponding with the average service of the locomotive.

We will now give the results of some previous experiments on the friction of locomotive slide valves, and will then summarize the principal figures for convenient comparison. In the RAILWAY MASTER MECHANIC of November, 1886, is a description of one of the earliest investigations of this kind. It was made by the test department of one of the Chicago roads, the object being to ascertain the difference in the power required to move a plain slide valve and a balance slide valve on the same locomotive. The apparatus consisted of a piston dynamometer placed on the valve stem and connected with an indicator. The engine had cylinders 18x24, and the valve was  $18\frac{3}{4}$  inches by  $8\frac{3}{4}$  inches, 62 per cent of it being balanced. The average results, with a boiler pressure of 135 pounds and speeds up to 20 miles per hour, showed that it required a force of 330 pounds to move the balanced valve, and 905 pounds to move the plain valve. The balanced valve offers but  $36\frac{1}{2}$  per cent of the resistance of the plain valve under about the same pressure. Six horse-power was required to work the plain valve at 40 miles per hour, while the balance valve required only 2.2-10 horse-power at the same speed. The coefficient of friction of the plain valve was 4 per cent, and for the balanced valve  $1\frac{1}{2}$  per cent. These experiments were made

with the engine in regular service, and the lubrication of the valves was free and continuous. The cylinder of the engine was not indicated, and the work of overcoming the valve friction is not therefore given in per cent of cylinder power.

In 1896 a committee of the Master Mechanics' Association made a report on balanced valves which gives the results of some tests made on the locomotive at Purdue University, to determine the friction of balanced valves. The valve was 19 inches by  $8\frac{1}{2}$  inches, and according to the rule adopted by the committee, the per cent balanced was 57. The rule recommended for balancing slide valves, both Allen and plain, was: Area of balance equal area of exhaust port, plus area of two bridges, plus area of one steam port. The average results showed that the unbalanced valve required twice as much work to move it as the balanced valve, and it is believed that this represents conditions in ordinary railway practice.

The tabulated figures in the report are in such shape that it is difficult to select a few principal figures representing general results, but we give the following as coming closer to ordinary conditions than most of the other figures: At  $6\frac{1}{2}$ -inch cut-off, at a speed of 20 miles an hour and 120 pounds steam chest pressure, it required .63 horse-power to move the valve. At 40 miles per hour and 132 pounds steam chest pressure it required 1.25 horse-power.

In connection with the work of this committee, some road tests were made on a 19x24 mogul engine with a piston valve, using the same hydrostatic dynamometer employed in the shop tests. The results show that at 69 revolutions and 117 pounds steam chest pressure, it required .37 horse-power to move the piston valve; at 108 revolutions and 113 pounds steam chest pressure, .42 horse-power; at 190 revolutions and 145 pounds steam chest pressure, 1.4 horse-power, or 6-10 per cent of the cylinder power.

The average results, compared with the shop tests of balanced flat slide valves, show that the power consumed by the piston valve was  $\frac{1}{4}$  of 1 per cent of the power of one cylinder, while the best figures from the test of balanced flat valves averaged  $\frac{1}{2}$  per cent, the piston valve requiring only one-half as much power as the latter.

We can, therefore, arrive at the general conclusion that a balanced flat valve requires only one-half the force to move it as an unbalanced valve, and a piston valve only one-half that of the balanced valve, or one-fourth that required by the plain valve.

Aspinall, in England, made two sets of tests of valve friction, one in 1889 and another in 1898. The general results of the later investigation showed that, with boiler pressure at 150 pounds, and speed at 6 to 18 miles per hour, and the lubrication 4 drops per minute, a plain phosphor bronze valve required 1,946 pounds to overcome its friction, and the average coefficient of friction was 8.78 per cent. With a cast iron Richardson balanced valve, the average force required to overcome friction was 854 pounds, and the coefficient of friction was 9.19 per cent.

If we summarize the principal figures obtained by the different investigators here quoted, it will be found difficult, if not impossible, to obtain an average which will have general application. The showing would be about as follows:

INVESTIGATOR.	Speed: Miles per Hour.	Steam Chest Pressure.	Horse Power Required to Move Valve.	Coefficient of Friction.	Kind of Valves.
1886—P. Wallis.....	} 40	130	6	4 %	Plain.
		130	2.2	1½ %	Balanced—62 %.
1896—Master Mechanics' Association Committee....	} 20	120	.63	.....	Balanced—57 %.
		132	1.25	.....	Balanced.
		106	1.28	.....	Plain.
		130	3.19	.....	Plain.
		145	1.40	.....	Piston.
		150	.90	.....	Piston.
1899—Wagner.....	} About 60	135	.50	.....	Piston.
		42	1.55	5 %	Balanced—34 %.
		122	3.31	3.6 %	Balanced—34 %.
1898—Aspinall.....	} 6 to 18	145	....	8.78 %	Plain Ph. Bronze
		145	....	9.19 %	Bal. Richardson

Some of the discrepancies noted above may be accounted for by the difference in lubrication, but, like many other locomotive tests, too many variables enter into the conditions, and results are obtained which are not comparable.

We will mention one source of error which may account for some of the erratic figures obtained: The Master Mechanics' Committee was unable to determine the stuffing-box friction of the valve stem, but states that it would probably be constant. None of the investigators of valve friction have taken account of the resistance of the packing of the valve stem, and while it may be constant during a test, it is important to know its amount, as it may be nearly equal to the friction of the valve itself. Indeed, it is easy to believe that, under certain conditions, it may be greater, and supposed tests of valve friction may really have been measurements of *valve stem* friction.

On modern locomotives the valve stem is at least 2 inches in diameter, and it is interesting, therefore, to note a paper before the recent meeting of the Mechanical Engineers' Society on the friction of steam packing, which gives the results of tests to determine the resistance of a 2-inch rod with various kinds of packing in the stuffing-box. From the data obtained the author calculates that, at a speed of 600 feet per minute and 50 pounds steam pressure, the average friction of the valve stem was equal to .3 horse-power. With hard packing, it was found that the friction increased almost directly with the pressure, and at 170 pounds pressure the loss would be 1 horse-power—this under conditions where the gland nuts were tightened with the fingers only. There is almost no limit to the friction loss caused by the injudicious use of the monkey wrench in tightening up nuts on valve stem or piston rod glands. It is important, therefore, that, in any careful test of valve friction, the variable loss, due to valve rod friction, be also measured and taken account of. With balanced or piston valves, the loss due to friction is small in any case when measured by the coal required for the work, but it is a satisfaction to know that it *is* small. The incidental effects of this resistance are more important.

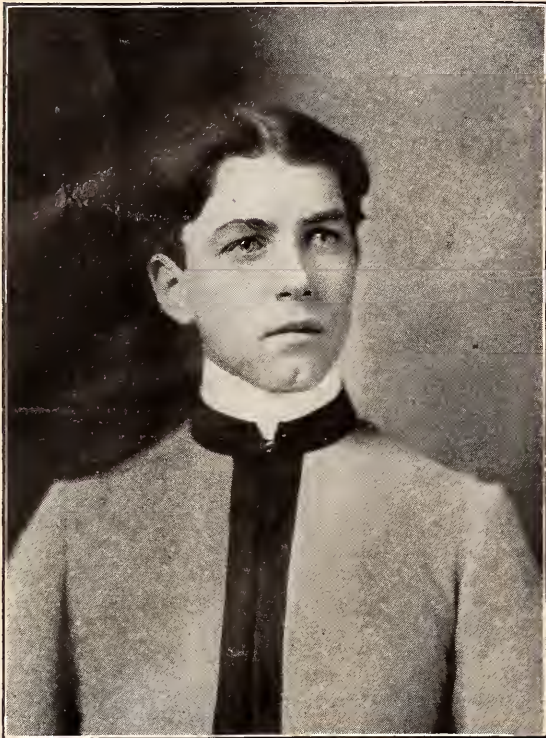
The steam and coal consumption is increased by excessive valve friction in three ways—first, by the extra work to be overcome in moving the valve; second, by the irregularity produced in the valve motion by strains on the valve gear; and third, by the fact that when the valve moves hard the engineer does not take advantage of the most economical cut-off as constantly as he would if the reverse lever was more easily adjusted.

The necessity for an easy movement of the reverse lever, by which, of course, the valve is moved by hand, has really led to the improvements in locomotive slide valves. With the large valves now in use and high pressure steam, a plain slide valve, unbalanced, would really be impracticable, and these conditions developed the necessity for a balanced valve. With continued increase in the size of the valve and in the boiler pressure, the work required to move the balanced valve by hand was so great that relief was only found in the use of the piston valve. The tests of piston valves which we quote, showing that the work required to move them is only one-half that required for a good flat balanced valve, are thus a very good reason for the general introduction of piston valves on large engines carrying high pressure.

## The Disposition of Railway Club Funds.

In our issue of November, 1899, we had something to say about the disposition of railway club funds, and at that time especially commended the St. Louis Club for its action in providing a scholarship in Blee's Military Academy, open to competition among the sons of its members. Chas. E. Koons, the son of the master car painter of the St. Louis Car

Co., was the fortunate young man who secured the scholarship, and has, in commencing his school year, already reflected credit upon the club, having stood highest in his entrance examination at the college. We give an excellent likeness of young Koons herewith. We understand that the club contemplates offering another scholarship as soon as arrangements can be perfected—this second one to be in Washington University.



CHARLES E. KOONS

Who is now enjoying a scholarship at Blee's Military Academy, given by the St. Louis Railway Club.

[The St. Louis Club is giving scholarships to sons of its members; the Western Club maintains a fine technical library and gives bound volumes of its Proceedings to its members; the Central Club endows hospital beds. Next!]

In this connection we wish to note that at the November meeting of the Central Railway Club, Mr. John Mackenzie warmly supported the position that we had taken with reference to the idle spending of club funds, and the president of the club subsequently stated that Mr. Mackenzie had but voiced the

sentiment of the Executive Committee. President Miller referred to the club's past lavish expenditure of funds, and said, in effect, that the Executive Committee had now taken a stand against the spending of money where it would not do any great good, and had instructed its present committee on annual entertainment to provide nothing elaborate. This club, at the same meeting, appropriated \$300 for the Brooks Memorial Hospital, at Dunkirk, N. Y.,—\$150 of which is to equip a room in the hospital to be known as the "Central Railway Club Room"; \$100 to

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equip a "Central Railway Club" bed in one of the hospital wards, and \$50 as a donation toward an elevator to be placed in the hospital.

At the same meeting of the Central Club a movement was started to have the club also endow a bed for railway men in some Buffalo hospital. It is evident that there is an awakening in progress. We now have the St. Louis Club giving scholarships to sons of its members; the Western Club maintaining a technical library and giving bound volumes of its Proceedings to its members, and the Central Club endowing hospital beds. How will these object lessons in the proper utilization of club funds be followed?

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## ON THE USE OF COLD WATER FOR WASHING OUT BOILERS.

BY EDWARD GRAFSTROM, MEM. AM. SOC. M. E.

The opinions of railway master mechanics differ widely on the question of what effect cold water, when used for washing out a hot boiler, has on the firebox steel. On many railroads it is the rule to mix the hot water in the boiler with cold, after the steam has been blown off, in order to cool off the boiler gradually, and in some places hot water is used exclusively for washing-out purposes. During the present busy times, it has not always been found convenient to wait for the boiler to cool, and hot water has sometimes not been available, in which cases the roundhouse foreman has given permission to turn on the cold water, against his judgment, and with a foreboding of future trouble with cracked side sheets and leaky flues.

On other railroads, however, especially when soda ash is not used, cold water is preferred on account of cracking off the scale better; and as soon as the steam and the hot water have been emptied out, streams of cold water are turned in, regardless of the consequences to the steel. The advocates of this system claim that there are no initial strains in the boiler when cold, for the reason that it was built in a cold state; and to bring it back to the temperature at which it was put up, will merely relieve it of all internal strains that have been produced in firing it up. In other words, while the structure is under the influence of the steam pressure and the high temperature due to the fire and the steam, it is under a strain, which gradually relaxes when the fire is knocked out and the steam is drawn, until it is virtually in its natural condition, when the cold water is turned in. This claim of immunity is based on the rapid

equalization of heat by conduction, as well as on the theory that, although a suddenly applied strain is twice as severe as one of the same magnitude gradually applied, yet it remains still to be shown that the sudden termination of a strain has any detrimental effect on the structure, even if the strain has been above the yield point. This is apparently due to the molecular inertia of the material.

It should not appear, from the above, that anybody believes it harmless to keep a stream of cold water playing on one particular spot of a hot steel plate. On the contrary, the water should be made to flow as evenly as possible over the hot sheets, so as to promote uniform contraction, no matter how rapid, as is the custom at shops where cold water is used exclusively.

Putting the question of internal strains aside for the present, there remains, nevertheless, the possibility that the heated steel plate, coming in sudden contact with the cold water, may become crystalline, brittle or fatigued—whatever term is preferred. At first thought, this does not only seem possible, but probable; if not at one time, yet after repeated operations. In order to clear up this phase of the question to his own satisfaction, the writer recently made some tests, the description and results of which are given herewith.

For the purpose of finding the temperature of the firebox sheets after the boiler had been emptied of steam and water and was ready for washing out, a thermometric scale was established by means of ascertaining the melting points of various substances, from beeswax, melting at  $140^{\circ}$ , to sealing wax, sugar, sulphur, etc., up to asphaltum, melting at  $290^{\circ}$  Fahr. By holding these substances against the firebox sheets of different locomotives ready for washing, it was found that the highest temperature was close to  $260^{\circ}$ .

Four coupons were next cut from new firebox steel. Two of these were heated at a forge to  $260^{\circ}$ , and then immersed in running water of the same temperature as that used for washing-out purposes. This operation was repeated 96 times, care being taken that the same side of each coupon was against the fire every time. Few boilers only are washed out as often as 96 times a year, so that this was taken to represent the severest effect of a year in the washing out of a boiler.

One of the coupons thus treated and one of the two in their original state were then put through a cold-bending test. Both of them doubled up flat, without showing a sign of cracking.

The other two coupons, one treated and the other not, were next put in a testing machine. The result was an ultimate tensile strength

for the heated coupon of 61,700 pounds, and for the other one 61,200 pounds. The elongation in both instances was the same.

From this it appears that the effect of cold water upon a hot steel plate, under the conditions usually connected with the washing out of boilers, does not affect the properties of the steel. Every master mechanic is familiar with the sudden cracking of a side sheet, when the hot water has been let out, or when the washing out is in progress; but this has also happened when hot water has been used, and is apparently due to internal strains in the structure, caused by local contractions, or to other circumstances not connected with the washing-out process; such, for instance, as excessive bulging out of the sides of a long firebox, from the mud-ring upwards.

## AN OLD TIME LOCOMOTIVE.

Through the courtesy of Mr. H. F. Dowst, general manager of the Washington County Railroad, of Maine, we are enabled to present a



THE OLD ENGINE, "LION." -

view of the old engine "Lion." This locomotive was first operated in 1843 on the old Palmer & Machiasport Railroad, afterward called the Whitneyville & Machiasport, and long since abandoned. The "Lion" was built in Boston in 1843, and was used constantly up to Dec. 31, 1890. A companion engine, similar in construction, called the "Tiger"

was also built the same year, and used quite as long. The road was used for the hauling of lumber from Mr. Cornelius Sullivan's mill, near Whitneyville, to Machiasport for shipment by water. The length of the line was  $7\frac{7}{8}$  miles, and it was of standard gauge. In 1897 the city of Portland bought the "Lion," and it is now on exhibition there. The same year a paper company at Lincoln, Me., bought the "Tiger," and

she is still in use, together with several of the old flat cars, hauling pulp-wood.

Mr. C. Sullivan, Jr., of Whitneyville, Me., whose father at one time owned the "Lion," furnishes the following information concerning this old relic: "This engine had driving wheels 4 feet in diameter; the cylinders were 9 inches diameter inside, and were 24 inches long, having a slide 18 inches long. The boilers were, I think,  $3\frac{1}{2}$  feet in diameter and 12 to 13 feet long, including the firebox, which was  $2\frac{1}{2}$  feet, leaving the shell about 10 feet long. They were wood burners, and had 72 copper tubes, 2-inch bore. They used to carry, when working, 60 to 125 pounds of steam; usually 90 pounds was carried. I think this was about the average. The same boilers were on them when they quit running that came on them when the engines were built. They used to draw seven and eight cars to a train, of forty-five to fifty thousand feet of dry lumber, and from thirty to thirty-five thousand feet of newly sawn pine, spruce or hemlock. They were built by Hinkley & Drury, of Boston, Mass. Later the firm changed to Hinkley & Williams. The engines weighed about 10 tons."

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## 70,000 POUNDS HIGH SIDE GONDOLA, P & R. RY.

The accompanying illustrations represent the new 70,000 pounds capacity high side gondolas designed in the office of the mechanical engineer of the Philadelphia & Reading while Mr. L. A. Shepard was the mechanical engineer of that road.

The specifications call for a car 34 feet long by 8 feet  $4\frac{1}{4}$  inches wide by 30 inches high inside. Two drop doors are provided, each 5 feet 4 inches long by  $14\frac{5}{8}$  inches wide, extending between the two intermediate sills and the needle beams, one door on each side of the center of the car. The usual location of the drop bottoms is between the needle beams and bolsters, but in this car they are located between needle beams on account of the arrangement of the coal pockets at different points on the system, making it more convenient for unloading from the center of the car.

The car was not designed primarily as a coal car, but more especially with reference to the ore and iron trade, its design at the same time making it possible for it to be used also in the coal carrying service.

The framing of the car consists of two side sills and two center sills of yellow pine, each 5 inches by 9 inches; four intermediate sills of yellow pine, 4 inches by 9 inches; two end sills of oak, 8 inches by 10



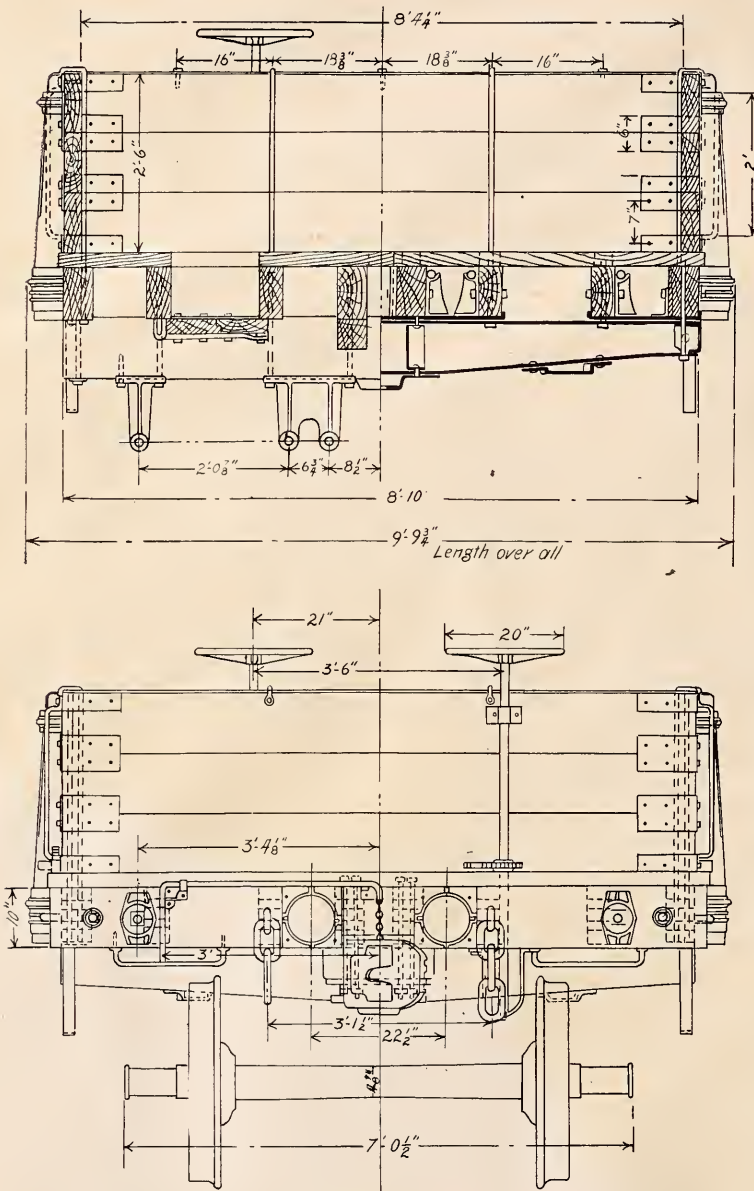
ter and two intermediate truss rods, and have pockets to receive the outer ends of the draft timbers. The needle beams are gained out  $\frac{1}{2}$ -inch deep to fit over longitudinal sills.

By means of the filling timbers, the framing of the car is strengthened, and at the same time a sort of continuous draft rigging is obtained

which gives more material for resisting the buffing strains, not distributing as much to the car framing proper as in cases of cars not provided with filling timbers.

Both ends of the car are equipped with safety chains, which are secured by  $1\frac{3}{8}$ -inch eye bolts with large washer and nut, bearing on the inside of the end sills. The Fox pressed steel body bolsters with malleable iron side bearings and the Fox pressed steel truck are also used.

The car has six truss rods  $1\frac{1}{4}$ -inch diameter, upset to  $1\frac{5}{8}$ -inch diameter at the threads. The outside rods bear on malleable iron truss rod washers,



70,000 POUNDS HIGH SIDE GONDOLA—P. & R. RY.

while the other rods, as previously stated, bear on the pressed steel end sill plates.

The doors for the drop bottoms are made of the best white oak,  $2\frac{7}{8}$  inches thick, each door being constructed in two pieces, bound together by strap iron and the hinges. The doors are closed by means of a

winding chain and shaft. The shaft is made of wrought iron, 2 inches in diameter, extending across the car and resting upon the top of the longitudinal sills.

The side and end planks are made of  $2\frac{7}{8}$ -inch yellow pine, and are protected from wear on top by  $\frac{1}{4}$ -inch iron running the full length of the planks. Sixteen side stakes hold the planks in place. The end planks are not hinged and can not be dropped. Pressed steel stake pockets are used, and 12 auxiliary stake pockets are provided, secured to the top side planks.

The cars are equipped with air brakes, also hand brakes with brake shafts at each end of the car, with brakes effective on both trucks. For convenience in inspecting and oiling, the air brake cylinder is located close up to the side sill, in the center of the car. Steps and grab-irons are located on each side and both ends of the car. All tenons, mortises and gaining, joints between timbers and top faces of sills are coated with Fernoline before erecting.

The special equipment of the car consists of Gould yoke couplers and Gould spring buffers, Butler drawbar attachment, Westinghouse automatic freight air brake, Fox pressed steel body bolsters, pressed steel end sill plates, pressed steel stake pockets, Fox pressed steel trucks, pressed steel center plates, Morris pressed steel box lids, Soule rawhide dust guards, and Christie brake heads, shoes and keys.

The general dimensions of the car are as follows :

Length over all.....	38 feet 4 inches
Width over all.....	9 feet $9\frac{3}{4}$ inches
Height over all.....	7 feet $6\frac{5}{8}$ inches
Length over end sills.....	36 feet $\frac{3}{4}$ inches
Width over side sills.....	8 feet 10 inches
Height from rail to under side of side sills.....	3 feet $3\frac{3}{8}$ inches
Height of drawbar.....	$34\frac{1}{2}$ inches
Inside length.....	34 feet
Inside width.....	8 feet $4\frac{1}{4}$ inches
Height of side planks (10 inches each).....	30 inches
Center to center of trucks.....	24 feet
Truck wheel base.....	5 feet 2 inches
Total wheel base.....	29 feet 2 inches
Gauge of track.....	4 feet $8\frac{1}{2}$ inches
Center to center of journals (across truck).....	6 feet 3 inches
Journals, M. C. B. standard, $4\frac{1}{2}$ inches by 8 inches.	

Wheels, 33 inches diameter, cast iron, M. C. B. standard, 650 pounds.  
Journal bearings, keys, box and lids, M. C. B. standard for 4½-inch by 8-inch journals.

Height top of rail to top of truck transom, with light weight of car body, 28⅝ inches.

All material used in the construction of the car is subject to the inspection and specifications of the company. Castings and forgings, as well as all other shapes in steel, etc., are made to conform, as far as possible, to the existing standards of the car department of the road. The cars ordered by the Philadelphia & Reading Railway Co. during November are to be substantially as this design, except that a steel underframing has been substituted.

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## THE REHABILITATION OF THE PISTON VALVE.

BY ROBERT F. HOFFMAN.

Atchison, Topeka & Santa Fe Railway.

### I.

The piston valve, had it been a living creature born into the world rather than an inanimate thing devised, would today be a most remarkable example of birth, followed by a slow and tentative development of usefulness; of a brief and apologetic activity; of a state of coma supervening for many years; and, finally, of a most virile awakening from a sleep of those many years of seeming death. The simile, if it hold, is only true to the railway aspect of the subject.

The history of this simple factor in the alternation of the current of power in steam enginery has been aptly told in a general voicing of the renewed interest which has centered upon it in the past two years. All indications, at present, make for the permanent re-employment of this form of slide valve in locomotives. The points of debate now rest chiefly within the circle that is described by the following questions: Is this form of valve adaptable to the widely varying duty of the modern steam locomotive? Can it be made a truly balanced valve, that will satisfactorily stand guard between the throttle and the exhaust pipe? And, passing these challenges, to what extent and at what relative cost will it endure?

To the first question, the answer should not form matter for great dispute. If there be tenable ground for the assumption that it is possible to design a D slide valve which will fairly distribute steam within a

specified duty requirement, then the piston valve is by nature fitted to better perform the same duty. Either that is confessedly true, or refuge for argument must be taken in admission that the flat valve is permitted to be driven from its true office, to accommodate costly and perpetual errors of design. The particular phase of objection to piston valves toward which this observation is directed, is the common insistence that various degrees of trouble and destruction must result from the use of piston valves, in that they cannot lift from their seats to relieve excessive compression. Does any member of the railway fraternity desire to state that he is designing and means to perpetuate a form of slide valve that performs a constant heel-and-toe movement upon ports, many of which are today fed by steam pressure of 200 pounds per square inch?

A D valve, properly proportioned and properly set, will rarely have occasion to lift from its seat. The fact that it does thus lift at any time is a fact to be held against its use rather than for it. It makes careless and extravagant valve setting possible to a greater degree than would otherwise be tolerable. The piston valve will stay just where it is placed. It will not rise above its duty, nor will it lag in the performance of it. Its action is prompt, easy and certain. It will arrive on time at every point in the steam chest for which it is correctly scheduled.

In the annulus of steam that fills its cage ports, there is a factor of loss for the piston valve by reason of this addition to maintained cylinder clearance. This loss, however, is a very small fraction of power as compared with the tremendous friction load of laggard flat valves of the strip-balanced type. Loss from additional steam, thus caught and held at each termination of steam admission, is in no appreciable measure comparable to the loss from halting valves and correspondingly early destruction of motion parts. Yet, this modicum of steam is virtually the price of a well-nigh perfect balance; of a reversing gear that can be thrown back and forth, while under steam, by the turn of a man's wrist. To this may be added the fact that by the presence of this additional clearance space—in no sense fatal or greatly objectionable—the range of action, before excessive compression can obtain, is widened.

To the first question, then, the answer, thus far, would seem fairly justifiable if made affirmative. The piston valve is possible of correct adaptation to locomotives, provided the second question be answerable in the affirmative. In the matter of balance, it is beyond dispute that a cylindrical valve, having expansion rings, serving as steam packing, is not and cannot be made a balanced valve. Various attempts, some measurably success-

ful, some quite abortive, have been made to eliminate or to materially lessen the friction of packing rings thus employed. It may repay the risk of inflicting mere truisms, to dwell briefly upon this feature. So much is being said; so much honest effort has been put forth in endeavor to circumvent a basic principle in this matter of balanced packing, that it may be timely to ascertain whether that which was so strenuously sought for was worthy of the endeavor. The effort has been to defeat the outward pressure of a sawn packing ring, as it is actuated by internal steam pressure. For this purpose, various devices have been resorted to. Small leakage grooves have been driven from ring seat to exhaust cavity, in some instances; in others, more complicated expedients have been employed. The attempt is hopeless. Were it possible to establish that exact nicety of pressure equation, wherein the force from within the ring would at all points of the valve's travel exactly nullify the pressure upon the ring from without, the ring would be a much more enticing (but still an undesirable) member. But, assume that means had been found by which the ring had been left free to act alone upon the impulse of its own resilience. Then in its travel over ports, both in compression and in expansion, the ring must be reduced in diameter to the extent the valve body will permit (and thus become void). For the further benefit of a doubt in favor of the packing ring, assume that it will close only and exactly to the bore of the cage; impossible, certainly, but even then it must be an easy fit to be a balance, and it has its sawn aperture for leakage in addition to any slight unevenness. Aside from the latter feature, then, the ring valve, in its ideal condition, is in effect a plug valve with two or more useless leakage slits put in at great relative cost. If, however, packing rings are to be used, as now, creating quite as much disturbance as the unbalanced area of the D valve, it would seem a profitless labor to discard the D valve.

The plain plug piston valve, with no adornment or incumbrance save two or three small oil grooves in its circumference has, for steam tightness, a chance quite even with that of the ringed valve. Its direct leakage, when valves are properly fitted, will not exceed the entailed leakage of sawn rings having constantly depreciating side faces. Its chances are likewise even with, or better than, those of the strip-packed D valve, whose wavering rectangular strips offer much invitation to truant steam. In the matter of applying the Allen supplementary port to piston valves, it is well to remember that with the plug valve this is simply a consideration of slight additional weight of metal. Observations during an extended period of operation with piston valves, quite

fully bear out my attitude. May the answer to the second question in chief be made affirmatively, saying that a piston valve can be so constructed as to be practically in balance and at once economical in the control of power?

The question of cost and economy will be deferred for a subsequent article, and it may be of value at that time to provide drawings of some designs that have been used, and of some that were merely taken under advisement and later discarded without experiment. These drawings, with a few indicator diagrams, some taken while drifting, some taken under steam, together with a brief statement of relative first cost and durability, should serve to largely remove the foregoing matter from the realm of opinion and perhaps establish the subject somewhat more definitely in the sphere of fact.

If it can be shown that many battles have been fought with ghosts of troubles; if the piston valve can be shown to be much less the troublesome and dangerous member that it has become fashionable to wrestle with, then let us say "Boo" to the bogie man—and use plug valves.

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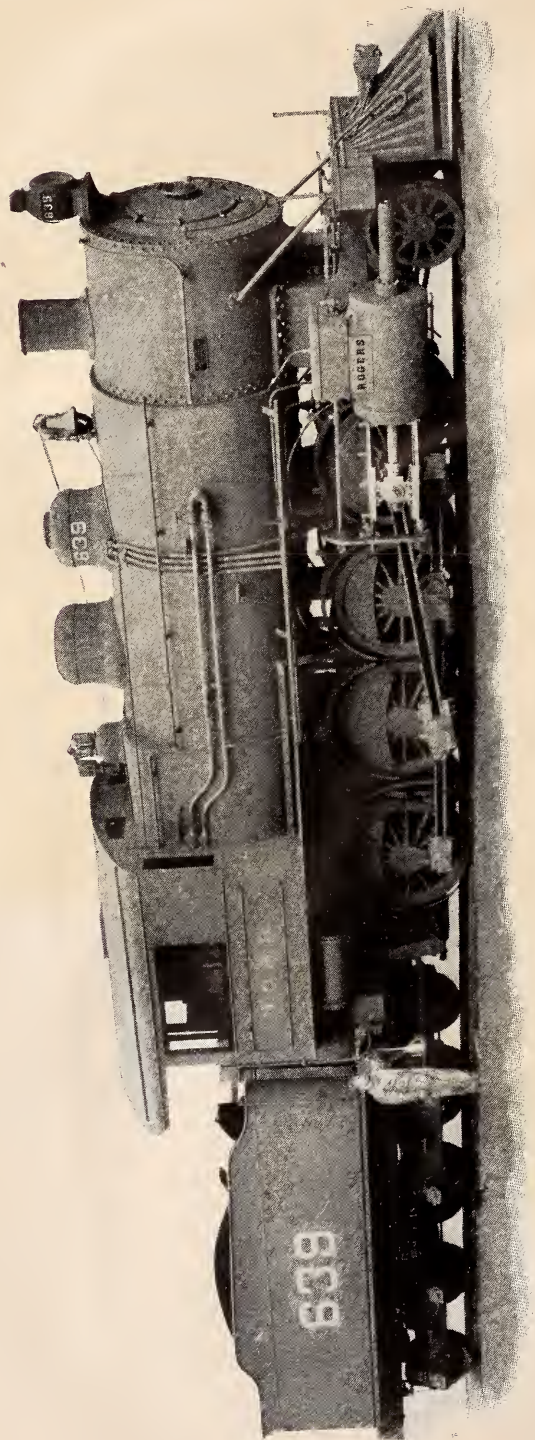
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## HEAVY CONSOLIDATION LOCOMOTIVE, ILLINOIS CENTRAL RAILROAD.

It will be remembered that in our issue of October, 1899, we illustrated and described the Brooks 12-wheeler, which was built for heavy work on the Illinois Central—the heaviest engine ever built. The Rogers Locomotive Works recently built an engine to go into the same service on the same road, but decided upon the consolidation type for its design. The engine is intended to haul trains of a maximum weight of 2,000 tons over grades of 38 feet to the mile.

This engine weighs 218,000 pounds, of which 198,000 pounds are on the drivers. It has 23x30-inch cylinders; 57-inch drivers; a Belpaire boiler, which is 80 inches in diameter, and designed to carry 210 pounds of steam; a firebox 132x42 inches in dimensions; a grate area of 38.5 square feet; and a total heating surface of 3,203 square feet, of which 252 square feet is firebox and 2,951 square feet tube surface.

The special equipment of the engine includes: Nickel steel driving axles and piston rods, cast steel driver centers and pistons, carbon steel boiler, McKee-Fuller truck wheels, U. S. iron stay bolts, Coffin toughened steel crank pins, Krupp tires, Hancock injectors, Leach sander,



ROGERS CONSOLIDATION LOCOMOTIVE, ILLINOIS CENTRAL RAILWAY.

Total weight, 218,000 pounds; weight on drivers, 198,000 pounds; cylinders, 23 x 30 inches; drivers, 57 inches; heating surface, 3,203 square feet, of which 252 square feet is firebox and 2,951 square feet tube surface; grate area, 38.5 square feet; fuel, bituminous coal; working

steam pressure, 210 pounds; boiler, 80 inches; tank capacity—  
water 5,000 gallons, coal 10 tons.

Detroit lubricators, Ashton safety valves, United States metallic packing, Barnes' whistle, Higgenbottom pneumatic bell ringer, French springs, Cicero bronze bearings, Little Giant pneumatic blow-off cock,

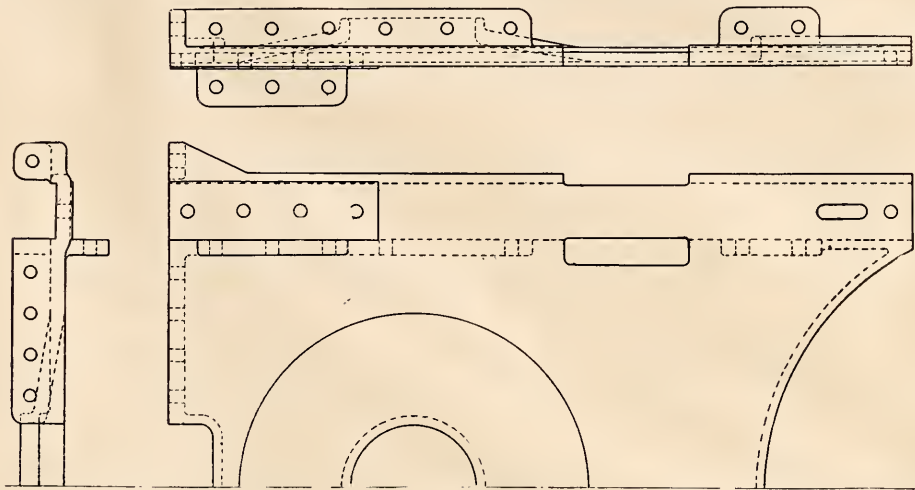


FIG. 1—FRAME-SUPPORTING CASTING.

American balanced valves, Franklin boiler covering, Westinghouse - American brake, Johnson coupler, Monarch brake beams.

In addition to our full perspective view of this locomotive, we also give some of the interesting details of construction. Figure 1 shows a steel plate casting

back of the cylinder saddle, securely bolted to the latter and to the frames, extending back of the cylinders 59 1/2 inches on the frame. This is intended to support the frames at that place, securing them to the cylinder casting in a more substantial manner than could otherwise be done, relieving the cylinder saddle to a great extent of the severe twisting strains that they are subjected to in locomotives of that class.

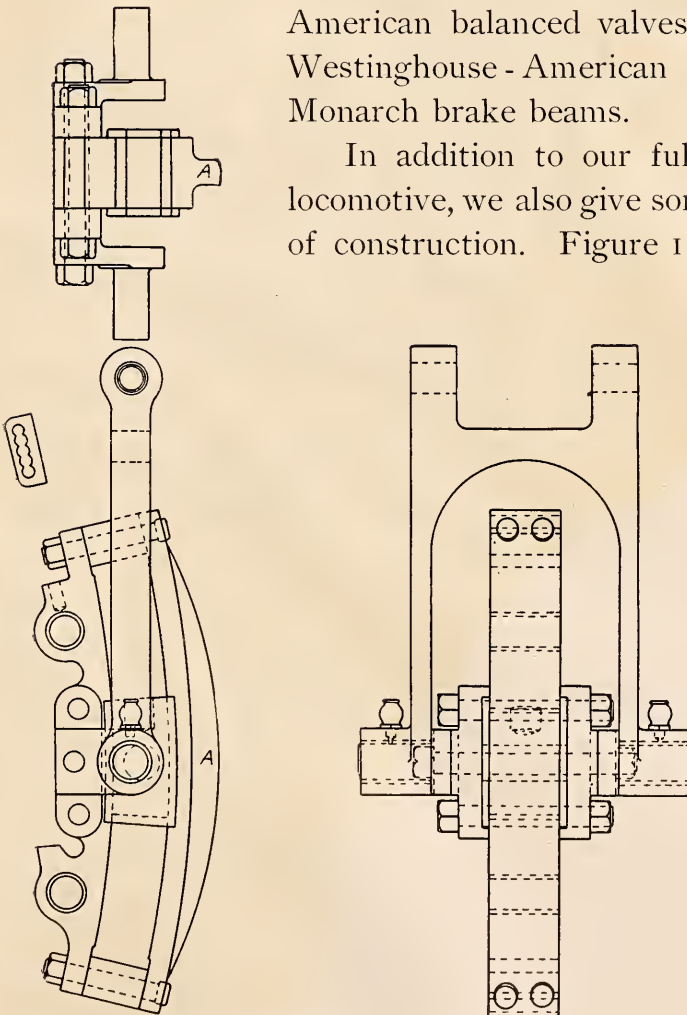


FIG. 2—LINK AND HANGER.

Fig. 2 shows the link and its hanger. The link is  $3\frac{1}{2}$ -inch face, and is supported on both sides by a horseshoe-shaped hanger, the saddle being in two parts, bolted to the back half of the link; the forward half has a rib "A" on its front face to give it stiffness. The lifting shaft arm end fills the space between its two upward extensions.

Fig. 3 shows the cast steel yoke of the valve motion arrangement at the driving axle, between the link and rockshaft. This yoke is suspended by a hanger "D," the upper end of which is held in a bracket "F," attached to a cross brace of the frame, and the lower end is attached to the yoke by a pin at "E." The back end of this yoke is

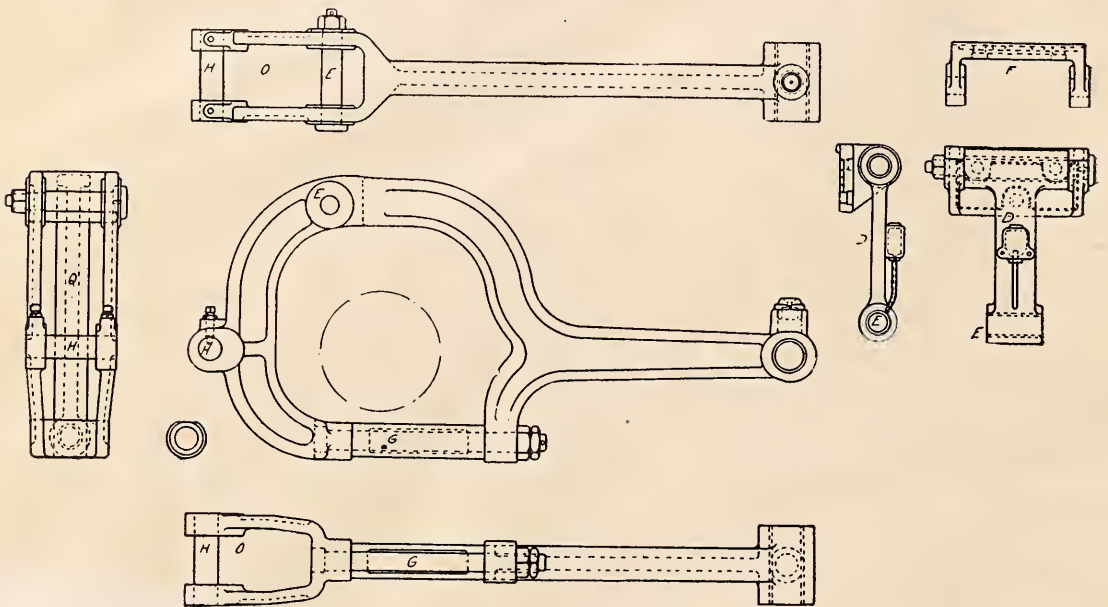


FIG. 3—VALVE MOTION YOKE.

double, as shown at "O"; the pin "H" passes through the two parts and also through the link block. The link in part occupies the space at "O," bringing it as close as possible to the axle, giving as great a length of eccentric rod as the distance between the axles will permit—48-inch radius of link. The gap in the yoke at the bottom is closed by a thimble "G" and a  $1\frac{1}{2}$ -inch through bolt. This arrangement brings the link, the yoke and middle of the pin of the rockshaft arm all in a direct line.

## THE WESTERN CAR FOREMEN'S ASSOCIATION.

The Western Car Foremen's Association, of Council Bluffs, Omaha and South Omaha, was organized at Council Bluffs, November 25, with the following charter members: Samuel Payne, car foreman, U. P. Ry.; M. P. Schmidt, car foreman, C., M. & St. P. Ry.; L. E. Briden-

stein, car foreman, K. C., St. J. & C. B. Ry.; James F. Spare, car foreman, U. P. Ry.; Peter Brandell, car foreman, C., R. I. & P. Ry.; John Brough, car foreman, Ill. Central Ry.; Geo. R. Anderson, car foreman, C. & N.-W. Ry.; E. H. Zickler, general foreman, C. & N.-W. Ry.; John F. Marshal, clerk, K. C., St. J. & C. B. Ry.; B. F. Turner, foreman, B. & M. R. Ry.; C. Spies, foreman Eastern Lines, Council Bluffs; J. B. Wilkerson, foreman, Mo. Pac. Ry.; O. Hanson, foreman, U. P. Ry.; W. H. Cressey, general foreman, South Omaha Joint Association; Martin Hogan, foreman, B. & M. R. Ry.; Henry Bergman, inspector, South Omaha Joint Association; and Frank Empkins, inspector, South Omaha Joint Association.

The following officers were elected for the ensuing year: President, M. P. Schmidt, C., M. & St. P. Ry.; vice president, W. H. Cressey, South Omaha Joint Association; secretary, B. F. Turner, B. & M. R. Ry.; treasurer, Chas. Spies, Eastern Asso. Lines, Council Bluffs.

The following were appointed as members of the Executive Committee: G. R. Anderson, C. & N.-W. Ry.; J. B. Wilkerson, Mo. Pac. Ry.; O. Hanson and S. Payne, U. P. Ry.; and Martin Hogan, Mo. Pac. Ry.

A committee of five members was also appointed to draw up by-laws and report to the next meeting, which was to be held at Union Pacific Transfer, Council Bluffs, Dec. 16, 1899.

The new organization starts out well, and the prospects are excellent for good work, on the lines followed by the Car Foremen's Association of Chicago.

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## THE PENNSYLVANIA RAILROAD PENSION FUND.

In our issue of September, 1899, we gave an extended account of the pension fund which the Pennsylvania Railroad Company proposed to establish. The plan has been finally brought into shape, and takes effect Jan. 1, 1900.

The Pennsylvania Railroad Company, the Northern Central Railway Company, the Philadelphia, Wilmington & Baltimore Railroad Company, the West Jersey & Seashore Railroad Company, and the Philadelphia & Camden Ferry Company have each adopted a similar plan of pension allowances, and also a similar policy of age limitation, and have entered into an agreement for the joint administration of their respective pension departments, under the title of "The Pennsylvania Railroad Pen-

sion Department." The general terms of the plan, as finally formulated, are as follows :

*First*—All officers and employes of the company who are required by the organization to give their entire time to the service of the company, who shall have attained the age of 70 years; or who, being between the ages of 65 and 69 years, inclusive, shall have been thirty or more years in the service of the company, and shall then be physically disqualified, shall be relieved and placed on the pension roll.

*Second*—Subject to ratable reduction, so that the entire annual expenditure for pension allowances by the five companies above named shall not at any time exceed the aggregate sum of \$300,000, pensions shall be allowed upon the following basis :

*Third*—For each year of service, 1 per centum of the average regular monthly pay for the 10 years preceding retirement. Thus, by way of illustration, if an employe has been in the service of the company for 40 years, and has received on an average, for the last 10 years, \$40.00 per month in regular wages, his pension allowance would be 40 per cent of \$40.00, or \$16.00 per month.

*Fourth*—Pension allowances shall be paid monthly, and shall terminate on the death of the beneficiary.

*Fifth*—No pension allowance shall be paid to any officer or employe for a period during which he may be receiving accident or sick benefits from the relief department.

*Sixth*—The acceptance of a pension allowance shall not debar the beneficiary from engaging in other business, but such person cannot re-enter the service.

*Seventh*—The pension department shall, under the supervision of the president, be in charge of a board of officers consisting, until otherwise ordered, of the vice presidents, the general manager and the assistant comptroller of the Pennsylvania Railroad Company. The board of officers shall be appointed annually by the boards of directors of the several companies, and shall, subject to the approval of the said boards, make and enforce regulations for the government of the department.

*Eighth*—No action which shall now or hereafter be taken in connection with the origin or furtherance of a pension department or plan, shall be held or construed to give any officer, agent or employe a right to be retained in the service or become entitled to pension allowances; but, on the contrary, each company may discharge any officer, agent or employe at any time when, in its judgment, the interests of the company

so require, without liability for pension or for other allowances, save only salary or wages then earned and unpaid.

The age limit for new employes is thus defined :

No person shall be taken into the service of the company who is over 35 years of age, except that, with the approval of the board of directors : *First*, former employes may be re-employed within a period of three years from the time of their leaving the service ; *second*, persons may, irrespective of age limit, be employed where the service for which they are needed requires professional or other special qualifications ; but, *third*, persons may be temporarily taken into the service, irrespective of age limit, for a period not exceeding six months, subject to extension, when necessary to complete the work for which engaged.

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## LOCATING THE CENTER OF GRAVITY OF A LOCOMOTIVE.

The Rogers Locomotive Works, before delivering the large Illinois Central consolidation locomotive that we describe elsewhere in this issue, undertook to determine its center of gravity. The center of the boiler of this locomotive is 9 feet, 2 inches, and the top of the boiler at the base of the dome 12 feet, 6 inches, above the top of the rail ; the top of the stack, sandbox and dome casing are all practically 15 feet above the rail. The crown sheet of the firebox is 10 feet, 6 inches above the rail at the flue sheet. In writing to us concerning this test Mr. Reuben Wells, superintendent of the Rogers Works, says :

“As not much seems to be known as to how high above the rails the center of gravity of locomotives having their boilers unusually high, such as this one, may be expected to be found, taking the whole engine in working order as one mass, a test was made of this engine to determine its center of gravity, by suspending it on the upper surface of two 3-inch steel pins or journals for pivots ; the one at the front being located 6 inches in front of the cylinder saddle, and the back one 6 inches back of the back end of the boiler, and both the same distance above the rails and on the vertical center line of the engine. The engine, when suspended, was complete, with all its parts in place, and boiler filled with cold water to the second gauge, the drivers and truck wheels all clearing the rails about 2 inches. The engine was as near as practicable in the same condition and of the same weight as it would be in working order. As mentioned, the steel suspension pins were 3 inches in diameter ; they were supported at both ends, and the bearing

surface resting on them was horizontal, so as to reduce friction at the bearing point to a minimum. On trial, the bearing points, as first located, proved to be considerably too high. They were lowered and tested again several times until the engine balanced on the pivots. Screws were used at the ends of the bumper for testing and to keep the 'roll' to either side within limits when the pivots had been lowered to the point of center of gravity. At that point a lift of about 300 pounds under the end of the bumper was sufficient to cause the engine to turn in the opposite direction to the extent that the bumper at that end was about 8 inches higher than the opposite end. On removing the lifting force the engine would not, of itself, return more than half way back to the vertical position, but required a lift of about 100 pounds at the low side to bring it vertical—about enough to overcome the pivot friction—but when vertical and free it would remain so. It required about 100 pounds, however, to start it to turn in either direction. The tests show that the point of suspension was probably as near the actual center of gravity of the engine as it was practicable to locate it. After the adjustments were all made, and the center of gravity point found, measurements showed the bearing point on top of the steel pin at each end of the engine on which it rested to be  $50\frac{1}{2}$  inches above the top of the rails as the engine would be when the drivers are resting on the track. That point is  $3\frac{3}{4}$  inches above the top of the main frames. Assuming the bearing point of the drivers on the rails to be 56 inches apart, then the base on which the engine runs is 1.10 times as wide as the distance its center of gravity point is in height above them. Without positive knowledge to the contrary, most persons, we think, judging from appearances only, would conclude that the center of gravity of a locomotive like this must be considerably above the point given, yet the tests show conclusively that it is not.

“If the center of gravity point of a locomotive like this is 10 per cent less in height than the base on which it is carried is wide, it is probable that the center of gravity could be carried still slightly higher without any detrimental results of consequence as regards the movement of the locomotive along the track.

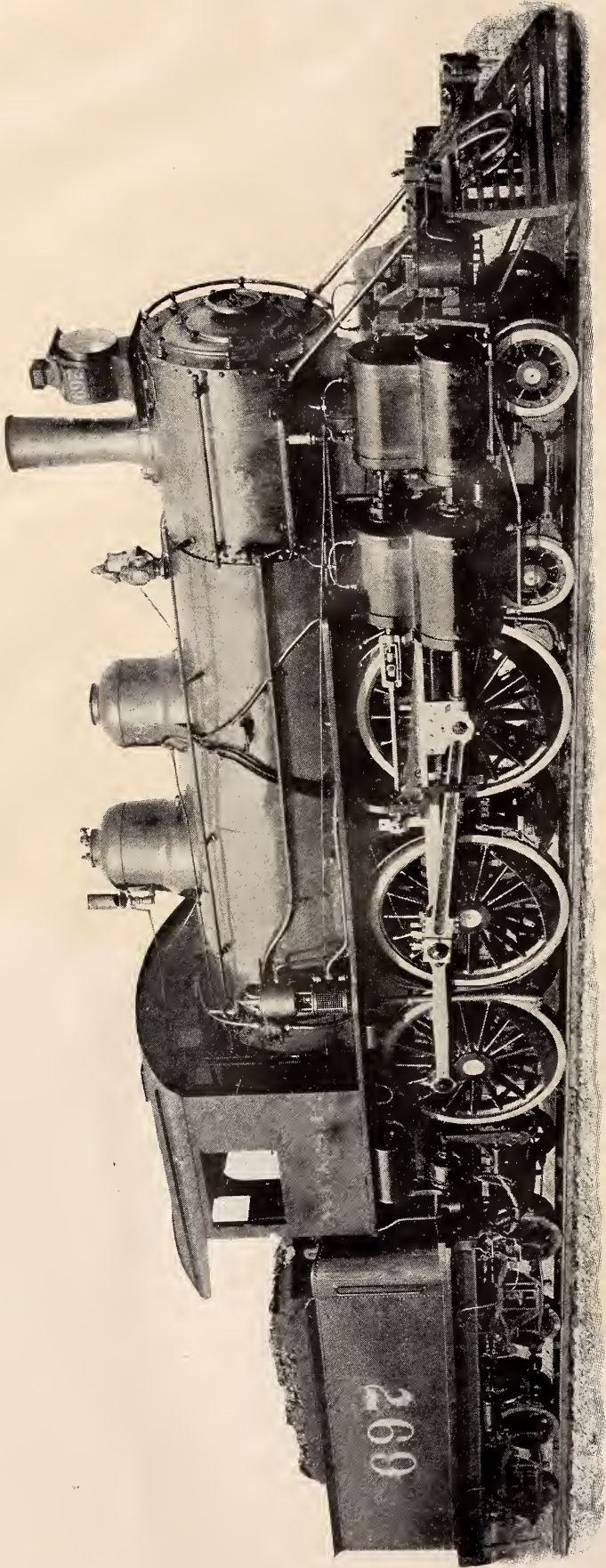
“We do not know of any tests being made heretofore to ascertain the center of gravity point of a locomotive in working condition by suspending it on pivots and adjusting them vertically until the point sought for was obtained, and it will be of interest, we think, to many persons interested in such matters to know just where that point is in a locomotive of this pattern and of these proportions.”

## BOILER COMPOUNDS.

Boiler compounds and purges, as viewed by the traveling engineer, were treated of in a committee report presented to the recent convention of the Traveling Engineers' Association. The conclusions of the committee were as follows :

1. The committee recommend the use of soda ash as a boiler compound, as it has the widest range of adaptability to the various incrusting ingredients contained in the feed water. There are a number of other compounds on the market, some possessing merit, but the cost bars their use on the locomotive, while soda ash is cheap and easily obtained, and will give good results when properly handled. Of course there is some water that will require a special compound, but the chemist should be able to decide that. The chemist should analyze the water and decide the amount of the compound to be used. It was found that in water containing from 2 to 4 pounds of incrusting matter to the 1,000 gallons, that from 6 to 8 ounces of the compound would keep the minerals in suspension, and in water containing more than this amount of incrusting matter to the 1,000 gallons, from 8 to 16 ounces of the compound will give good results.

2. Boilers should be furnished with at least two good pneumatic blow-off cocks, kept in good working order, and the boilers given a good blowing out, both on arriving and departing from terminals. The amount of soda ash for the trip should be put in at the terminal just before the engine is taken out. In using blow-off cocks on the road, we would recommend that they be used several times each trip and for a few seconds at a time. This will get rid of a large amount of the sediment thrown down by the purge and will prevent boilers from foaming, as we find on investigating cases of foaming that the trouble was caused by poor boiler washing and not using the blow-off cocks properly. Boilers should be inspected every time they are washed out, to see that the purge is keeping them clean and that the sediment and scale thrown down by the purge has not lodged between flues and sheets. There should be at least two flues left out in the center of the flue sheet and washout plugs put in, so the space between flues can be thoroughly washed. We find the average cost of the compound per 1,000 miles is between 25 and 35 cents, and the life of flues has been increased 50 per cent to 75 per cent. We also find where soda ash is being used, and boiler washing properly attended to, that it is a rare occurrence to have flues leaking on the road, while before soda ash was used, leaking flues and sheets were a continual source of trouble.



PLAYER TANDEM COMPOUND PASSENGER LOCOMOTIVE, A., T. & S. F. RAILWAY.

Total weight, 169,000 pounds; weight on drivers, 123,000 pounds; cylinders—high pressure 14 x 28 inches, low pressure 24 x 28 inches; drivers, 77 inches; heating surface, 1,923 square feet, of which 165 square feet is firebox and 1,758 square feet tube surface; grate area, 26.5 square feet; fuel, bituminous coal; working steam pressure, 200 pounds; boiler, 60 inches; tank capacity—water 5,000 gallons, coal 8 tons.

## FOUR-CYLINDER TEN-WHEEL TANDEM COM- POUND, A., T. & S. F. RAILWAY.

There has recently been built, in the Topeka shops of the Atchison, Topeka & Santa Fe Railway Company, a 4-cylindered 10-wheel tandem compound passenger engine. The cylinders are 14 in. and 24 in. by 28 in. The total weight of the engine is 169,000 pounds, the proportion of weight upon the engine truck being 46,000 pounds. The construction of conspicuous parts of this locomotive is here illustrated, in company with a half-tone plate of the engine as now in service.

In the summer of 1898, the Topeka shops built the first of five consolidation freight locomotives, whose cylinders were compounded in a similar manner. The freight locomotives have cylinders 15 in. and 25 in. by 28 in., and weigh 87 tons per engine, in working order. The tender, loaded, for both classes of engine, weighs 96,000 pounds. A test of long duration in road service upon the mountains of Colorado and New Mexico, demonstrated a water economy of about 13 per cent, by the use of the compound freight engine, as against a simple engine of the same class.

The freight engines have plug piston valves devoid of spring rings. So, also, has the passenger engine. The valve cages of the freight engines are mounted with planed bases upon ordinary valve seats, and are inclosed within what are, essentially, ordinary rectangular steam chests and covers. The freight engines have two saddles each, attached separately to an unusually long smoke arch. The saddle of the passenger engine, here illustrated, is cast in rectangular unit. The valve cages are cast as integral parts of their several cylinders, and are bored and bushed upon lines parallel to the center-lines of the cylinders. The cylinders, thus bearing cylindrical steam chests, are bolted to the engine saddle in the manner common to such construction.

The distinctive features of the valve gear (see Fig. 4) are the absence of all packing from the valve cylinders, and the flexibility of the cut-off of the high pressure cylinders as related to that of the low pressure cylinders. The latter feature embodies the ability to change the length of cut-off of the high pressure valves without disturbing the movement of the low pressure valves, for a given notch in the quadrant. The desired result is accomplished by lowering the back ends of the high pressure valve stems upon the arc of a rocker arm, which actuates both the high pressure and the low pressure valve stems. The sliding block, which is thus shifted to points nearer to, or more remote from, the point of full

sweep on the rocker arm, is set by a screw and gib, and is not adjustable from the cab. The rocker arm is of radial conformation. The radius is equivalent to the length of a portion of the high pressure valve stem which extends from the slide block on the rocker arm to a pin

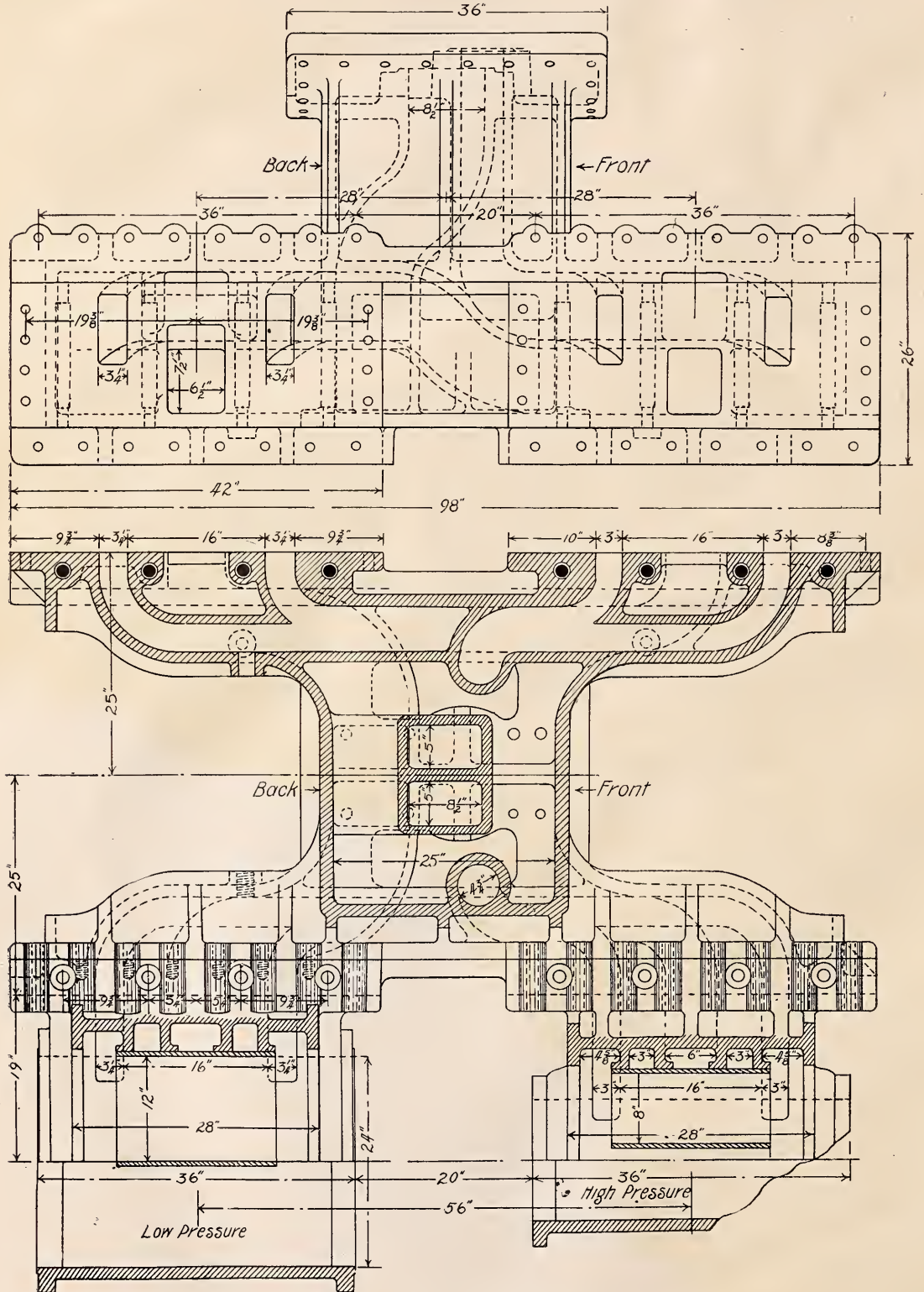


FIG. 1—CYLINDER SADDLE.

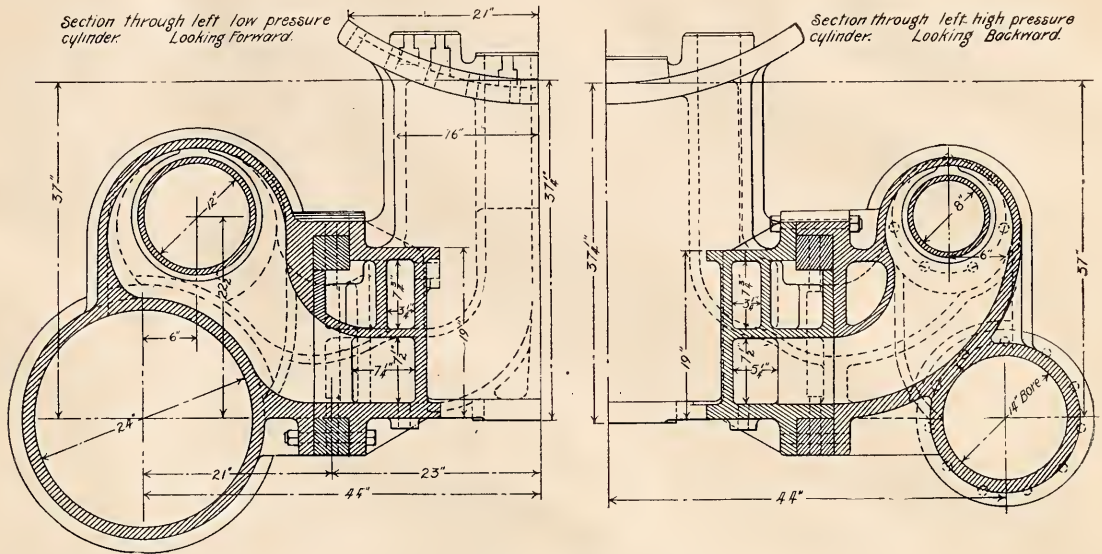


FIG. 2—CYLINDER SADDLE.

point short of the chest gland. This arrangement compensates for any departure from horizontal alignment that results from the shifting of the slide block.

The low pressure valve stem is hollow; the high pressure valve stem is solid. The latter works through the low pressure valve and valve stem, when a differential travel of valves is being used. This device is patented by Mr. John Player, superintendent of machinery of the Santa Fe Railway system.

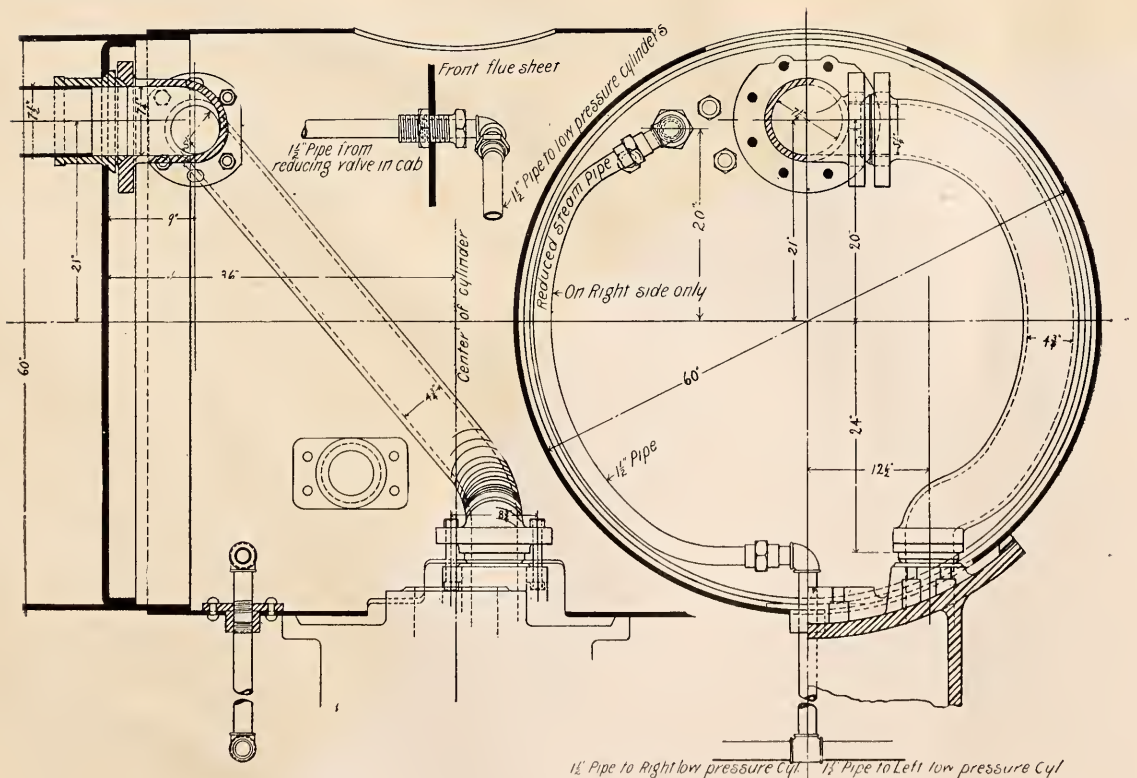


FIG. 3—STEAM PIPES.

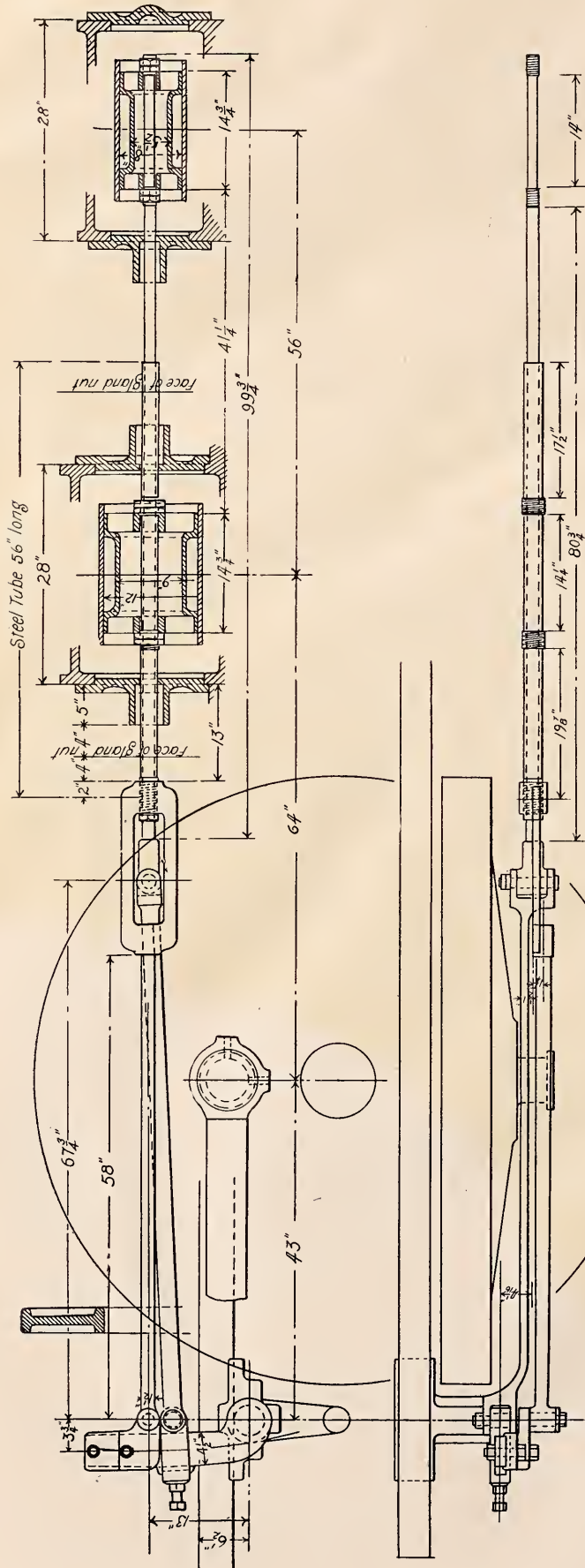


FIG. 4—VALVE GEAR.

The general effect of the construction, as seen in total, is that of symmetry. The drawings, Figs. 1 and 2, illustrate the saddle, cylinder and valve chamber construction, in connection with steam and exhaust passages complete. It is evident that two steam apertures, opening from a common source, supply high pressure steam to the smaller cylinders. These apertures, while they deliver steam to opposite ends of the valve chambers, are practically one passage in effect. The valves are hollow throughout their length. Steam thus delivered forms, therefore, a common volume within the valves and their cages, and stands ready to deliver promptly at either port. The single large opening for exhaust from high pressure to low pressure cylinders is easily readable in its subsequent subdivision into two delivery apertures to the low pressure cylinder. It is finally complemented by a single large exhaust opening in the low pressure end of

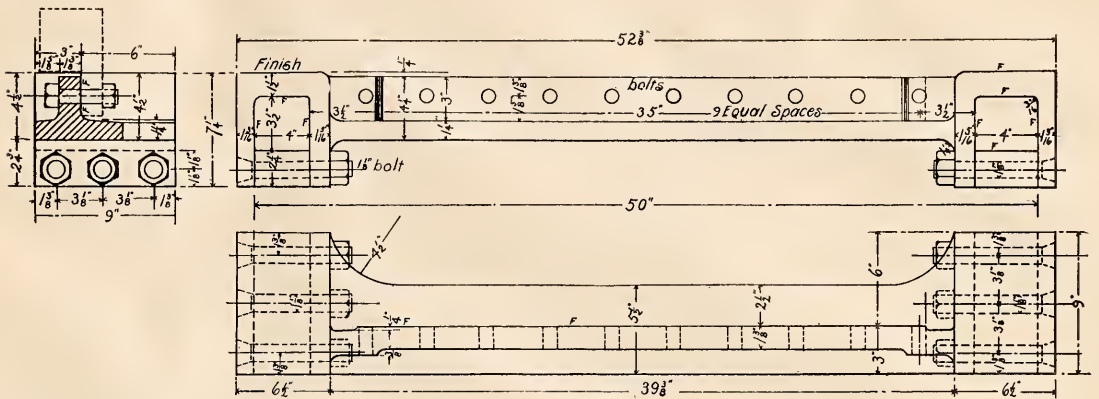


FIG. 5—FURNACE ANCHOR.

the saddle, as shown. All steam and exhaust passages are, therefore, within the saddle casting, except a 1 1/2-inch pipe, which is controlled by secondary throttle, and is used, upon occasion, to reinforce the low pressure steam supply. The saddle and cylinder castings are carefully lagged, to prevent undue radiation.

The valves have outside admission, with 1 inch outside lap and 6 1/4 inches travel in full gear. The high pressure valves have 3-16 inch inside clearance; the low pressure valves are line and line inside. All valves are set line and line outside. The link radius is 50 inches. The diameter of the high pressure valves is 8 inches; that of the low pressure valves is 12 inches. These dimensions, with cross-bridges deducted, afford equivalents of straight ports 1 5/8 inches wide and 19 inches and 28 1/2 inches long, respectively.

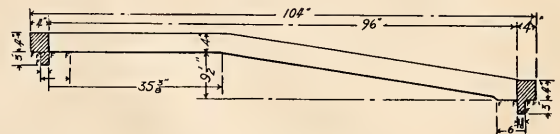


FIG. 6—MUD-RING.

Cast steel has been liberally used in the construction of this locomotive. The guide bars, guide yoke, and the furnace anchor are novel and admirable. The mud-ring is also of cast steel. An L-shaped formation of the mud-ring provides for the attachment of the cast steel furnace anchor. These parts, and their application, are shown in Figs. 5, 6 and 7. The anchor-piece rests across the frames and engages them, downwardly, with its open box ends. Passing downward to a liberal

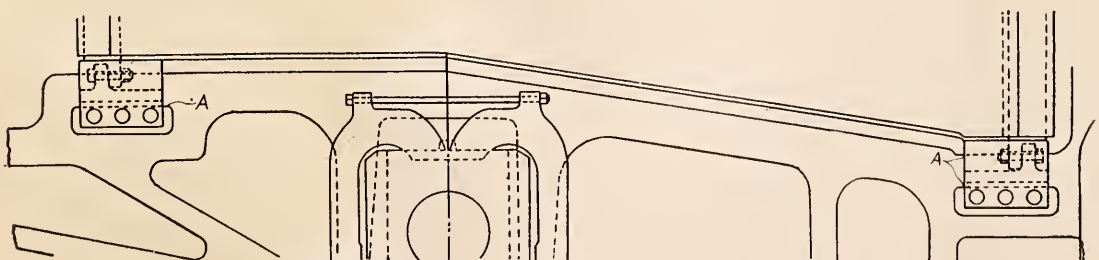


FIG. 7—SHOWING FURNACE ANCHOR FASTENINGS.

slot cut lengthwise in the body of the frames, a filler-piece inserted between the lips of the anchor, and within the body of the frame, is caught with driven bolts through filler and anchor. The anchor, complete, is therefore restricted in its movements to the limits of the slot in the frames, and is very well adapted to the double duty of expansion plate and vertical anchor at the deck and throat-sheet.

A second locomotive, in duplicate of engine 697, is now being built in the Topeka shops. Engine 697 has been in service about two months, on the Topeka division. A preliminary test with indicators, made while the engine was in freight service, gave no cause for concern as to operation at greater speed.

The design is that of Mr. John Player, superintendent of machinery, Mr. George A. Hancock, assistant superintendent of machinery, being close confidant in matters for consideration. The line drawings, some of which are here reproduced, are to be credited to Mr. G. E. Stolpe, chief draftsman.

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## THE CAR FOREMEN'S ASSOCIATION OF CHICAGO.

### DECEMBER MEETING.

The regular meeting of the Car Foremen's Association, of Chicago, was held in the rooms of the Western Society of Engineers, 1741 Monadnock Building, Chicago, Dec. 14, 1899.

President Morris called the meeting to order at 8:15 p. m. Among those present were:

Alderson, A. S.	Cook, W. C.	Husband, E.	Richardson, Wm.
Bates, G. M.	Davies, W. O., Jr.	Johannes, A.	Showers, G. W.
Bossert, C.	Deen, C.	Johnson, Axel.	Stagg, C. S.
Buker, J.	Etten, L.	Kuhlman, H. V.	Sharp, W. E.
Bourell, W. A.	Emerich, W. H.	Kehm, H. C.	Thiverge, J. C.
Bundy, C. L.	Ford, Geo.	Konze, Wm.	Thomson, Geo.
Blohm, Theo.	Gruhlke, E.	Montgomery, R. J.	Utt, A. G.
Carey, C. H.	Green, C. E.	Marsh, Hugh.	Wentsel, Geo.
Callahan, J. P.	Galvin, W.	Morris, T. R.	Williams, Thomas.
Constant, E. J.	Grieb, J. C.	McEwen, Jno. H.	Wolfe, Chas.
Cardwell, J. R.	Groobey, Geo.	McFarland, H.	
Cather, C. C.	Gardner, L. S.	Parish, Le Grand.	

### MISCELLANEOUS BUSINESS.

President Morris: According to the new constitution, which goes into effect tonight, the Executive Committee consists of a representa-

tive from each company having a member or members in the association. It makes a committee of 38, which will meet quarterly. From the members of this committee there is formed a sub-committee on subjects—a committee of 10—and also a committee on introductions and welcome.

We have received a communication from M. P. Schmidt, of Council Bluffs, Iowa, who states that they have formed an association at Council Bluffs and Omaha similar to this one, which is called the Western Car Foremen's Association of Council Bluffs and Omaha. They started with a charter membership of 16.

Secretary Cook here read the following list of new members :

R. S. Miller, N. Y., C. & St. L.; John Peters, C. & G. T.; F. C. Schultz, C., B. & Q.; H. L. Harmount, Walsh Brake Shoe Co.; Le Grand Parish, L. S. & M. S.; W. H. Emerich, Commerce Despatch Line; Wm. Richardson, Armour Car Lines; W. T. Willets, Lipton Car Lines.

President Morris: The first thing on the program for this evening is a case of a defective wheel, in dispute between two of our members. We have a number of blue prints here that the Secretary will pass around among the members, so they can see the nature of the defect.

After some desultory discussion, which did not prove very profitable or satisfactory, because of insufficient information in regard to the nature of the defect, it was decided that the party who had possession of the wheel should be requested to bring to the next meeting a section of it containing the defect. It will be taken up and discussed at the January meeting.

#### **BROKEN BRAKE WHEELS AND STAFFS.**

The association then took up the second topic, "Can a brake staff be bent and brake wheel broken, on a box car, under fair usage?"

Mr. Bates: We get cases of this nature occasionally, where there is a high box car and they try to put it into an elevator where the doors are not big enough. That is the way the brake wheels on box cars get broken. But I have seen a brake staff bent under fair usage—that is, what I considered fair usage, and it occurred in this way. There are a good many cars that have spindle couplers; and when the spindle becomes broken the coupler is pulled out, and if the uncoupling rod is back of the brake staff the staff is bent. If they are bent at the bottom in that way, I would call it fair usage. Many brake staffs are bent by striking overhead obstructions, which is unfair usage.

President Morris: Would not that be consequential damage?

Mr. Bates: I do not think so, because it all happens at the same time; you cannot prevent it in any way. If it could be prevented, and

the company handling the car would not remedy the matter, and allow the brake staff to be damaged, I would call it consequential damage.

Mr. Wentsel: We have had considerable experience with St. Paul cars at the Indiana elevator. We always considered it unfair usage, and always issued card for the defect.

Mr. Bates: We always card for a broken brake wheel and brake staff, providing it has been caused by striking an overhead obstruction. We have never made any complaint on that score.

Mr. Parish: We do not have many cases. I think it is a cardable defect.

Mr. Stagg: I think it could occur in fair usage. I have heard of switchmen who were able to break a wheel. But a brake staff and brake wheel injured together, I think is unfair usage. I think in a great many cases they are bent and broken by trying to put a brake on with a stick.

Mr. Deen: I do not think this is an owner's defect. I card in every case of that kind, and we have quite a number of them; I never hesitate at all to charge for bent brake staff and broken brake wheel.

Mr. Grieb: We experience difficulty of the nature described, but it is almost entirely, in fact I would like to say entirely, confined to our large box cars that are now being put into service, and mostly among eastern lines, where I suppose the restrictions in regard to clearances are more severe than in the west. I do not know of a case we have had with a western line; it is all in the east. We look upon it as unfair usage. I do not understand how it could be otherwise.

Mr. Davies, Jr.: I have repaired quite a number of St. Paul cars in that condition, and always considered it unfair usage. As Mr. Grieb says, of course, they are all on large box cars. We found out where quite a number of them were put in this condition—in the sugar refinery.

Mr. Wentsel: I move that it is the sense of this meeting that brake staff bent and brake wheel broken is unfair usage.

Carried.

#### **A BROKEN END SILL PROBLEM.**

President Morris: Our third topic is a case in dispute between two connecting lines at Chicago—"A received from B one of A's cars, to which was attached a repair card, showing two draft timbers and bolts applied by C. At the same end, the end sill is broken and partly gone between the draft sills. It is evident that the sill was damaged at the same time as the draft timbers that were removed. A asked B for de-

fect card for the broken sill, but B declined to card, claiming that his company is not responsible, the car having been safe to run when he received it from connecting line, before delivery to owners, but states that he is willing to sign joint evidence card showing condition of car. A claims that he, as the owner, should have been protected by B, as broken draft timbers and end sill at same end form a combination for which owner is not responsible, and repairs were only partly made, and that he is entitled to defect card, joint evidence card not being proper in a case of this nature." This subject is a very important one, and I guess all of us at one time or another have had such a question up. It is a very important one and represents quite a number of dollars to car owners. There is no doubt that when repairs are made of the nature described in this case, the party doing the repairs has attempted to evade responsibility and certainly should be held down to what it is responsible for.

Mr. Davies, Jr. : I should say that the delivering company is responsible. Section 3 of Rule 1 says: "Damage of any kind to body of car due to unfair usage, derailment or accident." This end sill was broken by unfair usage, I should judge, a piece being pulled out of it, and the delivering company should have protected themselves when they received it from the other company. So I am of the opinion that the delivering company is responsible for the end sill.

Mr. Callahan : I think the joint evidence referred to is about all A could expect to get out of B, as he evidently made no repairs to the car. Probably the sill was broken in such shape he could not see it. If C was not honorable enough to own up to its being broken, the only thing A could do was to repair the car.

Mr. Davies, Jr. : There were no wrong repairs found on the car ; joint evidence would be of no use.

Mr. Callahan : Well, the only thing he could have joint evidence for would be to show the defect to the end sill existed at the time the timbers were put on. If B would make a statement that they did not make repairs, you are supposed to believe what they say.

Mr. Grieb : I can hardly agree to the position taken by Mr. Callahan that the defect was one of a nature that could not be discovered. It seems that B discovered it all right, and I would like to know why A did not have the same opportunity, and if his inspectors were as diligent, why they failed to do so. The very fact that one set of inspectors did discover it and the other set failed to, incriminates the parties that failed.

Mr. Stagg: I do not see any reason why B should not be held responsible for this defect. As Mr. Grieb just stated, if the inspector did not see the defect at all, he would not have seen the repair card for draft timbers and bolts. I had a similar case a short time ago, where two draft timbers were put in a car. The end sill was broken out. There was no repair card placed on the car, but we had an inspector that was capable, and found the defects. We notified the party who made repairs. There was no objection made whatever. We received a defect card for the defects in question. I take the same position, that this party could have seen the defect; and B is responsible, and should have issued a card for the defect.

Mr. Cardwell: "B" in this case reminds me of the tramp who went to sleep leaning against a lamp post, and after he was asleep some one took the lamp post away. He is in rather an uncertain position, as a result of failing in his duty to protect "A" upon receipt of the car. We are to assume that the damage was simultaneous, and this evidence exonerates the owner from responsibility. But he has made his request upon "B" for a defect card, (an innocent party in one sense of the word but guilty of extreme negligence in accepting the car without a card of protection from "C"). In accordance with arbitration case No. 534, if "B" had broken a coupler, or even a knuckle, on this car while in his possession, he would have been directly liable for the entire damage. Now it does not appear that our Arbitration Committee would rest the result of a case of this kind upon the strength of a lug on a knuckle, which is liable to give way at any time. Therefore, had "B" been liable after the knuckle had broken, why is he not liable before? In the case referred to, the Arbitration Committee makes it a penalty for running a car with parts of it broken; in so far that that road assumes responsibility of the damaged part, should they chance to break another part, forming a combination. From the manner in which this case is placed before us, it is evident that the end sill and draft timbers were broken at one and the same time. If this is the case, "B" is, or was, in the same position as the owner of the car, to know it. Therefore, he should be held responsible to "A." He can petition for redress against the road from which he received the car, if he so desires, and balance his accounts.

Mr. Bates: I am of the opinion that B is responsible, for the simple reason that he did not protect himself when getting the car from C.

President Morris: Responsible in the way that he should furnish defect card?

Mr. Bates: Yes, sir. Mr. Callahan spoke of joint evidence. If I

understand this right, joint evidence is simply for improper repairs, and not for broken parts, therefore it seems to me that a defect card is the proper thing in this case. In similar cases, we have received defect cards, and we have also carded for some. I think it is the proper way to handle it, because, in the first place, the evidence goes to show that all the damage was done at the same time, which forms a combination; and secondly, the party making the repairs (that is, C) has not done the work thoroughly, and tried to evade responsibility for the whole transaction.

Mr. Thompson: I think the company receiving the car, if they did not protect themselves, should be responsible to the owner.

Mr. Buker: It looks to me as if C is the man responsible for this damage; as if it was a matter of covering up something; and I think C is the one who should be censured for the whole thing, although, in this case, I believe B should stand the damage. But if it can be traced back to show that the damage existed when the draft timbers were put in, I think C should stand for the damage.

President Morris: You say the owner should go to C for protection?

Mr. Buker: I say, if it can be shown that this damage was done at the time the draft timbers were put in, C should be censured for not doing proper repairs to the car.

Mr. Callahan: I suppose I have got to back down, as I have no supporters; but in this case the evidence says plainly that B did not damage the car. C is, no doubt, the guilty party, and I believe that it could be traced to him without any trouble.

Mr. Davies, Jr.: In that case, it is B's own fault. I do not see how he could trace it back, if he has no record of the broken end sill. If he had a record of the broken end sill, there would be no trouble in getting a defect card from C.

Mr. Marsh: It seems to me this is like the man who was arrested for some misdemeanor and placed in jail. When a lawyer called to see him, and heard his case, he said to the man, "They can't put you in jail for that." But the man replied, "I don't care whether they can put me in jail or not; I am here." And so it is with B. I do not think he is actually responsible for the damage, but at the same time he has failed to protect himself, and I think he should be held good for it, although C is the guilty man.

Mr. Kehm: We have a case similar to the one we are discussing. A road broke a coupler and draft timbers. At one point they replaced the coupler. They took the car to another point and put in the draft timbers. On arrival of the car home to our line, it came through St.

Louis, and the joint inspector issued a joint evidence card, stating that the end sill was damaged between draft timbers and was caused at the same time as the draft timbers were broken. We took it up with the road, and they said if we could procure a joint evidence card they would issue defect card. We declined their bill for the draft timbers, also for the coupler, and requested defect card for the end sill. We haven't secured either yet. I don't know whether we are going to or not; but that is the position we took; we didn't hold the intermediate line, but held the party doing the damage. That is the same position Mr. Callahan takes, I believe.

Mr. Cardwell: Mr. Kehm was protected there; the intermediate line was protected by the joint evidence card issued at East St. Louis, which is the same to the line delivering the car to the Illinois Central as a defect card would have been, I should think.

Mr. Showers: The joint evidence card issued at East St. Louis was evidence of the fact that the intermediate line had record of the broken end sill; so it would be in this case. If B had record of the broken end sill it would not be necessary for A to go to him, but he could go to C for his protection. I think this case is similar to the one decided in arbitration case 534. If the end sill was broken to such an extent as would ultimately cause its failure under fair usage, then C should have replaced the end sill at the time that he replaced the draft timbers. If he failed to do so, and unloaded his car on B, and B was negligent enough to overlook the provisions of Rule 1, which says that foreign cars should be given the same inspection as he would give his own, then I claim C is out of the case entirely and B should take the load.

Mr. Cather: The case that Mr. Kehm cited about one of his cars received at St. Louis shows one phase of this question, and in my opinion the matter was properly handled by the joint inspector at St. Louis, in so far that he gave us a joint evidence card, which is in this particular case, and might be in any case, a means of locating the responsible party. But so far as the owner of a car is concerned, the responsible party for any rough usage is the delivering line. Now I think the sum and substance of the whole thing rests right here in this supposition: Suppose that C had made no repairs to that car at all; that is, letting the end sill and the draft timbers both go to B in a defective condition, and B delivers that car to A in that condition. Then is it a cardable defect? Everybody will say, "Yes, there are conditions denoting rough usage." All right. Now then, if C partly repairs this car (it says here,

“It is evident that the sill was damaged at the same time as the draft timbers that were removed”) it certainly is rough usage just as if no repairs had been made, and A could properly hold the delivering line, B, responsible to him. It makes no difference to A who is responsible to B. That is B’s business.

Mr. Kehm: In holding B responsible, it seems to me that the first duty is to prove that the damage has all occurred at the same time. It is merely supposed that it did. B has no record of the broken end sill, and it is but natural to suppose that if A could catch it, B could also, and if C states positively that the end sill was not broken when the car left his line, the only damage that B did was the end sill, and it seems to me that would be an owner’s defect. I do not think you could hold B for it.

Mr. Davies, Jr.: I think that Mr. Kehm is wrong there, for the simple reason that A would not have to prove that there was a combination of defects. For the broken end sill alone, without anything else, he could demand defect card from B. It says the end sill was broken and partly gone, which I do not think could be done in fair usage. A could demand a defect card from B for the end sill alone.

Mr. Kehm: It merely hinges on what is unfair usage. There are numerous decisions where one part alone is not rough usage, and it seems to me that an end sill could be broken in switching as well as by pulling the coupler out, or by jamming it in, and if you do not break the coupler in addition to the end sill, there certainly is no rough usage indicated.

Mr. Cardwell: Is not Mr. Kehm getting off the track when he assumes that this damage was not done simultaneously? We have got this paper to go by, and it says it is evident that the damage was done at the same time, and we have got to consider that in our decision.

Mr. Bates: I never saw an end sill broken in the center in that way by fair usage. It has always been my experience that when an end sill is broken in that way one or two draft timbers are broken also, and I think it is only fair to assume that the end sill was broken at the same time that these draft timbers were. I do not think that anybody in this room ever saw an end sill broken out in the center in that way by fair usage.

Mr. Grieb: It seems to me, from the way the case is written up, that there is no question in the minds of A and B as to the damage resulting from unfair usage.

Mr. Parish: I do not think there is any question but that B is responsible.

Mr. Cather: The third paragraph in this statement seems to me to conflict with the second. It says, "A asked B for defect card for the broken sill, but B declined to card, claiming that his company is not responsible, the car having been safe to run when he received it from connecting line." That would indicate that he had knowledge of the condition of things.

President Morris: Not necessarily.

Mr. Cather: Well, did he know anything about it?

President Morris: He does not claim to know.

Mr. Cather: Yes; he says, "safe to run."

President Morris: Well, it did run. That is good evidence that it was safe.

Mr. Cather: Well, did he know? It might run, and still not be considered safe, so far as the rules go.

President Morris: It means, I think, that the inspector of B, who received it, found car safe to run; he found no defects that would make car unsafe. It does not say or infer that he noticed the defective end sill, or that he did not notice it.

Mr. Cather: Paragraph 2 says, "It is evident that the sill was damaged at the same time as the draft timbers that were removed." My remarks are founded on that condition.

President Morris: I will say that I know that neither A nor B know positively that these draft timbers were broken at the same time that the end sill was broken. That is merely a supposition. Almost any inspector would naturally suppose, seeing two new draft timbers at the same end, and an end sill broken out in this way, that it was done at the same time, although there is nothing to show that it was done.

Mr. Kehm: I was on the other side a minute ago, but in order to close the matter I move that it is the sense of this meeting that the delivering company is responsible for the end sill.

President Morris: The motion is that the delivering company, in this case B, is responsible to A for the broken end sill, and should give a defect card.

The motion was carried.

#### MISSING DEADWOOD PLATES.

Mr. Showers: I have a case on which I would like to get the ideas of the association. A has been receiving a number of cars home with

new deadwoods applied. His cars, in fact all of his cars, have deadwood plates applied to the deadwoods, the full length of the deadwood, and he applies them. It seems that a number of roads have been in the habit of applying new deadwoods when they are worn out, and leaving the deadwood plate off. When such a car is received home, A asks the delivering line for a defect card for the missing material—the deadwood plate. Is he right in asking this, or should it be considered that it was wrong repairs in leaving the deadwood plate off? Should he get a joint evidence card, or should he get a defect card in the way of missing material?

Mr. Stagg: It seems to me that if A's cars are equipped with deadwood plates, and he receives these cars home with new deadwoods, without plates on, it is virtually wrong repairs, and he should demand a card for wrong repairs. Not all of our cars are equipped with deadwood plates, but a great many are. We received a car a few days ago with a plate missing. We demanded a card for wrong repairs. We haven't received it yet, but we hope to.

Mr. Showers: We cannot see it in that way. If the deadwood as applied is not wrong, you can't say the material is wrong. If we get a joint evidence card for wrong repairs, we could bill for the deadwood only, and would have to lose the deadwood plate.

Mr. Stagg: I cannot see why wrong repairs would not cover it. If you make a request for wrong repairs, the party making the repairs will come back, and want to know where it is wrong; and you say the deadwood is wrong, not being sawed out for plate and the plate applied.

Mr. Deen: These deadwood plates are angle-irons. The deadwood is gained out so the plate sets in flush with the deadwood. Some of the cars have just the outside plate on, and they have deadwoods that are not gained out at all. There is no hole in front of the deadwood to show that there has ever been a deadwood plate applied there, and the deadwood fits down tight, showing it has never been gained out for the bottom angle of the deadwood plate. Speaking of wrong repairs, we had a case a short time ago where the brakes on a car were repaired. It was a double lever brake, and the party that made repairs put on a bottom rod with a tail-pin through. Joint evidence was signed and presented to the company making the wrong repairs, and they carded for the whole thing. I do not see why a deadwood would not go in the same way. I do not remember whether there was a dead lever guide or not. I think there was.

Mr. Showers: If you consider it wrong repairs, and that A, the

owner, should receive joint evidence, all well and good; but if you consider it missing material, I would like to have you say so.

Mr. Grieb: It seems to me, from what Mr. Deen has said, that it is a question of whether it is wrong repairs or missing material. If the deadwood frame indicated positively that no deadwood plate had ever been applied, it is a clear case of wrong repairs. However, if a deadwood plate had been applied—and there must be some evidence to show in the absence of the deadwood plate—it would be a case of missing material.

Mr. Bates: It seems to me that joint evidence, properly made out, showing that the deadwood plate was omitted at the time the new deadwood was framed, would be all right. I do not believe that anybody would put on a deadwood in that manner, and try to get out of paying for it.

Mr. Stagg: I move that it is the sense of this meeting that it is a case of wrong repairs.

Carried.

The meeting then adjourned.

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THE INTREPIDITY of the old time locomotive engineer is proverbial. We are all familiar with reports of the engineman who, seeing his child innocently playing on the track just ahead of his fast-flying steed, sprang from footboard to cowcatcher and seized the child from the jaws of death. Also, of the hero who, in the darkness, observed that the bridge ahead had been blown away, urged his engine on at a terrific speed, jumped with his train the 50-foot wide chasm, and landed his train and passengers safely on the other side. It is pleasing to learn from an English source that, in times of danger, the daring and courage of the American locomotive engineer are undiminished. A correspondent advises us that, in a recent conversation with an English author of some note, the latter made, substantially, this statement: "During my visit to your country I was much impressed with the courage and daring of your engine drivers. I was informed by an officer of one of your leading railways that one of their engine drivers had proved himself a hero in an emergency. He was rushing his passenger train along at a good rate of speed, when, rounding a curve, he suddenly perceived, at a short distance ahead, an open switch and on the siding an engine and goods train. As quick as thought he applied the air brake,

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which almost brought the train to a standstill. He then gave the engine a full head of steam. The coupling next the engine was snapped in twain. The engine thus liberated simply jumped ahead, smashing itself and the goods train into splinters. The carriages and passengers remained unharmed on the main line."

We have not learned the name of the railway official who furnished this thrilling narrative.

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## AIR PUMP EXHAUST FOR HEATING FEED WATER.

At the recent meeting of the Traveling Engineers' Association, a committee reported on the question, "Is it economy to use the exhaust steam from the air pump to heat the feed water?" The committee said, in substance :

"Your committee believes that it has been proven by experiment that a saving of heat and fuel can be accomplished by utilizing this exhaust, considering the cost of the pipes, fittings and flexible connections, and the maintenance of same necessary to conduct the steam from the air pump to the tank.

"The first evidence of economy in utilizing the air pump exhaust is the absence of the action of the exhaust on the fire when recharging the train at stations, as unnecessary blasts on the fire are expensive on account of the waste at the safety valve. The second evidence is the number of heat units saved by raising the temperature of the water in the tank a certain number of degrees, without additional expense other than the cost of apparatus for conducting the steam to the tank. Taking water at 50° temperature and raising it to 90 with steam that would otherwise be wasted, we have, under favorable conditions, saved 148 pounds of coal to each tank of water used, which would mean to the average locomotive a saving of nine tons of coal per month.

"Overheating the water in the tender is the most serious difficulty which attends the heating of the feed water with the air pump exhaust. It should be guarded against by placing the cut-out lever as convenient to the engineer as possible, and he should also be enjoined to utilize all the exhaust steam possible from the air pump. This, however, is, under the existing conditions, a very difficult matter, as we have been unable to learn of any appliance that would indicate to the engineman the tem-

perature of the water in the tank. Consequently, the engineer, fearing that he may get the water too hot, will naturally protect himself by not utilizing the air pump exhaust. In regard to the temperature to which the water can be raised without impairing the action of the injector, a number of our members have shown a preference to different makes of injectors as to the capability of each instrument for working hot water. It has been fairly demonstrated by experiment that any of the standard injectors or inspirators will, when working at or about their fullest capacity, work water 20° hotter than when the instrument is throttled at the steam or water for the purpose of reducing the volume. Therefore, when the feed water is heated by any appliance, better results can be obtained by using as small sized injector as practicable. This point your committee believes to be a very good one, as there are a great many medium sized locomotives running with No. 9 and 10 injectors, when a No. 8 would be far more economical with either warm or cold water.”

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## PERSONAL MENTION.

Mr. S. P. Bush, superintendent of motive power of the Pennsylvania lines west of Pittsburg, Southwest System, has been appointed superintendent of motive power of the Chicago, Milwaukee & St. Paul, to succeed Mr. J. N. Barr, who, as we have previously noted, resigned to become superintendent of machinery of the Baltimore & Ohio. Mr. Bush is a young man to assume such a high position—he is only about 36 years old—but he has made a record on the Pennsylvania that fully warrants the trust that is now placed in him by the Milwaukee & St. Paul management. He first entered railway service in 1884 as special apprentice on the Pittsburg, Cincinnati, Chicago & St. Louis, and has steadily risen to the head of the mechanical department of that road. He first worked for two and a half years in the shop and the foundry; then for one and a half years in the drafting room and on special work. From 1888 to 1891 he was the assistant engineer of the motive power department; for the next two years master mechanic of the Columbus shops, and since March, 1893, superintendent of motive power of the system. Mr. Bush has, outside of his direct work on the Pennsylvania, been an active participator in the work of the Master Car Builders' and Master Mechanics' Associations. He is now an executive member of the former association, chairman of its standing committee on brake shoe tests, a member of its standing committee on prices in Master Car Builders' Rules, and a member of its committee on revision of rules for loading long materials. He was also appointed chairman of this year's committee on metal dead blocks and safety chains, but resigned this post. He is also chairman of the Master Mechanics' committee on piston valves. It is evident that his talents are fully recognized by his co-laborers in associational work.

It is reported that Mr. T. W. Demarest, master mechanic of the Pennsylvania lines, at Logansport, has been appointed superintendent of motive power of the Southwest System to succeed Mr. S. P. Bush, who, as elsewhere noted, succeeds Mr. J. N. Barr of the Chicago, Milwaukee & St. Paul.

Mr. W. L. Gilmore, master mechanic of the Lake Shore & Michigan Southern, at Elkhart, Ind., has resigned that position after holding it continuously for 16 years. Mr. Gilmore has been in railway service steadily for 36 years, without enjoying any vacations worth mentioning, and will now take a well earned rest for two or three months at his home in Elkhart, when he proposes to again take up railway work. At this juncture of his career it will be of interest to briefly review Mr. Gilmore's past record. He was born in Boston, in 1848, and entered railway service in 1864, as machinist apprentice on the Concord Railway, in New Hampshire, becoming later machinist and locomotive fireman on the same road. In 1871 he left the Concord road and went to the Lake Shore & Michigan Southern at Elkhart, Ind., remaining at that point for four years, during which time he served as machinist, gang foreman, and night foreman. In 1875 he was transferred to the same company's shops at Norwalk, Ohio, where he served 6 years as general foreman. In 1881 he went to the Cleveland, Columbus, Cincinnati & Indianapolis, at Cleveland, Ohio, as master mechanic of the Columbus and Cincinnati division, remaining there three years. On Jan. 1, 1884, he returned to Elkhart as master mechanic of the Lake Shore road, and has held that post continuously to date. Mr. Gilmore has many friends in the railway world who will gladly welcome him back after the rest that he proposes to take.

Mr. W. J. Robertson has resigned as master car builder of the Central Vermont, this move being occasioned by the assumption of control of that road by the Grand Trunk. Mr. Robertson has served the Central Vermont faithfully and ably for 28 years. He commenced with that road in 1871 as general draftsman in the locomotive and car shops, remaining in that position until 1885, when he was made superintendent of motive power. Since the latter part of 1892 he has been master car builder of the same road, retaining that position continuously to date. Mr. Robertson was elected third vice president of the Master Car Builders' Association in 1898, and was re-elected to the same high office in June, 1899.

Mr. C. B. Young has been appointed chief draftsman of the motive power department of the Chicago, Burlington & Quincy, vice Mr. F. H. Clark, promoted to be mechanical engineer.

Mr. F. H. Clark, hitherto chief draftsman of the motive power department of the Chicago, Burlington & Quincy, has been appointed mechanical engineer of that road, with office in Chicago. Mr. Clark's well deserved advancement follows a service of some five years with the Burlington Railroad as chief draftsman. Previous to this connection Mr. Clark, who is a graduate of the University of Illinois, had had some experience in manufacturing and railway shops as machinist, and in electric lighting and construction, and also four years of active work in the employ of the late David L. Barnes, the famous consulting engineer. Mr. Clark assumes his new position with the best wishes of friends who have watched his careful, thorough work for years past, and who are heartily glad for him that he has been given this title upon so important a railway system.

Mr. David Brown, master mechanic of the Delaware, Lackawanna & Western at Scranton, Pa., has, it is stated, resigned.

Mr. W. O. Jewell has been appointed master car and locomotive painter of the Louisville, Evansville & St. Louis, with headquarters at Princeton, Ind.

Mr. W. O. Davies, Jr., has been appointed master car builder of the Laurel Hill Car & Coal Co., the W. P. Rend Transportation Co., and the Chicago & Central Ohio Coal Co., with headquarters in Chicago.

Mr. S. B. Mason has been appointed assistant to the mechanical superintendent of the Baltimore & Ohio, with office at Mount Clare, Baltimore, Md.

Mr. D. J. Redding, heretofore foreman of locomotive and car repairs of the Pittsburg & Lake Erie at Dawson, Pa., has been appointed master mechanic of that road, with headquarters at McKees Rocks, Pa.

Mr. J. E. Simons, having resigned, as previously noted, as assistant master car builder of the Pittsburg & Lake Erie, that office has been abolished. Mr. G. E. Carson has been appointed general foreman of car department, with headquarters at McKees Rocks, Pa., and will attend to the duties heretofore performed by the assistant master car builder.

Mr. Samuel Pullman, formerly master car builder of the Chicago, Rock Island & Pacific, died in Chicago, recently, aged 69 years.

Mr. Charles T. Browne, of the Baldwin Locomotive Works, was recently injured while testing a steam chest at the locomotive works and subsequently died as a result of those injuries.

Mr. Frank Schubert, of Parsons, foreman of the air brake department of the Missouri, Kansas & Texas, has been appointed air brake inspector of that road, vice C. C. Farmer. Mr. Schubert's headquarters will be in Parsons.

Mr. Charles Butler, general foreman of the Chicago & Eastern Illinois shops, at Danville, has resigned to accept a similar position with the Illinois Central at Effingham.

Mr. J. P. Coleman, hitherto of the Grand Trunk at Chicago, has been appointed master car builder of the Central Vermont, vice Mr. W. J. Robertson, resigned.

Mr. E. E. Brook, traveling engineer of the Pittsburg & Lake Erie Railroad, has resigned and taken an engine. R. W. Johnson has accepted Mr. Brook's position as traveling engineer.

Mr. W. C. Cook, chief clerk in the office of the general car foreman of the Chicago, Milwaukee & St. Paul, has resigned to accept a similar position in the office of the master car builder of the Swift Refrigerator Transportation Co., of Chicago. Mr. A. Kline succeeds Mr. Cook on the Chicago, Milwaukee & St. Paul.

Mr. O. H. Jackson, who until recently was master mechanic of the Santa Fe, Prescott & Phoenix, and Prescott & Eastern Railways, has been appointed master mechanic of the Belt Railroad, of Indianapolis.

Mr. John Parsons, one of the builders of the first railway locomotive constructed in America, and the oldest resident of Medina, N. Y., died November 28, at his home in Medina, aged 91 years.

Mr. Henry Israel, who for over 47 years has been a faithful employe of the Ft. Wayne Railroad, and who for the past few years has been road foreman of engines for the division west from Alliance, with headquarters at Alliance, has been given a new position at Allegheny City, where his duties will be to have the oversight of the engine-men in that city.

Mr. Frank Aitken, who was formerly connected with the Baltimore & Ohio South-western shops at Washington, Ind., has been appointed superintendent of the Columbus, Sandusky & Hocking shops, vice J. S. Mackenzie, who goes with the New York, Chicago & St. Louis as assistant master mechanic.

The jurisdiction of G. L. Potter, general superintendent of motive power of the Pennsylvania Lines west of Pittsburg, has been extended over the lines of the Grand Rapids & Indiana, with the title of general superintendent of motive power.

Mr. John Player has been appointed superintendent of machinery of the entire Santa Fe system. Mr. Geo. W. Smith has been appointed master mechanic, in charge of all lines west of Albuquerque; this includes the Santa Fe Pacific, the Southern California and the San Joaquin Valley roads. Mr. James Collinson has been appointed master mechanic in charge of the Gulf, Colorado & Santa Fe.

Mr. Malcolm H. Wallace, chief clerk of the motive power department of the Northern Pacific Railway, has resigned to accept the position of chief clerk to Edwin M. Herr, assistant general manager of the Westinghouse Air Brake Company, at Pittsburgh. Mr. Wallace is succeeded on the Northern Pacific by Mr. F. N. Finch.

Mr. W. H. Sullivan has been appointed foreman of the shops and roundhouse of the Wabash at Peru, Ind., vice J. W. Brown, resigned.

Mr. T. M. Baughan, general car inspector for the Baltimore & Ohio western lines, with headquarters at Newark, has resigned.

Mr. H. T. Ellison has been appointed master mechanic of the Chattanooga & Durham, with headquarters at Chickamauga, Ga.

Mr. E. H. Bankard, purchasing agent of the Baltimore & Ohio, has also been appointed purchasing agent of the Cleveland Terminal & Valley.

Mr. H. E. Yarnall, purchasing agent of the Choctaw, Oklahoma & Gulf, has removed his office from South McAlester, I. T., to Little Rock, Ark.

Mr. F. B. Shepley has been appointed purchasing agent of the Fitchburg, succeeding G. J. Fisher, resigned.

Mr. F. O. Bray, formerly division master car builder of the Lake Shore & Michigan Southern, has been given the title of storekeeper, although he is virtually on the retired list. Mr. Bray, who is 72 years of age, has been in the service of the Lake Shore for 47 years, or since 1852, and has been master car builder of the Michigan division since 1877. —*Railway Age*.

Mr. W. H. Holland has been appointed general foreman of the Lake Shore & Michigan Southern shops at Norwalk, Ohio.

Mr. C. E. Fuller has resigned as superintendent of motive power of the Central Vermont, and has been appointed assistant master mechanic of the Erie, at Susquehanna, Pa.

Mr. G. G. Gage, Sr., has resigned as foreman of the St. Louis Southwestern shops at Pine Bluff, Ark., and is succeeded by Mr. Charles Langston.

The office of master mechanic of the Lake Shore & Michigan Southern at Buffalo, N. Y., which has been held by Mr. Edward Elden, has been abolished, and the jurisdiction of Mr. A. A. Bradeen, master mechanic at Cleveland, Ohio, has been extended over the entire eastern and Franklin divisions.

Mr. E. DeSilva has been appointed acting master mechanic of the St. Louis, Peoria & Northern vice W. J. Hemphill, who, as previously noted, resigned to become master mechanic of the Chicago & Alton.

Mr. Albert S. Adams, who was master mechanic of the Boston & Worcester Railroad for eight years between 1850 and 1860, died at Newton, N. H., on November 8, at the age of 83. Mr. Adams designed the "Express" and the "Dispatch," two famous passenger locomotives in their day; and it was during his administration that bituminous coal was first used as a fuel for locomotives in Massachusetts. He was a prominent

member of the old New England Master Mechanics' Association, which was composed of such men as John B. Winslow, Wilson Eddy, George Griggs and John Kimball.—*Railroad Gazette*.

Mr. G. J. Fisher has resigned as purchasing agent of the Fitchburg. He has held the position since 1887, and was formerly purchasing agent of the Eastern Railroad and the Boston & Maine.

Mr. F. R. F. Brown, formerly mechanical superintendent of the Intercolonial Railway, has been elected secretary of the Dominion Iron & Steel Company, of Sydney.

Mr. James M. Thomas, Jr., heretofore roundhouse foreman of the Norfolk & Western at East Radford, Va., has been appointed general foreman of the shops of the same road at Portsmouth, Ohio, vice Mr. J. Cullinan, resigned to become master mechanic of the Columbus, Sandusky & Hocking.

Mr. J. T. Stafford, heretofore acting master mechanic of the St. Louis, Iron Mountain & Southern at Baring Cross, Ark., has been given the full title of master mechanic.

Mr. C. A. Sanders has been appointed assistant master mechanic of the Missouri Pacific at Fort Scott, Kan., vice Mr. J. T. Jones, transferred to other duties.

Mr. John C. Cox, formerly purchasing agent of the Baltimore & Ohio, died at his home in Pittsburg, Pa., on November 24, aged 79 years.

Mr. H. J. Warthen has been appointed master mechanic of the Carolina & Northwestern, with headquarters at Chester, S. C.

Mr. D. A. Doty has been made foreman of the Oregon Short Line paint shops at Salt Lake City, vice the late Mr. Bywater.

Mr. William Wright, general foreman locomotive and car department of the Vandalia Line, with headquarters in Terre Haute, Ind., has resigned to become superintendent of the Pressed Steel Car Company's plant at McKees Rocks, Pa.

Mr. J. O. Bradeen, master mechanic of the Lake Shore & Michigan Southern at Norwalk, Ohio, has been appointed master mechanic of the same road at Elkhart, Ind., vice Mr. W. L. Gilmore, resigned.

Mr. James Buchanan has resigned as division superintendent of motive power of the New York Central & Hudson River at West Albany, N. Y., to accept the position of master mechanic of the Delaware & Hudson at Green Island, N. Y.

Mr. J. M. Robb, general foreman of shops of the Chicago Great Western at Oelwein, Iowa, has been transferred to St. Paul as division master mechanic, vice Mr. L. L. Smith, who has been made general foreman of shops at Oelwein.

Mr. C. E. Slayton, division master mechanic of the Chicago Great Western at Dubuque, Iowa, has been appointed master mechanic of the Virginia & Southwestern, in charge of motive power and equipment, with headquarters at Bristol, Tenn., vice Mr. T. R. Shanks, resigned.

Mr. W. D. Robb, master mechanic of the Grand Trunk at Toronto, Ont., has been appointed superintendent of motive power of the Central Vermont, with headquarters at Saint Albans, Vt., vice Mr. C. E. Fuller, resigned.

Mr. Clarence Price, of Cincinnati, Ohio, has been appointed purchasing agent of the Chicago & Alton, with headquarters at Chicago, vice Mr. A. V. Hartwell, resigned.

Mr. F. F. Hildreth has been appointed acting general foreman of the car and locomotive department of the Vandalia Line at Terre Haute, Ind., vice Mr. William Wright, resigned to go to the Pressed Steel Car Co.

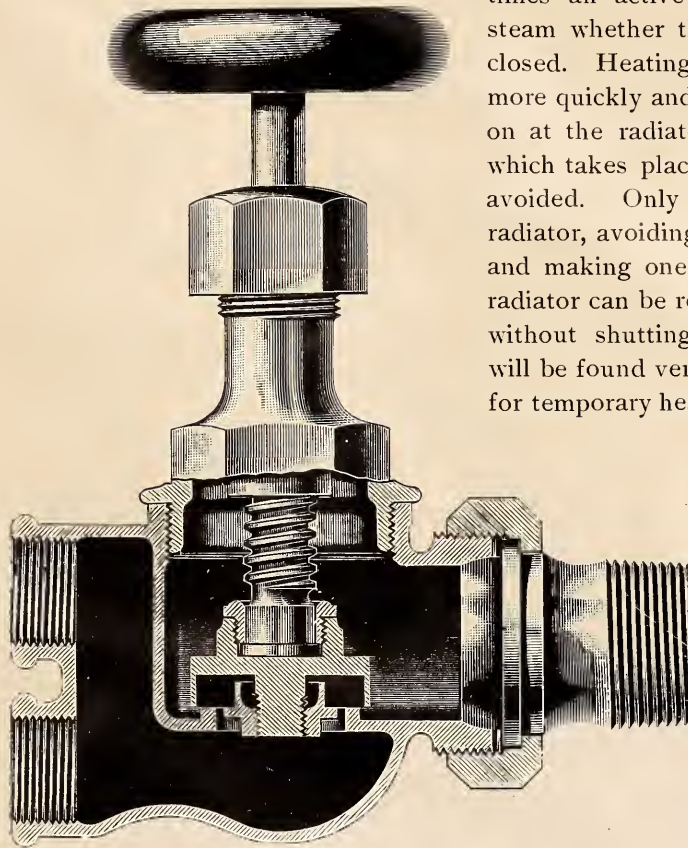
Mr. W. S. Haines has been appointed master mechanic of the Baltimore & Ohio at Newark, Ohio, vice Mr. W. H. Harrison, Jr., resigned.

### THE COLLIS CIRCULATING VALVE.

In the illustration herewith is shown a sectional view of a new valve for radiators, heating coils, etc., which is just being placed on the market. As will be seen, it has on one side a connection to the radiator, and on the opposite side there are two openings or connections, both into the same chamber, the upper one for the steam, the lower one for return. This is to permit a circulation from the steam to the return pipe, and to maintain at all

times an active and positive circulation of dry steam whether the valve is open, partly open or closed. Heating surfaces can thus be warmed up more quickly and effectively when steam is turned on at the radiator; and the usual water hammer which takes place when steam is first turned on is avoided. Only one valve is required for each radiator, avoiding the necessity of the return valve and making one valve do the work of two. The radiator can be readily disconnected or reconnected without shutting down the whole system, which will be found very convenient when using radiators for temporary heating in new buildings. The valve

can be adapted for use with any of the automatic heat regulating systems, by removing the regular bonnet and substituting the diaphragm bonnet and trimmings of the regulating system that may be used. It is not a new or untried device, but has long been experimented with by some of the ablest men in the heating business, by whom its merits have been proved. The valve



is made in three sizes, as follows:  $1\frac{1}{4}$ -inch,  $1\frac{1}{2}$ -inch and 2-inch to radiator, with  $\frac{3}{4}$ -inch by  $\frac{3}{4}$ -inch, 1 inch by 1 inch and  $1\frac{1}{4}$ -inch by  $1\frac{1}{4}$ -inch steam and return connections, which will supply radiators or coils up to 60 square feet, up to 100 square feet, and over 100 square feet of surface respectively.

The valves are made of the best steam metal, extra heavy, either plain or nickel plated, nicely finished; and they contain all the improvements, and are made in the same careful manner, as the regular Jenkins Bros. radiator valves. Further information may be obtained by addressing the manufacturers, Jenkins Brothers, at either of their offices—New York, Boston, Philadelphia or Chicago.

### SUPPLY TRADE NOTES.

In a recent circular the Columbian Electric Car Lighting and Brake Company, of New York, calls attention to the fact that it is the owner of basic patents for gear devices to transmit power from car axles for operating electric lights, ventilating fans, etc., in cars, and that its device is now in operation on the New York Central, Pennsylvania, Baltimore & Ohio, Boston & Albany, Union Pacific, Rutland, Illinois Central, Lake Shore & Michigan Southern, Canadian Pacific, Cleveland, Cincinnati, Chicago & St.

Louis roads, also the Wagner Palace Car Company and the Pullman's Palace Car Company. A number of contracts have also been secured from other railway companies for the equipment of their cars, which contracts are now being filled. This company also controls the Lindstrom lever brake and the circular states that the Pullman Company has made a contract with it to furnish this device for 6,000 cars. It has also equipped some two thousand passenger cars of the leading trunk line roads with this lever brake. The Pullman cars now running into the Pennsylvania station at Jersey City are equipped with it. A gear device for transmitting power furnished by windmills for electric lighting purposes has been perfected by the company, and it is believed that it will come into extensive use for country houses and in small towns. The Skinner electric brake, for electric cars, is owned by this company and has proved wholly satisfactory in careful tests made under the supervision of the New York Board of Railroad Commissioners.

The Harrison dustguard has been specified on the 50 cars, of 80,000 pounds' capacity, being built by the Pullman Company for the Hocking Valley; on the 500 steel cars being built by the Pressed Steel Car Company for the Pittsburg & Lake Erie; on the 50 passenger coaches being built by Harlan & Hollingsworth Company for the New York Central, and on the new passenger combination, baggage and express, and coal and box cars which the Southern has recently ordered.

The Keasbey & Mattison Company, of Ambler, Pa., has commenced work on a new addition to its plant in South Ambler. The building will be 298 feet by 60 feet, and will cost \$50,000 to build.

The Watson-Stillman Co., of New York, is now represented in the west by Mr. F. T. West, whose headquarters are at Chicago; a stock of this concern's goods is now carried in Chicago. The company is about to ship a large hydraulic press to the English Brush Electric Co. The press is capable of exerting a force of 500 tons. The working pressure is 6,000 pounds per square inch. A smaller hydraulic press is now being prepared for shipment to the Havre works of the French Westinghouse Electric & Manufacturing Co. The company is also preparing some of its hydraulic machinery for shipment to Paris and Brussels.

The Pennsylvania Car Wheel Co.'s works, located in Lower Allegheny, Pa., have been sold to the Pressed Steel Car Company. The entire output of the plant, for the present, will be taken by the Pressed Steel Car Co.

The sales of the Wells Light Mfg. Co.'s lights for the past three months have been very large, exceeding the sales for the same period for the past four or five years. The prospects are that the output for the next three months will be still larger.

A. O. Norton, Boston, Mass., has added some new special machinery to his plant to keep up with the increasing demand for his ball-bearing lifting jacks. He reports several large export orders received this month.

The Cleveland Twist Drill Co. is following the wise policy of keeping its facilities for conducting the processes incidental to its line of manufacture up to the high standard of its output, arguing that a model tool is the legitimate product of a model shop.

At a recent meeting of the stockholders of the Westinghouse Machine Co., in addition to ratifying the recommendation of the directors for a new issue of \$1,500,000 in bonds, plans were discussed for the erection next year of a gigantic forge and steel castings plant to be operated in connection with the present works. Plans for the proposed forge and steel castings plant are now being completed by Thomas Rodd, chief engineer of the Pennsylvania Co. The present works are being vastly extended to take care of the growing business, and the forge and steel castings plant will give employment to about 300 more men. For these, two steel buildings will be erected. The new steel cast-

ings plant will have an output of 80 tons a day. The forge will turn out finished forgings weighing as much as 20 tons apiece. The improvements planned, when completed, will involve the expenditure of something like \$100,000.

The Sargent Company, of Chicago, is installing the machinery in its Chicago Heights plant, and looks forward to operating the iron department at an early date.

The Cincinnati Corrugating Co., Piqua, Ohio, have just issued a new and handsome map of the South African Republic, Orange Free State and Cape Colony, the seat of the present warfare between England and the Boers. The map is excellently printed in colors, and complete in details, thoroughly revised and up to date, showing all the points of interest in the war. The company will be pleased to mail a copy, ready for hanging, to any one requesting same.

Mr. Wallace W. Johnson, who has for a number of years past been associated with the Keasbey & Mattison Company, manufacturers of boiler lagging, is now in the service of the Franklin Manufacturing Company, as its representative.

New shops, and additions to shops, are reported by our exchanges during the past month as follows: The A., T. & S. F. will build an engine house and coal chutes at Bartlesville, I. T.—Work has been begun on a new machine shop for the Cotton Belt Railroad at Tyler, Tex.—The paint shop of the Denver & Rio Grande at Burnham, Colo., was burned recently.—The Canadian Pacific Railway Company has prepared plans for new car building shops at Toronto, Can.—The machine shops of the Union Pacific, at Green River, were destroyed by fire recently, and will be replaced by a modern plant.—The St. Louis Southeastern will build machine shops and a roundhouse at East Waco, Tex.—The Pittsburg & Lake Erie is to build a new roundhouse and machine shop at New Castle, Pa.—The Chicago, Milwaukee & St. Paul Railway will build a number of engine stalls and erect additional coal sheds at Faribault, Minn.—The acquisition by the Pullman Company of the Union Pacific shops, hitherto used by the Colorado & Southern, will compel the building of another big shop at Denver by the Colorado & Southern.—The Southern Pacific is to build a number of coal chutes at different points along its line.—The Little Rock & Hot Springs Western Railroad is about to let a contract for a new roundhouse at Hot Springs.—The Canadian Pacific Railway Co. has awarded the contract for building an addition to the foundry buildings at Hochelaga, Que., to J. P. O'Leary.—The Gulf, Colorado & Santa Fe will build at Bellville, Tex., a 16-stall stone engine house, sand house, 30-pocket coal chute, and reservoir with water tank, columns, etc.—W. P. Carmichael, of Lafayette, Ind., has been awarded the contract for the rebuilding of the shops of the Wabash at Fort Wayne, and also for a 16-stall roundhouse.—The Southern Pacific will soon begin work on new machine shops at West Oakland, Cal., plans for which have already been prepared.—A roundhouse to cost \$40,000 is to be built at Logansport, Ind., by the Pennsylvania.—The Chicago & North-Western is constructing a roundhouse at Clinton, Iowa. The building is 376 feet outside diameter. The company will also build an oil house, 32 by 34 feet, at the same place.—The Union Pacific will add a foundry to its shops in Cheyenne, Wyo.—The Union Pacific shops at Cheyenne, Wyo., have been destroyed by fire. The shops will be rebuilt.—The Rio Grande Western has built a new boiler shop at Salt Lake City.—Nearly \$200,000 is to be expended by the Chicago & Alton in improving its shops and terminals at Bloomington. The changes include a new car shop, a central power, lighting and heating plant and an electrical station for supplying power to drive the car shop machinery.—Chief Engineer Cowan has plans completed for the Colorado & Southern paint shop which is to be erected at Denver. It will be 50 by 250 feet on the ground, and 40 feet to the comb of the roof, with a capacity of 8 day coaches at one time.—Plans have been completed for a new roundhouse at Denver, for the Colorado & Southern.—It is stated that the Cleveland, Akron & Columbus Railway Company will build a new roundhouse at Akron next

summer.—The Buffalo, Rochester & Pittsburg Railway will probably erect new shops at Du Bois, to cost about \$300,000; the company will also build a new roundhouse at Du Bois.—At Smelter Junction the Canadian Pacific Railway has completed the construction of a new 5-stall roundhouse and repair shop.

### PNEUMATIC TOOL LITIGATION.

#### Card from the Chicago and the Standard Companies.

CHICAGO, ILL., November 29, 1899.

We wish to notify all our customers and the trade in general that, in the patent litigation entered into between the Chicago Pneumatic Tool Company, Joseph Boyer, the Standard Pneumatic Tool Company and the Chouteau Manufacturing Company, all suits have been dismissed by the advice of their respective attorneys, they recognizing that the Boyer and Chouteau patents cover the fundamental principles of all pneumatic hammers, without the combined use of which no successful pneumatic hammer can be made.

Recognizing the value of their respective claims, they have purchased licenses from each other covering their present style of hammers.

We consider this action necessary for the protection of users of our respective tools.

CHICAGO PNEUMATIC TOOL COMPANY,

By J. W. Duntley, President.

STANDARD PNEUMATIC TOOL COMPANY,

By Edward N. Hurley, President.

#### Card from the Q and C Company.

NOVEMBER 27, 1899.

Referring to the articles now appearing in the mechanical papers pertaining to litigation on pneumatic tools, and in order to make clear the position of the Q and C Co., we wish to distinctly state that we are not in any way involved in this controversy. The line of tools manufactured by us are protected by our own patents, unique and broad in themselves and absolutely clear from any infringement. Full protection will be given to any purchaser of our tools from any liability on account of their use.

We also wish to state that we have completed our line of pneumatic tools, and, in addition to hammers and riveters, will shortly offer for sale pneumatic drills, both for metal and wood work, and pneumatic hoists, and trust that you will investigate the advantages of our devices before purchasing any tools of this description.

THE Q AND C COMPANY,

C. F. Quincy, President.

#### Another Card from the Q and C Co.

We notice in recent issues of the railway and mechanical press, reference to a circular issued jointly by two manufacturers of pneumatic tools, in which they state that the patents controlled by them cover the fundamental principles of pneumatic hammers, without the combined use of which no successful pneumatic hammers can be made.

We do not, at this writing, desire to express our opinion as to the accuracy of this statement when applied to *valved* hammers, but it is absolutely misleading and damaging to our interests in its present form.

We wish to state that the *valveless* hammers manufactured by us are not in any way an infringement of the patents they refer to, or any others, and that the question of their success is one that is settled by their use and not by statements of other competing manufacturers.

THE Q AND C COMPANY.

# RAILWAY MASTER MECHANIC

WALTER D. CROSMAN, EDITOR.

EDWIN N. LEWIS, MANAGER.

W. E. MAGRAW, ASSISTANT MANAGER.

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Vol. XXIV.

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No. 2

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THE INTERCHANGE RULES are about due for their annual revision by the railway clubs. The usual reports of the latter to the Master Car Builders' Association are called by Secretary Taylor for April 21. It is now pretty generally agreed that the less that is done with the rules the better. They are now in fairly good shape. There were, it will be remembered, comparatively few changes made at the last convention, many proposed changes by the different clubs being not concurred in by the Arbitration Committee. The gratifying results following the policy of leaving the rules alone, as far as possible, are indicated by figures just given by Secretary Taylor, which show the number of cases decided by the Arbitration Committee during the last three years to be as follows: September, 1896, to September, 1897, 111 cases; September, 1897, to September, 1898, 38 cases; September, 1898, to September, 1899, 35 cases. We are further informed, that of the cases decided since September, 1899, none have arisen under the rules now in force. The inference is strong that the rules are now in good working shape, and that they should be subject to further alteration only under the control of a very conservative policy.

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## Heavier Power and Lighter Grades—An Object Lesson.

The annual report of the Northern Pacific Railway is unusually interesting to motive power men, as the mechanical department receives much more attention than is usually given in the annual reports of other railways.

The important feature which it reveals is the close co-operation of the transportation and engineering departments with the motive power department.

The Northern Pacific road was originally built with heavy grades and light rails, and was equipped with small locomotives and cars of low

capacity. It has been the policy of the present management, during the past nine years, to change these conditions, so as to reduce the cost of transportation, and the work is now nearly completed. The plan, as originally outlined, was to adjust the grades of the various divisions so as to make it possible to haul trains of uniform and maximum weight over considerable sections of the road, and thus avoid the detentions and cost incident to rearranging trains at terminals. While it was impracticable on account of the extreme length of the main line and the mountain ranges which it crosses, to secure the same maximum grade for all divisions, yet a uniform tonnage of trains on adjacent divisions has been secured, by an approximate equation of power and grades.

The locomotives purchased in recent years have been of the heaviest type, and during the fiscal year 1897-1898 forty-three new locomotives were purchased, and in 1898-1899 twenty-three new locomotives were added to the equipment and twenty-eight old engines were sold. By such changes in the locomotive power during the last fiscal year the total weight on drivers of assigned locomotives has been increased 9.6 per cent and the total horse-power capacity increased 10.5 per cent.

The company now has seventy-one compound locomotives, all but three or four of them Schenectady 2-cylinder compounds, and nine of them are passenger engines. The compound locomotives on this road have continued to show a superior economy when compared with simple engines in the same service. A number of them have been in service three years, but have not yet required general repairs.

Most of the freight car equipment bought in recent years has been 70,000 pounds capacity for both flat and box cars, and a large number of Rogers' ballast cars of 80,000 pounds capacity are used in winter for coal, temporary high sides being added, so that the full capacity of forty tons of coal can be hauled. The capacity of freight cars under repairs has been increased by reinforcing the bolsters and the use of larger axles, and since 1896 the increase in capacity thus obtained has been equivalent to 960 cars of 60,000 pounds capacity.

It has been found, as the result of the introduction of heavier power, that the saving in the cost of transportation has been far in excess of that incident to grade revision alone.

The results that have attended the adoption of the improved methods of operations and grade reductions, show that since 1890 there has been an increase of over 100 per cent of tons per train mile, an increase of 38 per cent in tons per loaded car mile, and, notwithstanding a reduction

in revenue per ton mile of 25 per cent, there has been an increase of 60 per cent in revenue per train mile.

In increasing the tonnage of trains, it has been found that the schedule of freight trains west-bound was too fast for economical operation, and the loss of hauling capacity of engines incident to increased speed is enormous. In the report the statement is ventured that there is no single reform that can be adopted that will yield so large an increase in net earnings as the adjustment of the speed of freight trains with reference to the economical performance of the locomotives.

The progress made in the last three years in car loading and train

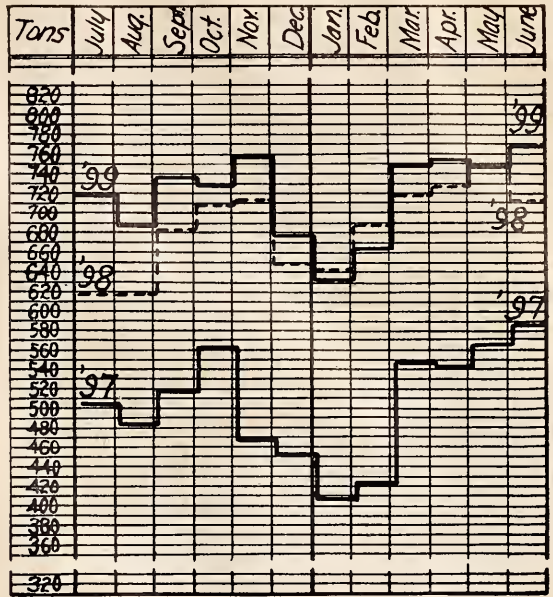


FIG. 1—AVERAGE GROSS TONS PER TRAIN MILE.

loading is shown by diagrams, Figs. 1 and 2, though it is probable that the low train loads in 1897 are the result of a smaller volume of traffic available for hauling.

With reduced grades, more powerful engines and greater capacity of cars, the remarkable improvements which these diagrams reveal could only be obtained by a

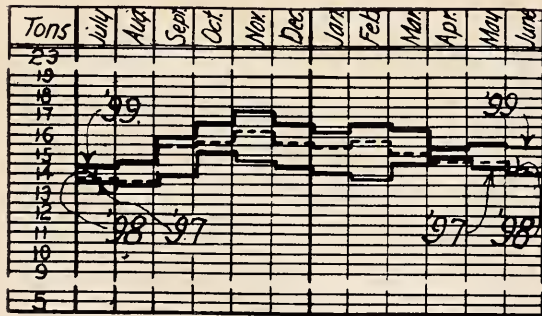


FIG. 2—AVERAGE NET TONS PER LOADED CAR.

a close co-operation of the officials and men in the transportation and motive power departments, and this is cheerfully recognized in the report.

IT IS well settled that a violation of the rules of a railway company will defeat recovery of damages against it. The exception to this is where the company itself has sanctioned the custom of its employes to act in violation of the rules, and has thus virtually abrogated them. This exception, the supreme court of Michigan goes on to explain, is based upon the theory that it would be unjust in employers to establish rules, and then sanction their violation, and interpose such violation as a defense. And it holds, in the case of Fluhrer

against the Lake Shore & Michigan Southern Railway Company, that it is only where a rule is violated by employes so universally and notoriously that it is a fair inference that the company sanctioned and approved the violation, is the company debarred from making a defense in a personal injury case of a violation by the employe of a rule. Custom alone is not sufficient to bind it. More particularly does it here hold that when a company had entered into a contract with an employe, in which he acknowledged the receipt of a copy of its rules and agreed to abide by them, it had met the case against it, even though it was not negligence in itself for the employe to do the act forbidden by the rules and which resulted in his undoing. The burden of proof, it maintains, was then cast upon the plaintiff to show that the company sanctioned a departure from the rule by a custom so universal and notorious that the company was presumed to have had knowledge of it and to have ratified it.

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## THE REHABILITATION OF THE PISTON VALVE.

BY ROBERT F. HOFFMAN.

Atchison, Topeka & Santa Fe Railway.

### II.

In the matter of first cost of production of piston valves, as compared with the first cost of partially balanced D valves, a reasonable scale of comparison may be established from machine tool operations as conducted in railway division point shops. Manufactured in contract quantities, as for locomotives ordered in considerable numbers of a given class, the superior facilities of manufacturers would enable them to materially reduce the figures later quoted for both types of valve.

The skilled labor involved in the making of a balanced slide valve of the strip type is so well known as to require little reference in this connection. There is required only regularly good planer, shaper and bench work, with immaterial amounts of blacksmithing and drill work, values of which are considered in the itemized summary of cost.

The proper making of a plug piston valve is at once a much more simple and a more exacting process than the making of the D valve. Given good valve metal, the nice fitting of the plug valve to its cage, at the first, largely determines the length of its service and, as well, its efficiency in regard to steam retention. A valve that is fitted too loosely is, to all intent, seriously worn when it leaves the lathe; a valve fitted too closely may operate ideally under steam, and work quick destruction when "drifting" is required. To establish the allowable limit of diametric clearance between valve and cage, the nature of the road or of the

division must be, to some extent, considered. To accommodate the changed relations of parts while using steam, or when air is being drawn in through relief valves while drifting, it is necessary to know the location and arrangement of steam chests, and also the extreme conditions under which the valves will be required to operate. Statements, these, of self-evident facts, but statements which assume their true value only in the eyes of any who have tried to establish the safe middle ground for such equipment, where the requirements are most exacting.

Obviously, the most trying conditions under which the qualifications of the plain piston valve could be put to the test would be those entailed upon a rugged mountain division. It is such a division which is now held in mind—a division where, in crossing an outlying range of the Rocky Mountains, curves of  $10^{\circ}$ , with grades of slightly more than 185 feet to the mile, form the most arduous parts of the division's difficulties. Continuous descents of from nine to sixteen miles are made, drifting, after thoroughly heating all steam acting parts in climbing such ascents as those cited. The moment the crest of such a division is reached the change in the internal temperature of steam chests is great. The range of temperature between the quickly chilled valve cage and the more protected valve likewise is great. In winter, these manifestations are most clear. It is upon mid-winter experiences, with piston valves mounted in cages within ordinary steam chests, that these comments are based.

Without entering upon the detailed transactions of the work the results may be stated, thus: A plug valve turned and burnished to an absolute sliding fit will operate admirably under steam. It will also tear the quadrant loose from its moorings, or break eccentric blades when going down a mountain side.

The proper amount of allowance for temporarily unequal shrinkage in drifting was found to be two one-thousandths (.002) of one inch—about the thickness of the paper upon which this matter is printed. To the latheman, this is just that amount which will make it possible to feel a slight lift of the valve within its cage when finished, quite smooth, and quite free from oil. Under no circumstances should a file be used in finishing the valve.

A valve fitted as described will prove up correctly under all the customary tests for "blowing." It will run a daily trip of 110 miles, for a period of from six to eight months, in the most severe service, without cause for complaint. It will run one year without necessity for renewal in a good-water country, and probably longer. Observations upon which these statements are based were taken in large part where water fed to

boilers analyzes above 80 grains of encrusting solids per gallon of water ; where the mixing of waters highly charged with various carbonates and sulphates results in priming at times when there is excessive foaming. The trial of endurance of valves was therefore more than ordinarily severe. A strip balanced D valve, under the conditions stated, will require the removal of its chest and the dressing of the valve face, valve seat, balance table and spring strips at least twice per year ; probably double that amount of work.

The relative cost of properly making and maintaining the two kinds of valve would then be about as follows, contemplating one year's service for each type, 18 x 24-inch engine :

## BALANCED D VALVE.

Valve casting, 100 pounds, at 3.6c.....	\$ 3.60
Four balance strips, 20 pounds, at 3.6c .....	.72
Steel strip springs, 1 pound, at 6.5c.....	.065
Planing valve, 8 hours, at 28.5c.....	2.28
Planing balance strips, 5 hours, at 14c.....	.70
Facing strips to bearing, 5 hours, at 28.5c.....	1.425
Blacksmith, springs, ½ hour, at 32.5c.....	.16
Drilling, ½ hour, at 15c.....	.07
Repairs for one year.....	6.98
Total for one valve one year.....	\$16.00
Total for one engine (two valves).....	\$32.00

## PLUG PISTON VALVE.

Valve casting, 63 pounds, at 3.6c.....	\$2.268
Lathe work, 5.5 hours, at 28.5c.....	1.567
One valve—renewal per year.....	3.835
Boring cage, 3 hours, at 28.5c .....	.855
Total outlay, one valve one year.....	\$8.525
Credit 50 pounds valve scrap at 1c.....	.50
Net outlay, one valve one year.....	\$8.025
Total for one engine (two valves).....	\$16.05

Taking the strip balanced valve as a basis, it is evident that there is a margin of 50 per cent economy in favor of the piston plug. Quite that much, for the reason that the mental balance of conditions, carried by the writer, has constantly been cast for the D valve, rather than against it, in making this summary. The idea, borne throughout, is rightfully that of limiting the endurance of each type of valve to the time at which it becomes extravagant in use of steam.

It is well to say, just here, that unless the useful life of the plug valve be carefully determined, under the conditions wherein it is operative, and the limitation thus set be carefully adhered to, the valve is capable of working great extravagance in the steam outlay. Like many

other good things it is more desirable in its use than in its abuse. In the matter of mere neglect in daily operation, however, it will work where a flat valve would cut to dust.

Types of valves, and results obtained from them, will be reserved for a later article in connection with brief comment upon the work performed.

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## ELECTRIC TRAVELING CRANE MOTORS.

Owing to the fact that crane motors are "intermittent workers," motor manufacturers have been in the habit of supplying machines too small for the work for which they are intended. They rely on the capacity of the machine for developing an additional 75 or 100 per cent for short periods, and thus bringing the maximum horse power up to what has been specified. The results in some instances have been curious, not to say disastrous. For instance, a crane maker might order a 10-horse power for his hoisting motor, knowing that he has a right to expect that machine to develop 17 to 20-horse power, for short periods, providing it is properly rated. But the motor maker supplies a 6-horse power machine, doubtless appeasing his conscience by his knowledge of the fact that it will develop 10-horse power intermittently. The consequences are what might be expected—injurious heating, excessive sparking at the commutator, frequently broken wires in the armature, and the total failure of the motor after a few months of dissatisfaction.

Latterly the best makers of electric cranes have the motors so arranged that worms, worm wheels, and bevel gears, and their concomitant evils are entirely dispensed with. In the earlier types, the power from the hoisting motor was transmitted by means of a worm to the hoisting gear, the idea being to make the crane self-sustaining without the use of a brake. Experience has proved that this arrangement, where heavy work is concerned, is not reliable, since in one instance a crane, constructed on this principle, allowed its load (a partly finished locomotive) to take charge of the motor and run down with a dangerously high velocity. Usually spur gearing is now used throughout, in conjunction with an automatic magnetic brake. When current is switched onto the hoisting motor it puts into circuit an electro-magnet possessing sufficient power to raise the brake lever and render it inoperative at the moment that hoisting or lowering commences, and also during its continuance. The act of "switching off" immediately, and without any attention whatever on the part of the operator, allows the brake to be automatically applied. It is necessary that the brake lever be fitted with a damping arrangement so as to prevent the excessive shock to the gearing that would otherwise arise in the event of the brake being too sud-

denly applied. The advantage of the magnetic brake is obvious. If from any reason during working operations, the current should fail, the brake lever would be instantly released, and the brake would take charge of, and sustain the load. Mechanical brakes of various designs and principles are sometimes used in conjunction with the magnetic brake just described.—*Arthur Parrott, in Cassier's Magazine.*

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## CONCERNING LONGER STROKES FOR LOCOMOTIVE PISTONS.

BY T. S. REILLY.

For many years past it has been the universal practice to provide a length of stroke of 24 inches for locomotive pistons. The adoption of this length of stroke was probably not due to any specific reasons, other than that it bore a very good ratio to the piston areas and pressures in vogue in the past, that the tractive power demanded of the higher speed engines was not very great, and that, since the custom was to use a small driving wheel where greater tractive power was required, a greater length of stroke was not permissible on account of the proximity of the crankpin to the tire. Of late, however, there seems to be a general inclination to use a longer stroke, and it might be well at this time to consider some of the reasons for this tendency, and to regard the probable limitations thereof.

Since in passenger service the question of speed is paramount, and the loss in mean available pressure becomes so great at the increased piston speed due to an excessively long stroke, we shall probably see but a slight increase of stroke in locomotives built for this service, unless drivers are enlarged beyond existing limits. But in freight service the use of larger wheel loads has witnessed the adoption of larger driving wheels, in the effort to compensate the resulting increased severity on track by rendering better counterbalancing possible. A driving wheel 62 inches in diameter is considered to be about right for modern freight service. This will allow us to lengthen the stroke to 36 inches, if we so desire, for with the center of crank on the bottom quarter we will still be 13 inches from the rail, which allows us sufficient room inside the tire to provide very nicely for the reception of a crankpin of any desired size.

As regards the effect of the difference in piston speeds, if we take a locomotive developing about 22,000 pounds tractive effort with 200 pounds boiler pressure, we will find that one which has 16½ x 24-inch cylinders and 50-inch drivers is nearly right, and the piston speed of such an engine will be 800 feet per minute at 30 miles per hour. A locomotive with

15 x 36-inch cylinders and 62-inch drivers will give almost exactly the same tractive power, and at the same speed will have a piston speed of 975 feet per minute. The loss in mean available pressure due to this higher piston speed will be about 9 pounds had we worked at full stroke, but the amount of steam consumed in the mile would be almost precisely equal, and since the tractive power furnished has been the same, it is evident that the benefit of the longer strokes equalizes this defect. But since we generally work expansively, the greater range of adaptability to the requirements of the grade, rendered possible by the use of the longer stroke, would seem to be an argument in its favor.

With a 36-inch stroke the proportion of available use of the crankpin is greater, on account of its advancing further from the dead point on its circle of movement with the same advance of the crosshead, than is the case with a stroke of 24 inches, which possibly accounts for the retrieval of the loss in mean available pressure at full stroke. The longer stroke would also appear to permit of greater refinement of cut-off, without the disagreeable jerking incident to a short cut-off in the shorter stroke engine. The weight of the cylinder is less, and there is a saving due to the smaller piston and the consequent lessened weight of the reciprocating parts, including the lighter main rod design that we can use through there being less thrust on the pin, all of which is quite a consideration as we advance to larger cylinders.

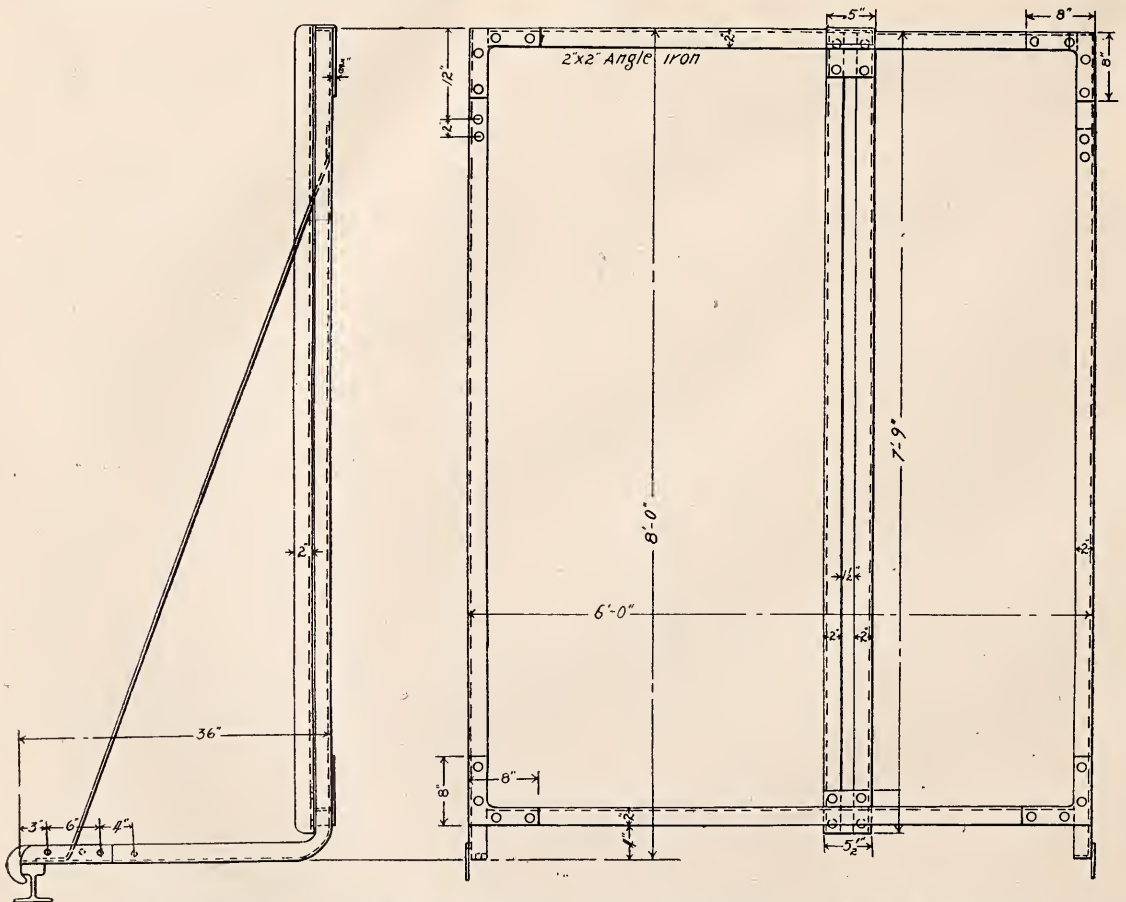
Further than this, it is hard to see wherein there is any advantage to be derived from an increase in the length of stroke. For, in order to develop a certain tractive effort, if we do not resort to compounding, we are obliged to use the same quantity of steam in either case. For instance, we may compare the 15 x 36-inch cylinder engine, already mentioned, with one whose boiler pressure, diameter of drivers and tractive effort are similar, but whose cylinders are  $18\frac{3}{8}$  x 24 inches. We will find that at any given proportion of cut-off, both engines will have taken the same quantity of steam, and that at any given proportional point of the expansive stroke, the same quantity of steam will have produced an equal tractive effort.

This brings us around again to the conclusion that, in any endeavor to utilize more fully the expansive properties of steam, we are compelled to resort to compounding in order to provide a larger piston area for the reduced expanding pressure to act upon. And when we compound, we not only extract more power from the same quantity of steam, but we affect the stroke favorably, by distributing the power more uniformly throughout its length. As to the benefits to be derived from an increase

in length of stroke in compound engines, the practical usefulness of such a step in locomotive practice would seem to depend, as in the simple engine, principally upon the size of cylinder necessary to develop a required tractive effort. In other words, we may hold that where the shorter stroke will not necessitate cylinders of very large size and weight, it is not advisable to increase the stroke; but where these cylinders would, with a 24-inch stroke, run up to, say, 20 inches or more in diameter, their weight and that of the reciprocating parts becomes so great that it would seem advantageous to provide the required increase of power through a suitable increase in the length of stroke.

## ARRANGEMENT FOR DRILLING OUT OLD STAY BOLTS IN BOILERS.—C., R. I. & P. R. R.

The drilling out of old stay bolts in locomotive boilers is a tedious job without suitable arrangements for supporting the drill. Mr. G. Cour, foreman of the boiler shop at the Chicago, Rock Island & Pacific shops in Chicago, some time ago went to work to facilitate this operation and finally succeeded in getting up a rig that meets the requirements.



ARRANGEMENT FOR DRILLING OUT OLD STAY BOLTS.—C., R. I. & P. R. R.

As seen by our engravings, the arrangement consists of a large frame, built up of 2-inch angle iron, braced by two  $1\frac{3}{4} \times 1\frac{1}{4}$  inch flat iron. The lower part of this frame is hooked over the rail on which the boiler stands, and the upper part is secured to the boiler by a couple of chains.

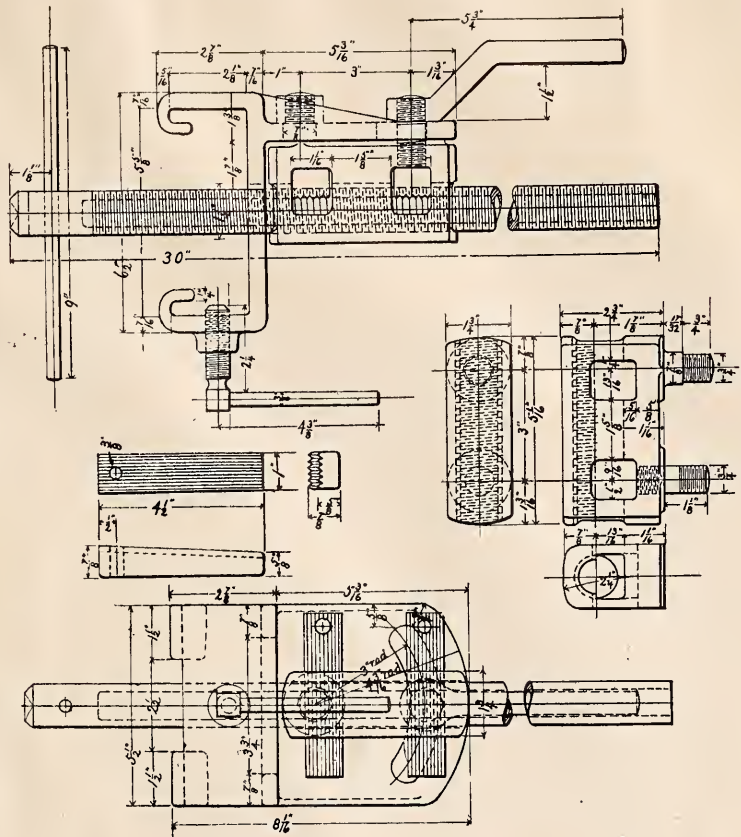


FIG. 2—FEED SCREW ARRANGEMENT.

The vertical support taking the feed screw arrangement is also built up of 2-inch by 2-inch angle iron, connected with a plate at top and bottom;

the top plate is bent so as to be adapted to hook over the top angle iron, but the lower end of the two connected angle irons simply rubs against the lower part of the frame.

The feed screw arrangement, shown in detail in Fig. 2, is hooked on these vertical angle irons from the bottom, and held at any point by tightening the set screw. In order to adjust the feed screw to the radii on the different parts of the boiler, the nut or stem holding the feed screw is held on a pivot, and when the proper angle is reached the nut or sleeve is held firm by tightening the set screw.

To quickly adjust the feed screw lengthwise, the nuts have threads on one side only, the other side being bored out so as to allow the feed screw to disengage from the threads and slide in or out as desired.

When ready for feeding, the screw is held to the threaded side of the nut by the two keys, which are grooved to match the thread on the feed screw.

As will be seen, vertical and radial adjustment is provided for in the feed screw attachment; and by sliding the vertical crossbar in the

frame the feed screw is easily adjusted horizontally. This arrangement has been found very useful, not only in the boiler shop, but also at the erecting pits.

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## LOCOMOTIVE DRAFT APPLIANCES.\*

BY C. H. QUEREAU.

Too frequently general principles are entirely overlooked, or not given sufficient weight. The statement has frequently been made that draft appliances which have been proved by extended experience and experiments to be the best adapted for a given quality of coal or section of the country, do not, and will not, prove at all adapted for similar classes of coal in other sections, and that it is necessary to use entirely different designs. This seems an unreasonable proposition. In this connection it should not be forgotten that the discussion relates only to draft arrangements, and not to the other parts of steam producing appliances, such as grate area and the distribution of heating surfaces.

The sole purpose of the draft appliances is to produce a vacuum by means of which the necessary oxygen for the combustion of the fuel is provided, and to properly distribute this. The primary source of the forced draft necessary with locomotives is the force of the exhaust steam, and the most efficient design of draft arrangements is that which will produce the required vacuum with the least loss of power, that is, with the least back pressure. Assuming that such a design has been devised and its deficiency established, it follows that it must be the most efficient whatever the locality in which it may be used, and whatever the grade of coal, and the only reasonable change in the design which should be allowed is to increase or decrease the vacuum to meet the necessities of the case by increasing or decreasing the back pressure.

No claim is made that this most efficient arrangement has been designed, but it seems reasonable to believe it is within the range of possibility, and when designed should be universally the most efficient. For instance, it having been shown that the shorter the front end, the more efficient the exhaust jet is, this remains true the world over, no matter what the fuel or other conditions may be; as the most efficient method of regulating the back pressure has been shown to be by means of the tip, any design which fails to make the area of the tip less than that of

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\*Extracts from report written by Mr. C. H. Quereau, assistant superintendent of machinery of the Denver & Rio Grande Railway, for the next session of the International Railway Congress.

every section between it and the cylinder must be faulty, wherever used. It is granted that other considerations than the greatest efficiency, such as convenience and cheapness of manufacture, should frequently determine matters of design.

It is quite commonly believed and stated that the final adjustment of parts of the draft arrangements, such as draft pipes, should be made, not on the testing plant, but with the locomotive in service, and that the efficiency of stack designs can be proved only in the same way. In short, that the results obtained on the testing plant serve only as indications as to the most efficient arrangement or design of certain parts. If the testing plant is such as is used at the Purdue University and by the Chicago & Northwestern, where the locomotive can be tested under service conditions, there is room for argument as to the correctness of the statement. It certainly would not be made as to the most efficient steam distribution. Why should the investigation of the production and distribution of the draft be based on a different principle?

The most efficient draft design is that which produces a given vacuum, and properly distributes it, with the least back pressure. Is it not reasonable to believe that the same methods and apparatus, by which it was demonstrated that the shorter the front end the more efficient the exhaust jet, could be successfully used to determine as certainly the best adjustment of the petticoat pipes, the best proportions and shape of the stack, and the proper arrangement of the baffle plates to secure any desired distribution of the draft? That this would demand considerable time and careful experimenting will be admitted without argument, but results so obtained would have the decided advantage of being free from personal prejudice and based on a more solid foundation than mere belief.

Quite frequently very efficient designs are condemned because those in charge fail to assume that the enginemen are inefficient or poorly trained, but conclude, almost as a matter of course, that it must be the draft apparatus. An instance may be of service in making the point clear. A design of draft appliances which distributed the draft uniformly was in successful operation on a certain division, which secured an increase in the diameter of the tip, thereby increasing the power and efficiency of the locomotives on which it was used, also their steam capacity, but at the same time made it necessary that the fire on the grates be comparatively light and evenly distributed, necessitating careful work on the part of both the fireman and engineman. It happened that these

locomotives were sent to a division where the front end arrangements concentrated the draft mainly on the front half of the grate, thereby necessitating a heavy fire forward and less care on the part of the enginemen. As a natural consequence, the engines which were proved to be the best on one division were promptly condemned on the other, on the ground that the draft arrangements were faulty, while the fact in the case was that the men were at fault. Because of the experience of the first division, the engines finally became favorites on the other, but had they come directly on to the second division from the manufacturers, it is more than probable that the design of the draft arrangements would have been condemned beyond redemption, a period of changes based on cut and try methods would have followed, and finally, when the enginemen had become accustomed to the changed conditions, and the production of steam had thereby become satisfactory, whatever arrangements happened to be on the engines at the time would have received the full credit for the improvement.

#### CONCLUSIONS.

##### (a) Means Adopted to Increase the Production of Steam by Increased Draft.

This topic naturally falls under two heads: The producing of the vacuum, and the distribution of the draft.

##### *The Production of the Vacuum.*

1. The most efficient means of producing the vacuum are evidently those which accomplish the result with the least back pressure in the cylinders.

2. These can best be determined with a locomotive on a testing plant where the conditions can be made those of regular service.

3. The proper basis for determining efficiency is that which compares the cause, back pressure, with the result, vacuum, and conclusions drawn solely from the vacuum obtained are of doubtful value.

4. The steam passages from the cylinder should be of ample proportions.

5. The exhaust pipe passages should gradually contract from the bottom to the tip, without abrupt curves.

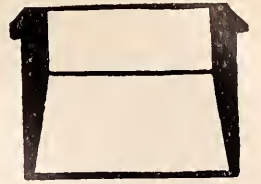
6. The area of the opening through the tip should be less than that of any section between it and the cylinder.

7. The exhaust pipe should be single, with a partition but little, if any, higher than 13 inches, and the total height as short as possible, con-

sistent with easy curves in the pipe and a proper arrangement of the netting, providing the height is not less than 19 inches.

8. The steam passage in the exhaust tip should be of the shape shown in the accompanying figure.

9. Crossbars in the tip lessen the efficiency of the exhaust jet.



10. The front end should be as short as possible.

11. With front ends more than 60 inches in diameter, double draft pipes increase the efficiency, but careful designing and thorough workmanship are necessary to prevent them from warping and working out of adjustment. If they become displaced they are worse than useless.

12. With properly designed draft pipes it is probable that the greater the distance from the exhaust tip to the base, or choke, of the stack the greater the efficiency.

13. Either the taper or straight stack is more efficient than the diamond stack.

14. Probably the taper stack is somewhat more efficient than the straight, when the proportions of each are the best for any given case, because of the more easy approach and exit afforded the gases by the former.

15. The correct rules for the most efficient stack proportions are still open to question.

16. The theory of the adjustable exhaust tip is admirable, but the results of experience have been that those designs tried so far soon become inoperative. To be permanently successful a design should be automatic and beyond the control of the engineman; connected with the reversing gear, for instance.

17. As far as practicable, the plane of the netting should be at right angles to the currents of gases passing through it, so as to offer as little resistance as possible.

18. The area of the openings through the netting should be greater than that through the flues, when possible.

#### *The Distribution of the Draft.*

So far as known, there are no published results of the most efficient arrangement of diaphragm plates or draft pipes, so that conclusions concerning them are largely matters of opinion or personal experience.

19. With diamond stacks the distribution of the draft is best accomplished by the use of draft or petticoat pipes.

20. With extended front ends and straight or taper stacks the baffle plates are almost entirely depended on for regulating the distribution.

21. It seems entirely probable that with the extended front end a design may be developed which will leave out the baffle plates and depend entirely on draft pipes for the distribution of the draft, and that such a design would be more efficient than those which depend on the baffle plates.

(b) For Preventing Fires Caused by Sparks from the Stack.

22. The extended front end is of little practical use as a receptacle for cinders.

23. The baffle plates and netting should be so designed as to extinguish the sparks, break the cinders up, and then discharge them into the open air.

24. Systematic and competent inspection of front end arrangements, especially the netting, at regular intervals, in connection with a permanent record showing the condition at the time of inspection and the repairs made.

25. The use of fire guards, made by plowing two or three furrows as far from the track as possible, and then burning over the ground between the tracks and furrows.

(c) For Utilizing the Heat of the Exhaust Steam.

26. American practice has not yet developed a successful design for this purpose, though two roads are making the attempt.

27. The exhaust from the air pump is being successfully used by a number of roads to heat the water in the tender.

28. Because of the fact that most American locomotives are equipped with injectors instead of pumps for feeding the boiler with water, and that the injectors will not work with feed water hotter than about 120° Fah., it seems probable that the maximum benefits of heating the feed water by means of the air pump exhaust will not be derived till the control of the temperature of the feed water is made automatic. Experiments with this end in view are being made.

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## SAFETY APPLIANCES.

In its current report the Interstate Commerce Commission discusses the applications by carriers for extension of time within which to comply with the Safety Appliance Act in respect to the use of automatic couplers and train brakes, and states the reasons for its recent order granting an extension of seven months to Aug. 1, 1900.

As disclosed to the commission by the reports of its inspector,

many carriers have been using automatic couplers so out of repair that the cars could not be uncoupled without the train men going between the cars, and being, in some cases, obliged to resort to mechanical means to get the cars apart. Such a coupler is not automatic, and its use subjects the men to risks and dangers obviously greater than those which existed when the old link and pin coupler was employed. The commission has called the attention of the railway presidents to the defective condition of automatic coupling attachments in their car equipment.

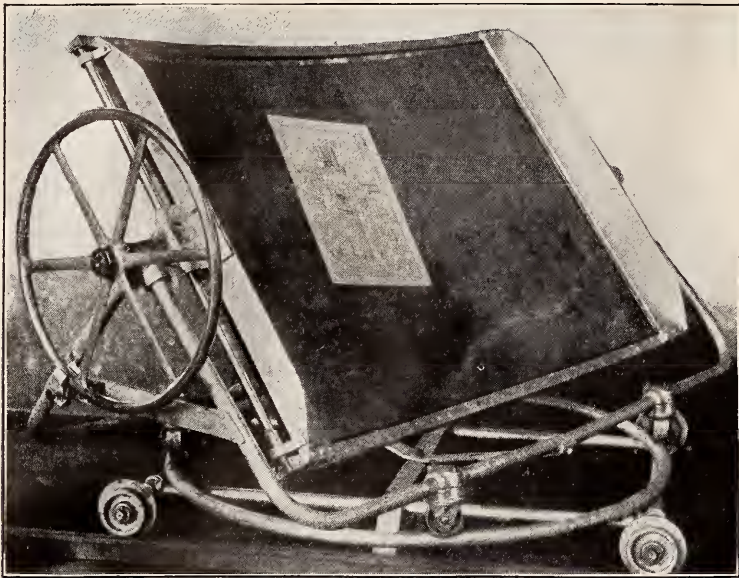
Previous to its last annual report the commission had expressed the opinion that until all cars were equipped, the advantages of automatic couplers as a means of protection to employes would not be demonstrated by the falling off in the number of killed and injured in coupling and uncoupling cars, and that view finds some support in the showing of casualties for the year ending June 30, 1898, when the number killed was 279 and the number injured was 4,988. While 1 employe was killed out of every 349 employed in 1893, and in 1897 the number was 1 killed to 647 employed, the figures were 1 killed to 518 employed in 1898. The ratio of injured to those employed was 1 to 13 in 1893, 1 to 22 in 1897, and 1 to 21 in 1898. In 1899, for which year full returns have not yet been made, it is found that 199 were killed and 5,339 injured upon 89 roads, while in 1898, on the same roads, 209 were killed and 5,484 were injured.

Trainmen, other than enginemen and firemen, include switchmen, flagmen and watchmen. Flagmen and watchmen are not engaged in coupling cars, but from long practice they have been classified with the switchmen. Efforts are now being made to do away with this anomalous classification.

The number of employes killed and injured by falling from trains during the year ending June 30, 1898, was 473 killed and 3,859 injured. For the year ending June 30, 1893, 644 were killed and 3,780 were injured. When the train brake comes into general use it is believed that the number of killed and injured from this cause will be very largely reduced. The train will then be under the control of the engineer, and the men will not be obliged to walk on the running boards or use the tops of the cars for braking. The number of killed and injured from this cause is as great as, if not greater than, the number of those killed and injured in coupling and uncoupling cars.

The causes of the large number of deaths and injuries still resulting to employes while engaged in railway operation are believed to be: (1)

The increased percentage of inexperienced men employed since the decrease which resulted from the panic of 1893. (2) The greater number of tons carried per man employed, owing to the use of cars having greater weight and greater weight-carrying capacity. (3) The use of old and inferior cars, owing to the unusually great demands for transportation facilities on all the roads and in all sections of the country. (4) The transition from the link and pin to the vertical plane type of coupler.



## A CURVED GLASS BLUE-PRINT MACHINE.

The desirable features of a blue-print machine are ease and rapidity of operation, such adjustment as to secure the direct rays of the sun, and means whereby close contact between the tracing and the sensitized paper may be secured. The machine here described and illustrated, was designed to meet the above requirements, and was first built for, and in, the shops of the Lewis Institute, of Chicago. It was described in a paper presented by Mr. Paul Mellen Chamberlain at the recent New York meeting of the American Society of Mechanical Engineers. The substance of Mr. Chamberlain's paper follows :

The operation of the car and the universal adjustment is so clearly shown in Figs. 1 and 2 that explanation seems unnecessary. The iron work is all galvanized to avoid rusting after exposure to rain or snow. The glass is curved to a radius of 13 feet. Attached to one end

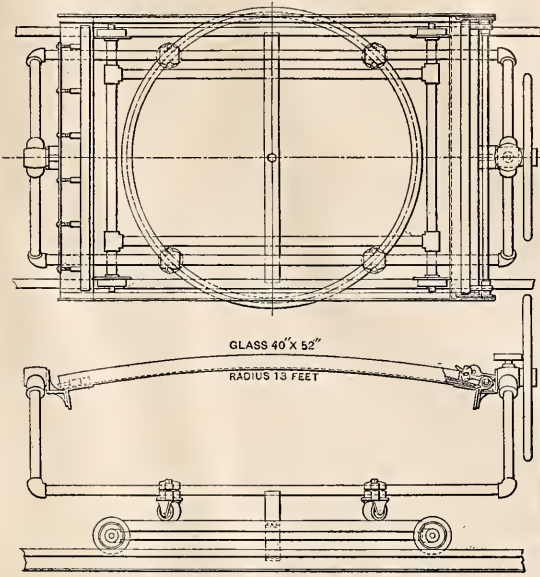


FIG. 1.

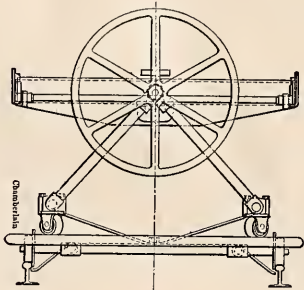


FIG. 2.

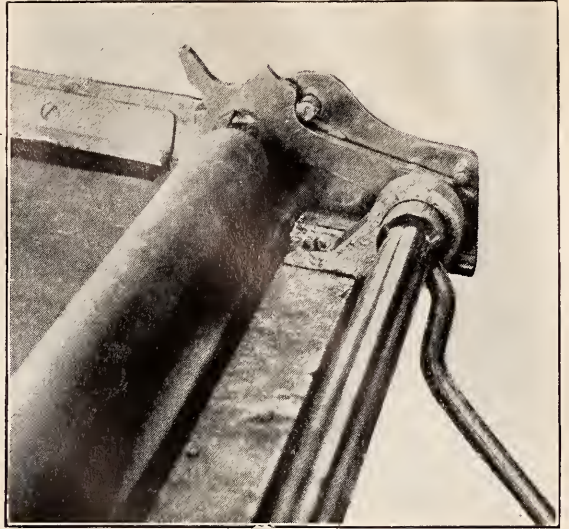


FIG. 3.

of the frame is a sheet of canvas-rubber packing about one-thirty-second of an inch thick. The other end of the rubber cloth is fastened to a steel tube which serves as a roller to roll the cloth on, and also as a stretcher. Square projections at each end of the roller are engaged by hook cams as shown

in Fig. 3, which are operated by eccentrics on each end of a steel rod, rotated by a handle at one end, through an angle of  $180^{\circ}$ .



FIG. 4.

The operation is this: The rubber cloth is rolled back on the steel tube, and the paper and tracing are placed on the convex side of the glass; the cloth is unrolled with one hand, leaving the other free to adjust or turn down crumpled edges of the tracing, as shown in Fig. 4; the ends of the steel roller are engaged by the cams, and a turn of the handle stretches the cloth, giving a pressure component normal to the glass; the frame is turned over, the car pushed out of the window, and the frame adjusted to the proper angle with the sun's rays. The operation is rapid; the placing of tracings very easy, and the contact obtained between tracing and paper all that could be desired.

Three years of use have demonstrated its convenience and durability.

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## WHAT DOES IT COST TO RUN TRAINS AT HIGH SPEED? \*

BY F. A. DELANO.

A good deal has been said and written in the last year or more about the phenomenally high speed made in this and other countries, and superintendents of motive power, mechanical engineers and locomotive builders have all pointed with justifiable pride to the records made by particular engines. The writer was recently asked by a superior officer to tell at short notice how much more it cost to operate a train scheduled at a very high rate of speed, than a train at a moderate rate of speed and after studying the matter over carefully for some hours, came to the conclusion that an answer to the question was so complicated a one that it could only be made in general terms.

When asked by the officers of the Western Railway Club to write a short paper at short notice, I could think of no question which needed an answer so badly, and no question which would be of more general interest to railway and mechanical men than the question of the cost of running high speed trains. In a general way the subject has been pretty constantly in the minds of operating officers of railways, but when we come to answer the question in figures, how little data is at hand to assist us?

For convenience we will group these items of cost of operation, which are increased with high speed as compared with moderate speed service, under the following headings:

*First*—Increased fuel consumption.

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\*A paper presented at the January meeting of the Western Railway Club by F. A. Delano, superintendent motive power C., B. & Q. Railway.

*Second*—Higher grade or standard of machinery, material and service required for extra fast trains.

*Third*—Increased wear and tear, cost of maintenance of machinery, permanent way, etc.

*Fourth*—Increased risk of accident by breakage of machinery, injury to track, etc.

*Fifth*—Increased risk of accident, such as collisions with other trains, and risks taken to avoid collisions.

*Sixth*—Delay to traffic on account of keeping the road clear.

We will consider each of these headings in sequence.

*First:* The ordinary formulæ for train resistance would indicate that the cost of operating a train at, say 60 miles per hour, as against 30 miles per hour would entail an increased fuel consumption of something like 62½ per cent. [This is determined by the Baldwin Locomotive Works formula:  $R = 3 + 1.6 V$ .] The figures, which I have been able to get at short notice, indicate that the increased fuel consumption per car or ton is much greater than this, and certainly proportionate to the speed. This is largely due to the fact that a locomotive cannot be operated as economically at higher speed, and that if designed with a special view to economical operation at very high speeds it will have a very diminished tractive power. By way of illustration, I may cite a very interesting series of indicator cards I recently saw, taken from an engine to determine the steam distribution in the cylinders at the same cut-off, but at speeds varying from twenty to fifty-seven miles per hour. Although the cards were considered as making a most satisfactory showing, the drop in the M. E. P. was astonishing. [The figures showed a drop of 42 per cent in M. E. P. for an increase of 30 M. P. H. in speed.] A more familiar way in which the same fact is forcibly brought to our attention is the recollection that a class of engines which formerly handled trains of ten to twelve cars successfully on many of our trunk lines 10 years ago, is now discarded for branch or light service, and engines of more than twice the power do not handle as long trains. Obviously the difference is due to the enormous increase in the demand on engines in the way of speed. Furthermore, in comparing engines of today with those of ten or fifteen years ago, it will be noted that the increase in boiler capacity has been much greater than the increase in cylinder dimensions.

*Second:* In extra fast service, no expense, one may say, is spared to prevent breakdowns, detentions, or failures of any kind; even the waste which is put in the oil boxes of cars and engines is of a special quality; the journals are burnished; the brasses are especially scraped

or machined; the coal which is put on the tanks is selected coal, broken in advance so that the firemen will not be obliged to break it. The locomotive itself is looked over by the best mechanics, and the master mechanic gives a large share of his thought and attention to the condition of the engines and cars in such trains. In the superintendent's and despatcher's office in the same way, especial attention is given to avoid delays; in the maintenance of way department, from the roadmaster to the section man, the constant thought is to make the track safe for this special service. In other words, the entire character of the service is keyed up to a necessarily high pitch, which while accruing in a measure to the benefit of the other service, nevertheless adds expense which it is impossible for any man to more than guess at. It is, of course, unnecessary to add that the best locomotive and car equipment is used in such trains.

*Third:* The added cost of wear and tear of machinery, rolling stock and track is noticeable. It has often been noted that on a new piece of track a heavy engine hauling a high speed train will often do an immense amount of damage in throwing out of line and surface, a track which has stood up satisfactorily under a number of heavy though slowly moving trains. With old track in good condition the difference in the effect of high speed as compared with slow trains, is of course very much less noticeable, but that the difference exists nobody of experience doubts. The best evidence of the added cost of wear and tear of the machinery is shown in the records of engine failures which are kept by many railways. It has been found that by keeping these failures divided between freight and passenger service, the fact is disclosed that the failures of engines in passenger service are in much greater ratio to passenger train mileage than the failures in freight service, and this in spite of the fact that the best motive power equipment is used in passenger service. A still further analysis of these failures shows that an overwhelmingly large proportion of the failures in passenger train service occurs in special fast passenger and mail trains, the failures in light and slow passenger service being almost *nil*.

*Fourth:* In spite of the care that must be used, the risk of accidents, breakage of machinery or failure of track and structures cannot be lost sight of. What this risk is worth in terms of an insurable quantity would take an actuary with statistics covering years of actual performance to determine. Eternal vigilance has sufficed to reduce accidents in high speed service to a comparatively low figure, but how

terrible in consequences such accidents can be is too well known to railway men to dwell upon.

*Fifth:* The risk of accidents to other trains is also an unknown quantity which is most difficult to determine. It may operate in several ways. The effect of a collision, it is known, varies as the square of the velocity, but it is not only in collisions that the risks are great. There are many other small and elusive ways in which this item operates. Take the case so familiar to railway men, who have had experience in the engine or train service, of a freight train trying to get in on a side track to clear some special train. There may be a hot box on the train requiring attention, but the engineer and conductor looking at their watches see that they must hurry or have an explanation to make. The box is allowed to go with perhaps scanty attention and a risk is taken which once in a while results fatally. Accidents from collisions of trains are fortunately rare on good trunk lines, but the character of the service required to avoid them is of the highest class. There would be small necessity for the expensive block and signal systems were it not for the excessively high speed trains. Divisions of railways on which such trains are not run, are, we know, successfully operated without them, and the expense of all such safety appliances does not enter so much in the first cost as in the cost of maintenance, renewal, and the wages of employes attending them.

*Sixth:* The delay to other traffic due to high speed trains while a most difficult factor to determine, is to my mind perhaps the most serious one. I remember reading an article by Mr. Ely, now chief of motive power of the Pennsylvania system, which appeared in *Scribner's Magazine* for March or April, 1892, in which he discussed, as I recollect it, in a very interesting way, the possibility of operating trains at excessively high rates of speed. It was at a time when there was more or less discussion as to whether it would be possible to build a locomotive that would run 100 miles an hour and whether, when it came to making such high speed as this, electric motors would not displace locomotives. The point that Mr. Ely made was that while it might be entirely feasible to design a locomotive to make such a speed, the real difficulty was a transportation difficulty. He showed by a number of illustrations that it would practically mean an independent track, and, of course, in figuring the cost of operating such a train, the interest on the value of the track and right of way to which it must have exclusive use would have to be taken into consideration.

It has been pointed out a good many times by practical railway men

that the way to do a maximum amount of business over a piece of railway is to have the speed of all trains as nearly uniform as possible. The most familiar examples which we have in our daily lives, of the carrying capacity of a railway moving its trains at a relatively slow but uniform speed and at frequent intervals, are the street car lines and elevated roads. When we read the statistics of business done by street car companies and elevated roads on holidays and compare them with the numbers handled by steam roads we are sometimes astonished at the difference. The steam road handling its long trains at infrequent intervals cannot begin to do the business of the street car line or elevated road with its frequent trains following each other even at a much more moderate rate of speed.

A fast train following a slow one soon catches up with it, or, as the expression goes in railway parlance, "runs over it." The slow train must take a side track. This takes time, and furthermore an allowance or clearance must be given between the trains to provide for safety. Reversing the case, a slow train following a fast one, lags behind it and leaves a big gap, during which time the railroad is unoccupied, or, summing the case up, the high speed train in just the ratio which its speed exceeds that of the other train, makes a gap in front and behind it, during which time it has the exclusive use of the track. Take a simple illustration of three stations, "A," "B" and "C" on a railway, located 30 miles apart; a train leaving "B" at 30 miles an hour is caught by a train leaving "A" at the same moment but running at 60 miles an hour just as the two trains reach "C," but as this would not be a practical way to operate, an allowance must be made to permit the slow train to side track and also provide a safe interval of clearance between the trains; hence it is obvious that the slow train leaving "B" must leave the full amount of time for side tracking and clearance ahead of the fast train leaving "A." Cases such as this and much more complicated, especially in the case of a single track railway, are a mere commonplace in railway operation, and in many cases there is a much greater divergence in the speeds of trains considered than in the illustration suggested.

I remember that at the time a special fast train was put on an important trunk line, it was said that the running of the train was fully justified by the fact that the train earnings were more than twice the average passenger train earnings of the road, but many shrewd and conservative men said that the true expense had not been fully considered, and it was further pointed out as an actual fact the passenger and freight service of the road was, to a great extent, paralyzed by the fast special

train. It is quite certain that it must have impaired the capacity of the railway to handle business.

There are other ways too indefinite to classify, in which especially fast service has increased the cost of transportation in general. It has led to the construction of larger and more powerful engines, and has educated the public as well as railway men to the point where the old fashioned speed of twenty to thirty miles an hour is considered slow even for freight. More powerful engines have, of course, brought about some economy in greater tractive power, but the greater power and greater ability to handle trains at speed has encouraged to some extent a laxness in engine, train and yard men. How often one hears the expression when a passenger or freight train leaves any station behind time, "Oh! that is nothing, we can easily make that up." Every railway officer knows that the general speed of all trains has greatly increased in 10 years; few of them know how rapidly many of their trains are run between stations.

Steam railways have done most to educate the public to this demand for speed, but there have also been other forces at work. In the domain of urban and interurban transportation there has been an astonishing change. Cable cars which once seemed rapid as compared with horse cars are now thought slow in comparison with electric cars. What the limit of speeds will be, and whether it is best for the human race that the speeds of transportation be increased is not within the province of this paper. The point I wish to enforce is, that speed costs heavily, just how much I am not prepared to say. The general superintendent of an important trunk line recently gave the cost of operating an extra fast train as \$2.00 per train mile. How this figure was reached I do not know, but, at a guess, I should say it was none too high. However, I feel that I must close my paper with the question expressed in the title still unanswered, and with the hope that some one else better qualified can answer it.

[An abstract of the discussion on the above suggestive paper will be given in our next issue.—ED.]

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## BENZINE LOCOMOTIVES A SUCCESS.

In Germany a notable measure of success has been attained in the development of the idea of using the gas motor in locomotive work. The Otto Gas Engine Company has led in this development, and through the courtesy of Mr. T. W. Snow, manager of the Chicago house of the Otto interests, we are enabled to present some features of the current

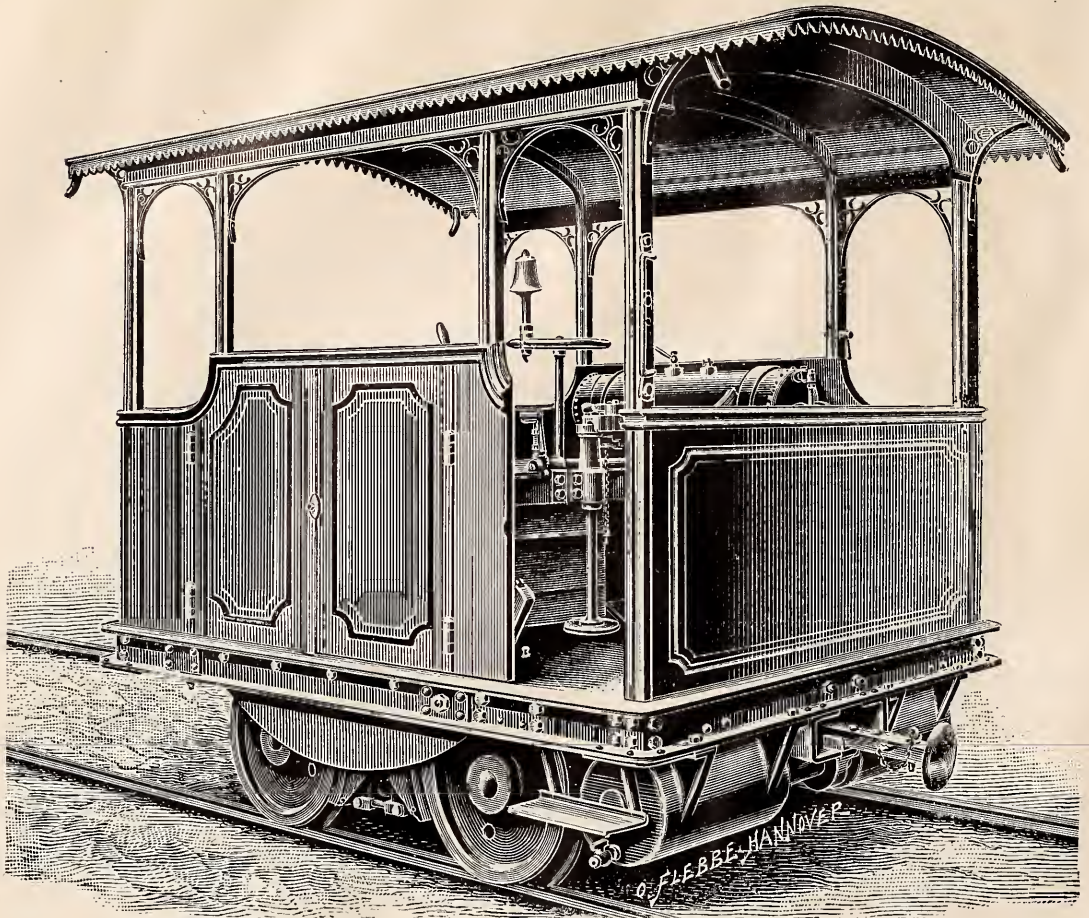


FIG. 1—THE OTTO BENZINE LOCOMOTIVE.

practice. Some fifty of these locomotives have been built to date, of various types, and ranging up to as high as 18 and 20-horse power. We illustrate, in Figs. 1, 2 and 3, a locomotive used in street railway service, and in Fig. 4 show an adaptation to mining work.

The principle of design and operation is well shown in Figs. 2 and 3. The locomotive has a steel channel bar frame, carried on two axles, and supporting a single cylinder four period cycle benzine motor. (It should be understood that "benzine" in Germany is practically identical with our "gasoline.") The main shaft drives, through spur gear, a second shaft carrying two friction cones which can either revolve loose or be caught to the shaft by a friction clutch. Each of the cones imparts (through a pair of spur wheels having different diameters) motion to a third shaft, which is connected with the axles by an endless chain. Provision for gradual starting is made. The endless chain, which transmits the motion, is constantly running in the same direction, and it passes over sleeves which are loose on the axles, but which may, separately, be made fast thereto by a clutch. When the clutch of one axle is made fast, the locomotive runs in one direction; and when the other axle is made fast, in the other

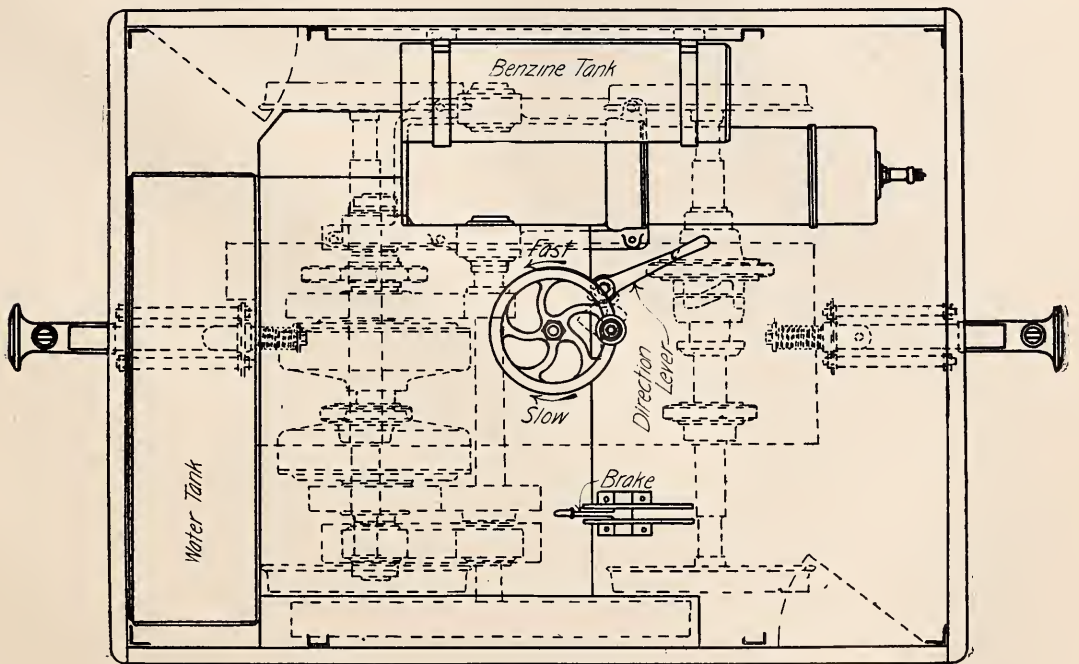
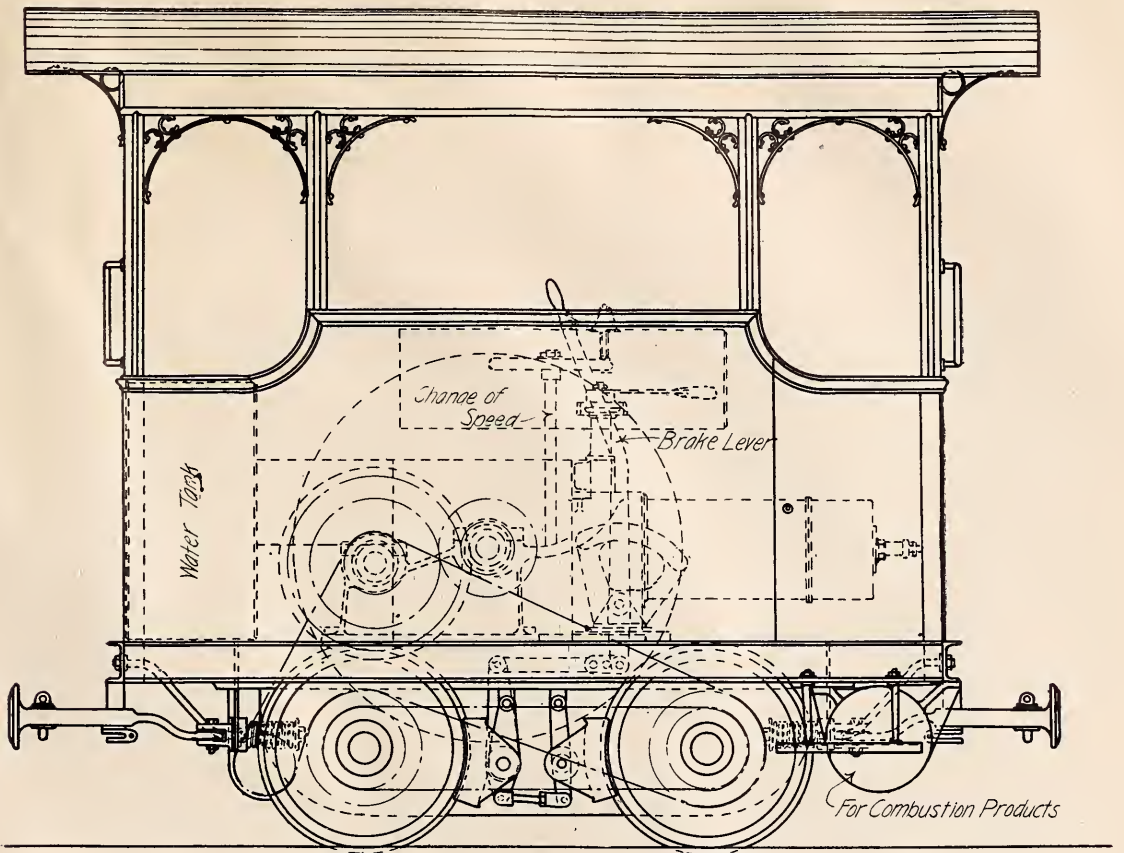


FIG. 2—OTTO BENZINE LOCOMOTIVE.

direction. The two axles are connected by an endless chain, so that, whatever be the direction in which the engine runs, both the axles are motors. The friction clutch, which determines the speed, is controlled by a lever actuated by a screw, the clutch for changing the direction of running being worked by a counterweighted lever.

The fuel, benzine, is carried in a cylindrical receiver, as shown, from which it is forced into the engine by a small pump, entering the explo-

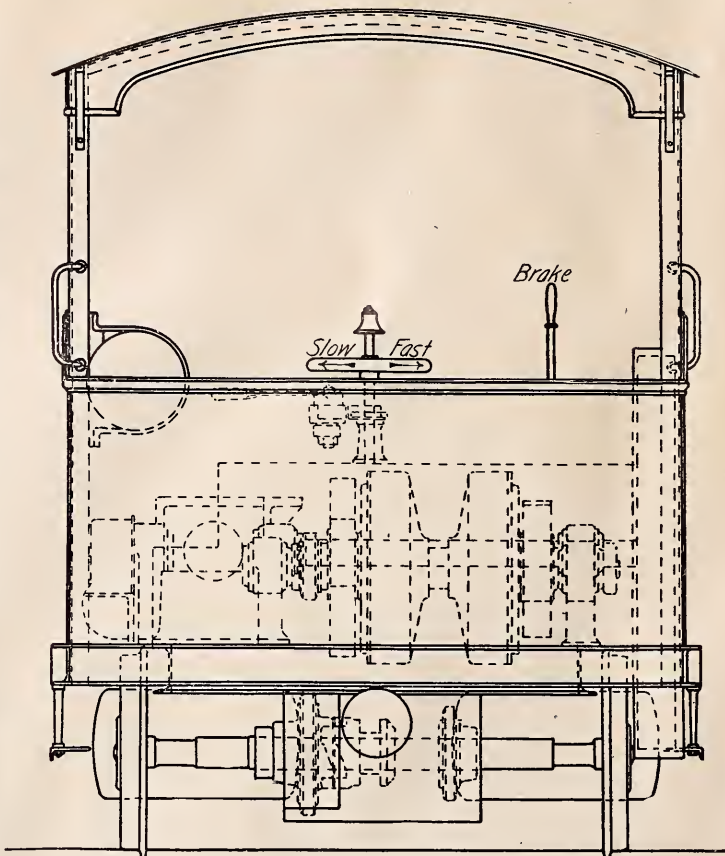


FIG. 3—THE OTTO BENZINE LOCOMOTIVE.

sion chamber in a finely divided state; at the same instant the piston draws in air, which is carburetted by contact with the benzine vapor. Ignition of the charge is effected by an electric spark, produced by an armature struck by a cam at each admission, and which moves sharply in the magnetic field of a permanent horse shoe magnet, the spark being produced in an explosion chamber shut in from the atmosphere. The rotation of the motor is regulated by the fly wheel shown at one side of the engine. The running of the engine is controlled by a centrifugal governor which acts on the distribution cam. Starting is effected in a few revolutions, and for increasing the speed the air admission is diminished for rendering the gas richer. When the engine is standing, a lever is pulled, which raises the governor's sliding ring, thus making the admission minimum; and, if the stoppage has to be continued longer, the admission is entirely suppressed, the subsequent start being effected by means of the fly wheel and a self-starter. The products of combustion escape through wire gauze and pass into a cylinder placed at one end of the locomotive, in which cylinder they expand, afterward issuing through one of the perforated ends. These engines are capable of running 14 hours on one charging of benzine.

We have no exact figures at hand showing the costs of operation, but we understand that they are very low, even though benzine prices are much higher in Germany than here. The repair account is also very low. Locomotives on this same general principle are used successfully in mines, the design being such, with an inclosed combustion chamber, that they are perfectly safe in the foulest mines.

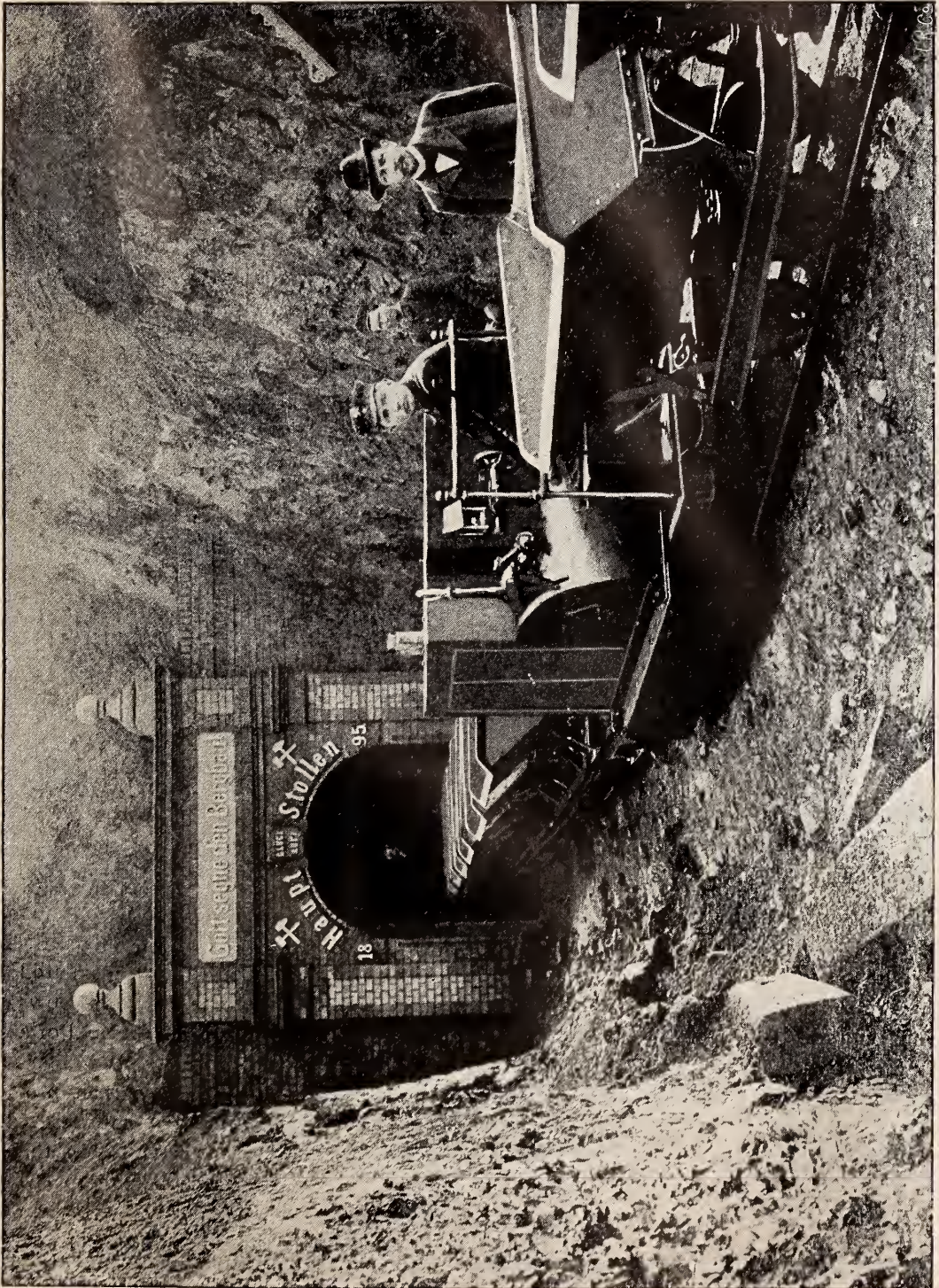


FIG. 4—THE OTTO BENZINE LOCOMOTIVE IN MINING WORK.

# THE CAR FOREMEN'S ASSOCIATION OF CHICAGO.

## JANUARY MEETING.

The regular meeting of the Car Foremen's Association of Chicago, was held in the rooms of the Western Society of Engineers, 1741 Monadnock Building, Chicago, January 11, 1900.

Vice President Sharp called the meeting to order at 8 p. m. Among those present were:

Alderson, A. P.	Earle, Ralph	Johannes, R.	Shannon, V.
Anderson, A.	Groobey, Geo.	Krump, M.	Saum, G.
Bates, G. M.	Grieb, J. C.	Kline, Aaron	Stripp, R. G.
Blohm, Theo.	Gardner, L. S.	Keebler, C. F.	Skilling, J. K.
Buker, J.	Goehrs, Wm. H.	Kramer, Wm.	Schultz, A.
Bundy, C. L.	Guthenberg, B.	Kroff, F. C.	Smith, R. G.
Bossert, Chas.	Gruheke E.	Morris, T. R.	Spohnholtz, J.
Bates, B.	Hunt, T. B.	Murray, D.	Schoeneberg, C.
Bourell, W. A.	Harvey, H. H.	Marsh, Hugh	Thompson, D.
Callahan, J. P.	Hedrick, E.	McAlpine, R. R.	Van Dyke, John
Cook, W. C.	Hultman, C.	Norman, Frank	Wolfe, C.
Constant, E. J.	Hansen, A.	Nightengale, H.	Wensley, W. H.
Cardwell, J. R.	Husband, E.	Olsen, L.	Wentsel, Geo.
Deen, C.	Jones, R. R.	Showers, G. W.	Williams, Thos.
Depue, Jas.	Jones, A. A.	Sharp, W. E.	

Secretary Cook reported the following new members: John K. Skilling, B. & O.; J. W. Bourell and B. A. Keeler, L. S. & M. S.; H. H. Harvey, C., B. & Q.; V. P. Bush, Aaron Kline and F. A. Schroeder, C., M. & St. P.

The resignation of Mr. W. C. Cook as secretary of the Association was announced; and Mr. Aaron Kline was elected to succeed him.

Upon motion of Mr. Cardwell, the Association passed a vote of thanks to Mr. Cook for his efficient work as secretary.

[The deferred topic of responsibility for a peculiar and very unusual defect in a car wheel, was then taken up. The discussion is valueless without the defect before the eye, and is therefore omitted. It is hoped to have an account of this matter, with a photographic view of the defect, in our next issue. It was decided formally that it was a defect for which the owners were responsible.—ED.]

### "ARE LONGITUDINAL SILLS IN REFRIGERATOR CARS ' CONCEALED PARTS? "

The first item in the program for the evening was as above, and the discussion was opened by Mr. Stagg.

Mr. Stagg: In the first place, I wish to say that refrigerator cars having insulated floors nailed to the bottom are not to be considered in the subject at all. Everybody knows that a sill on a car of that description is concealed. It cannot be seen. We get hold of a great many of these cars that are drooping at the ends. I do not wish the members to infer from my remarks that I consider that every car that droops has broken sills, but it is sometimes an indication of broken sills. If we receive such a car on our line, and are asked to make an inspection of it, we make an inspection the best we can. We come to the transom, and it is utterly impossible for a person to tell whether that sill is broken or not, over the transom. All sills, as a general rule, are broken from the top and not from the bottom, and we cannot see whether the sill is broken or not, when we come to the transom, which is 7, 8, 9, 10 and, if it is a wooden transom, 12 inches

wide. That part of the sill, in my opinion, is not in view of the inspector and should be considered a concealed part of the car, and the only way for an inspector to see it would be to take the floor down, which, of course, cannot be done. Now we take this same car and run it east, get it back and send it home to the owner, and then some defect in the floor over the king bolt is found. They take down the floor and four sills are found broken. The owner of the car comes back on the delivering line for the broken sills. I think, from the inspector's point of view, the sill is a concealed part of the car, though I do not think we ought to pass a motion tonight considering it a concealed part. I think it would be a good idea to have this matter brought before the Master Car Builders' Convention at its next meeting, and ask that association to take this question up, and say if a sill is to be considered a concealed part of a car. Under Section 28 of Rule 3, I note that concealed parts, of course, are owners' defects, providing they are damaged under fair usage. The following page, Section 46, defines what is fair and what is unfair usage. The question I want to get at is, what relation does this subject, tonight, have to the two sections that I have mentioned in Rule 3. A question was brought up about brasses some time ago, and I believe it was decided that brasses ought to be considered concealed parts of a car. Now I do not think that a brass is a concealed part, because it can be seen. But, as I mentioned before, the portion of the sill over the transom is certainly a concealed part; and if the four sills are broken, of course the delivering company is responsible. They won't be broken unless it is unfair usage; unless you can prove they are rotten.

Mr. Wensley: On account of the insulation between the sills, a man can see the bottom of the sills but he cannot see the top. Certainly, from an inspector's point of view, it is concealed; but whether that is going to conflict with the rules, I do not know. The rules say you can break two sills, but if more sills are broken it is a delivering line defect. I would not want to have anything brought up to put ourselves on record as going against the M. C. B. rules on that question, because we have a few refrigerators of our own.

Mr. Bundy: I have always considered that sills were not concealed parts in a refrigerator car, unless, as Mr. Stagg says, it is a refrigerator car where the insulation boards are nailed on the sills so as to hide them entirely. On most refrigerator cars there is a strip nailed on to hold the insulation, leaving a portion of the sill that is visible to the inspector, while the remainder of the sill is concealed. If more than two sills are broken, the combination is broken, and the party damaging the car is responsible.

Mr. Deen: If the sills in a refrigerator car are not considered concealed parts, I would like to ask why not. Inspectors of private companies, as a rule, mark cars to examine the sills. Then the floor is removed and the sills examined. If the sills are found to be broken, then they come onto the delivering line for card for broken sills. Evidently, at the time, they do not know whether the sills are broken or not. If they knew at the time the sills were broken, they could make the request at the time; but they mark car to the shops to examine the sills. Therefore, I think they must think themselves that the sills are concealed parts.

Mr. Hunt: Of course there may be a vast difference between what an inspector thinks is a concealed part and what the rules say are concealed parts; because, as Mr. Bundy says, it is mentioned in the rules that if more than two sills are broken, the party doing the damage is in for the damaged sills, which indicates, to my mind, that the sills are not intended to be classed as concealed parts. Nor are they mentioned in Rule 3, Section 28. I do not think that sills should be considered as concealed parts, because they cut too great a figure in the make-up of a car. In fact, you may say that the life is taken out of a car if the sills are gone. If the sills are considered concealed parts, you might then break a car in two and say: "We don't need to pay for that car, so far as the sills are concerned, because sills are concealed parts, and don't the rules say the owner of the car should stand the repairs?" That would not do. The M. C. B. Association, we are sure, did not consider sills concealed parts, according to the wording of the rules now in force.

Mr. Bates: I would like to ask Mr. Hunt if his inspectors can detect a broken sill in a

refrigerator car? If they are unable to do so, it seems to me that the sills are concealed; otherwise, if they are not concealed, his inspectors and every other inspector can see them. The M. C. B. rules specify, of course, all inside or concealed parts are owner's defects. They do not name only the inside, but also include outside parts that are concealed, sills not excepted, for it strikes me that they are not entirely visible parts. I know that there are not any of our inspectors who can take a refrigerator car and look it over and detect broken sills. A car may have a drooping end, and they may think that it has broken sills; but they do not take a record of it, because they are not certain. The rules, of course, say what constitutes rough usage; but as both "inside" and "concealed" parts are mentioned, it seems to me that it was intended to include outside concealed parts. The Arbitration Committee, I believe, have often considered brasses concealed parts, and I think if they considered brasses concealed parts, sills, in refrigerator cars where the insulation boards are near the bottom, certainly are concealed parts.

Mr. Hunt: It is true that on most refrigerator cars the sills, except the bottom portion, are concealed. To the best of my knowledge, this subject has never come up before, at least I have never heard of its having been brought up; and, as I said before, the sills cut too great a figure in the make-up of the car and cover too much in the cost of the car to make it well to class them as concealed parts. I fully believe that it was not the intention of the M. C. B. Association to consider them as concealed parts. They mention in Section 28, Rule 3, "Locks, grain doors and all inside or concealed parts of cars missing or damaged under fair usage," yet I never heard sills brought up before in this light. While we cannot see all the sill, we can see a portion of it. At the same time, I do not think we are having much trouble as regards sills. If we find a car with three broken sills—if they are newly broken, we would consider that we broke them, of course, and I believe we ought to replace them; but if we have a car on the repair track and find three sills broken, and breaks very old, I do not think we would have any trouble in getting rid of that car by simply writing the owners and telling them the condition of things. But if we broke the sills—more than two—I think we should pay for them. I really don't believe that they ought to be considered concealed parts.

Mr. Thompson: I agree with Mr. Hunt, that the sills in a car should not be considered concealed parts. It is in conflict with the rules. The four sills being broken, it seems to me, the car would droop over so it could be seen.

Mr. Morris: I would like to ask Mr. Hunt what he would do in case he delivers a car home to the owners and they find three sills broken, say, and he did not know whether they were broken on his road or not. He says he would be willing to pay for them if he broke them. But suppose he does not know whether he broke them or not. Suppose they had been broken by somebody else, and the car given to him in that condition, so far as he knows. On account of the sub-flooring, an inspector is not able to notice the defect. Does he think then that it would be just for owners to ask for a card?

Mr. Hunt: Of course if we delivered car with broken sills, and our inspectors did not get onto it—that is to say, if possibly the sills were broken when we received the car from some of our connections, and if our inspectors did not discover the defect—I presume we would have to pay for the sills. If an inspection showed that the sills were newly broken, of course there is room for judgment to be used, as in all of these cases. We may find, when digging into the car, that the breaks are old; possibly we have only had car ten days, and the breaks are found to be six months old, at least. If it was Mr. Morris' car I don't think he would ask us to pay for the sills; I would not ask him, if the breaks were old ones, if it was my car. But if car had been away from Mr. Morris a long time and we could determine the sills were broken in the last two or three weeks, or months, why, I would have to stand it. There are conditions that govern all of these cases. Take, for instance, a Milwaukee car. It may have just left that road a month before. We may have taken that car east and brought it back and you discover three broken sills, but the sills may show they

were broken a year. You would not ask us to pay for those sills, if they were broken that long ago; so I say that in all the rules that can be made, there is always room for judgment to be used, and, as I said before, on the question that Mr. Morris brought up, the fact that we received this car from some of our connections, with sills broken new—our not getting onto this would place us in a position where we would have to stand good for the sills. I suppose we have paid for defects that we haven't caused, but we don't know it. If we don't get onto these defects we must pay for them when we deliver the car, providing they are a combination.

Mr. Deen: If you can't see that the sills are broken how are you going to get on to it? If the sills are covered up, how are you going to know they are broken, and how is the inspector going to know and make a report? In that case you would have to card. A refrigerator car may run for a year or two with two sills, possibly three, broken, and not droop enough so you would really think that the sills were broken. Then, in handling the car the fourth sill becomes broken. Then upon examination the sills are found broken and they want you to pay for the four sills. Possibly, three had been broken for six months or a year.

Mr. Grieb: I think that Mr. Morris' inquiry and the reply made by Mr. Hunt lead us to the proper solution of this question. I think it would be rather difficult to arrive at a decision, if not impossible to frame an iron-clad rule that would cover all cases. The conditions will vary to such an extent that any resolution that might be passed upon, on this particular question, would hardly apply to all cases; the various conditions concerning the case would have to be taken into consideration, and very often settlements arrived at more on the basis of equity than a strict interpretation of the rules. There are doubtless refrigerator cars where the sills certainly are hidden parts in every sense of the word; and there may be cars so constructed that the bottoms of the sills are exposed sufficiently so that they would not be so considered; and it seems to me that the only way to do is to bring the parties interested in a case of this kind together and let them settle it among themselves. There would hardly be much trouble in doing that.

Mr. Marsh: I believe there are two standpoints from which to look at this sill question. For instance, take the standpoint of the inspector. If these sills are considered as not concealed parts, then it is very evident that the inspector must take up a new branch of the business. It is my opinion that sills are concealed—you cannot see one when broken. The insulation between the strips hides everything.

Mr. Hedrick: If we get a car on the repair track with drooping ends and we find on examination that there are two old breaks, and they are really the cause of the third and fourth breaking, we would have to pay for the four sills, but it does not seem to me that this is right at all. I think the proper way for this question to be settled would be to call the Master Car Builders' attention to it and have them frame a rule to fit this case.

Mr. Depue: It is my opinion that the sills in refrigerator cars are concealed parts of a car. Over the transom it is impossible to see the sill at all and, as a member stated, it is invariably the case if there are sills broken they are broken over the transom, and from the top. If they are broken from the bottom, or anywhere else than over the transom, they might be seen, but it would be a very rare instance where you find sills broken in that place.

Mr. Goehrs: It looks to me that it would not make much difference whether they were concealed or whether they were not. That is not what we are getting at now. For example, we get a car with two sills broken, and as soon as we receive it find three are broken. Who is responsible for it? We can see about two inches of the sill from the lower end, and I dare say it is next to impossible to see the sill at all over the body bolster.

Mr. Miller: I do not think that sills in a refrigerator car can be considered concealed parts of a car. The very fact that our inspectors find the indication of broken sills is evidence that they are not entirely concealed. I think that where there are only two sills broken and nothing else in connection with them, the owner is responsible for the defect; but

where there are three sills broken, of course the delivering company will be held responsible. If the sills show very old, I do not think that any car owner would hold the delivering company responsible; at least, we don't. Of course, a good deal of judgment has to be used in cases of this kind. It don't take long for broken sills to get in such condition that the defects look old, on account of water running down and discoloring the wood, etc. I think there is no difficulty in determining what is "owners responsible" and what is not, in cases of broken sills, under the present rules.

Mr. Callahan: I think in nine cases out of ten, the sills are concealed; but under the existing rules we cannot call them concealed parts.

Mr. Kroff: Well, suppose that sills are concealed. I don't see that it makes any difference about that, because the M. C. B. rules allow you to break two sills, and if there are two sills broken and you break two more, I don't think the car owner would take advantage of you, simply because there were two sills broken old and two sills broken new, and make you pay for the four sills. I think the rule is right as it is. I don't think it cuts any figure about their being concealed or not.

Mr. Hunt: Looking over the question, it seems to me that it might have been worded a little differently. It says: "Are longitudinal sills in refrigerator cars to be considered as concealed parts?" Is it meant, are they to be so considered according to the present rules? Or was it meant, "Should longitudinal sills in refrigerator cars be considered as concealed parts," to be entered in future rules?

Vice President Sharp: This question was merely brought up for discussion to see how the members felt about it; it is perhaps best that no action be taken. We will take up the next question: "Does the breaking of an American continuous drawbar key and draft timber at the same end of car form a combination that the owners of the car are not responsible for?"

### **RESPONSIBILITY FOR BROKEN CONTINUOUS DRAWBAR KEY AND DRAFT TIMBER.**

Mr. Bates: In opening this discussion, I wish to state that several cases of this kind have come to my notice. In fact, I have been asked to give my opinion as to whether a draw timber, broken in connection with an American continuous drawbar key, at the same end of car, formed a combination. My opinion was, and is at present, that it did not. Some of our members claim, I believe, that the American continuous drawbar key is a substitute for a spindle, and when broken in connection with a draft timber, at the same end of the car, forms a combination; while the fact is, that cars equipped with the American continuous draft rigging have a spindle as well as two continuous rods, hence the drawbar key can not be a substitute for the spindle. I claim that the continuous rods are substitutes for the spindle because they do the pulling instead of the spindle, and while it is true that the draft is also on the drawbar key, it is only performing the function that the rivets do in securing a pocket to a coupler. Therefore, the slot key must be properly classed with pocket rivets, because the key secures the continuous rods to the coupler, the same as the rivets secure a pocket to a coupler. I do not believe that any member of the Car Foremen's Association would attempt to say that pocket rivets are substitutes for a pocket, and that a draft timber broken in connection with pocket rivets at the same end of car would form a combination. Therefore, if a draft timber is broken in connection with a drawbar key at same end of car, I claim that it forms no combination, but is an owner's defect just as though it were a draft timber broken in connection with pocket rivets.

Mr. Wensley: We get a great many cars on our line with American continuous draft rigging, and if a drawbar key is broken in connection with a draft timber, we charge the owner every time. We have never had a bill disputed. It is considered an owner's defect.

Mr. Shannon: It is certainly an owner's defect.

Mr. Hunt: The case seems a little peculiar, and I am inclined to think there would be various opinions regarding it. I do not know but that Mr. Bates is about right. The drawbar key is not a spindle; the continuous rods are more the spindle than any other part of the arrangement. The rods elongate and the large or cross key pulls into the timbers and breaks them, and the keys break in fair usage, I believe, many times over more than in unfair usage. Hence, I think that a broken key and a broken draft timber does not form a combination.

Mr. Grieb: We have heretofore considered the key in an American continuous draft rigging as a substitute for a spindle, and the breakage of it in connection with a draft timber has been regarded by the Milwaukee as indicative of rough usage. I don't think that this is quite right, because it is almost impossible to break this key without breaking the draft rigging. If we had a case of that kind we would not charge the owners. If other people are having no difficulty in collecting bills of that nature, I would be very happy to make bill also. We handle a class of refrigerator cars that are entirely equipped with this class of rigging, and that is where we have the most trouble. We have not attempted to collect for them, feeling satisfied that the spirit of the rules defined such breakage as rough usage. I would be very glad to see our practice amended, if that seems to be the general rule among the lines represented here.

Mr. Kroff: I think that most of these keys are broken by a pull; it is not by a jam. I do not know that I have ever seen a drawbar key and a draft timber broken unless it was pulled out—the damage at the front end. My opinion is that it is an owner's defect and should be billed.

Mr. Morris: As Mr. Grieb has stated, the Chicago, Milwaukee & St. Paul Railway has always considered the breaking of an American continuous drawbar key and a draft timber a combination that the owners are not responsible for. The draft key is really a part of the drawbar. While it is true that all of these drawbars are supplied with spindles, I think it is pretty general on all cars so equipped, for the spindle to act as a guide merely to the spring and followers and, as a rule, it is not used for pulling. A key should be considered pretty much the same as a pocket in an ordinary case. In the case of an American continuous drawbar rod the strain is from one drawbar to the other, and the draft timbers are really nothing but a guide to hold the drawbars up in position, and I think in justice to the owners they should not be compelled to pay for defects that occur to a key and draft timber at the same time. The Chicago, Milwaukee & St. Paul have no cars equipped with American continuous drawbars, and I think it will be conceded by every one that in making a decision and acting as we do, it is from the most honest motives possible. Certainly, we have lost a great deal of money in failing to charge the owners for defects that occur in this way. The spindle, which seems to be the rock on which most people split, is one that should not come into consideration at all. It is no part of the pulling arrangement; it is simply, as I said, a guide for the springs and followers, and has nothing to do with the draft.

Mr. Wensley: We claim that all the pull on any of these cars equipped with American continuous drawbars is altogether on the key. Invariably, when broken, it breaks in the center; and when it pulls out, out goes the center of the draft timber. We take down the timber, make repairs and bill them on card, and we have never had a bill rejected. I think we repair on an average about four a week.

Mr. Grieb: I am pleased to learn from the gentleman who spoke last, that they make these bills and have no difficulty in getting them paid. We will start out and do the same.

Mr. Miller: I move that it is the sense of this meeting that a broken draft timber in connection with a cross key of the continuous drawbar is due to unfair usage.

Mr. Showers: In considering the American continuous drawbar, how many of us take into consideration the size of the drawbar key? The majority of them are 1x5 inches. That

is about half the size of the key in the American continuous drawbar rigging. The draft is from the opposite end of the car and not from the end which is coupled on. If a key of that size is put in the opposite end, I see no reason why they should break under fair usage, unless the keys are allowed to run until they become almost worn out. I think the sentiments expressed by Mr. Morris are about my own.

Mr. Bates: I would like to ask Mr. Showers if he ever saw a key break that was in good condition, and not badly worn? I have failed to see any; they break when they become worn. Take the pocket rivets that go into the pocket—they are  $\frac{1}{8}$ -inch rivets—and if they get worn they break off. New rivets are seldom broken by fair usage, but when worn they frequently break, and I claim it is the same thing with these drawbar keys.

Mr. Showers: In answer to Mr. Bates, I will say that where a drawbar key breaks by itself, we will all admit that it is an owner's defect. The rules allow us to remove and replace a drawbar key and bill owners. If the railway operating the car is negligent enough to allow these keys to run until they become dangerous, when they have a perfect right to remove them and bill the owner, I see no reason why they should not stand the additional damage. It is just the same with drawbar rivets. Car owners are responsible for them. They never think of allowing them to run until they become dangerous, but they replace them and bill owners. Why not replace the American continuous drawbar key as well as rivets, and not bill owners for the additional damage to the car caused by their negligence?

Mr. Hunt: They sometimes break when they are not worn. And after all that has been said, I still think that it is an owners' defect in connection with the draft timber.

Mr. Jones: Most of the Great Western cars are equipped with American continuous side rods. I consider it unfair usage when a cross key and draft timber are broken. We had a case the other day. Two draft timbers broke. We demanded card from the connecting line, but they refused to grant us protection. We sent to the road that made repairs on the car, put in a cross key and welded the continuous rod, and procured a defect card for the two draft timbers and the cross key.

Mr. Kroff: These side rods stretch, and in a good many cases the keys pull right out under the draft timbers. They are damaged long before the draft keys are broken, and when they do break, it just simply pulls off under the draft timber. I consider it an owners' defect.

Mr. Jones: I would not consider it a broken draft timber by having it split off. There are two  $\frac{7}{8}$ -inch bolts that run down just outside the key toward the end of the draft timber, and if the draft timber is split out you can't call it a broken draft timber.

Mr. Kroff: I don't believe I ever saw an American continuous draft rigging that the drawbar didn't have to be shimmed up, in order to get the slack out of it, so it would be safe to pull in a big train without breaking the key.

Mr. Miller's motion was here put, and was lost by a rising vote of 31 to 19.

Vice President Sharp: One of our members has prepared a paper on "Defective Uncoupling Parts of M. C. B. Couplers." Mr. Groobey will now proceed to read his paper.

#### ANALYSIS OF REPORT MADE TO THE INTERSTATE COMMERCE COMMISSIONERS BY ITS INSPECTOR; AND A FEW OBSERVATIONS ON UNCOUPLING DEVICES NOW IN USE.

BY GEO. GROOBEY.

*Mr. President and Gentlemen:*

Quite recently I received a report from the Interstate Commerce Commission on the condition of safety appliances, and it occurred to me that an analysis of same would be of interest to this Association. The report was submitted to the Commission by one of its inspectors, whom, I should judge, is a competent car man. His report covers the period between

October 8 and December 4, inclusive. During this period he visited the following places : Olean, N. Y. ; Nashville, Tenn. ; Cleveland, Ohio ; Rochester, N. Y. ; Louisville, Ky. ; Buffalo, N. Y. ; Chattanooga, Tenn. ; Evansville, Ind. ; St. Louis, Mo. ; East St. Louis, Ill. ; Chicago, Ill. ; Cedar Rapids, Iowa ; Olwein, Iowa ; St. Paul, Minn., and Alexandria, Va., and his inspections were made wherever possible, sometimes on side tracks and sometimes on main tracks. Indeed, I gathered from his notes that the inspections were principally made on trains made up and passed by car inspectors as O. K. for service. He says in reporting loose castings : "I only note those that are very loose." This is significant when the number of loose castings shown in this report is considered. Special attention should also be given to the large number of cars reported having lift-rods with handles too close to car. We all know that in cold weather, switchmen and trainmen wear heavy thick gloves or mitts, and we can easily imagine they have difficulty in getting a firm grip of the rods that are bent too close to the end of the car. His report shows 1,266 cars having defects, and, in summing up, he says that, in his opinion, 25 per cent of the cars in service equipped with automatic couplers are defective through various causes. This being so, it would indicate that, in round numbers, he inspected over 5,000 cars in the period named, finding, as we have just seen, 1,266 defective. His defects come under the following heads :

Broken chains . . . . .	546	Rods gone . . . . .	20
Loose castings . . . . .	403	Rods broken . . . . .	8
Handles too close to car . . . . .	365	Rods too long . . . . .	2
Chains too long . . . . .	63	Rods too short . . . . .	1
Castings gone . . . . .	81	Rods bent . . . . .	77
Castings broken . . . . .	17		

This makes a total of 1,583 defects on 1,266 cars. The apparent discrepancy in having more defects than cars is, of course, accounted for by the fact that some cars were defective on both ends.

What is of striking importance in the above figures are the three items : Broken chains, 546 ; loose castings, 403 ; rods too close to car, 365 ; and I think it would be of value to the railroad companies and of interest to ourselves to go into these questions thoroughly and see if the men who are engaged daily in handling and repairing these parts cannot devise or suggest improvements. It must be apparent to all, that these defects must be remedied in some way, and it is from associations of this character that some practical suggestions must come.

With a view of provoking discussion, I will make a few observations. We will first take up the most serious defect, namely, broken chains. We are all familiar with the application of uncoupling devices and can readily see that the attaching of the chain to that part of the coupler known as the locking-block, and the coupler being attached to the rear end parts, we have arrived at the foundation of the draft arrangements, and as the horizontal movement of the coupler is regulated by the condition of these parts, we will begin our investigation at this point. We must first know the exact size of the pocket and see that drawlugs are securely fastened. We then place in the pocket the follower plates and drawbar springs, and it is right here that we should ascertain the exact compression of the spring, so that we can regulate the length of chain to be applied. The compression of the standard 20-ton drawbar spring is  $1\frac{1}{8}$ ". This gives us  $3\frac{1}{8}$ " travel per car. If the above parts are rightly applied and maintained, the defect known as broken chains would be considerably reduced, but not eliminated by any means. Do we as repair men always pay sufficient attention to repairs of these parts ? Do we not sometimes apply a lighter spring than is called for by the capacity of the car, and do we not sometimes apply a spring that through long service has lost its elasticity and become compressed to such an extent as to allow considerable play, and thus upset previous calculations as to length of chain. We should also ask that some standard size of chain should be decided upon. One railroad company has adopted a standard of  $\frac{3}{8}$ " chain for this purpose. Another one thinks that  $\frac{1}{4}$ -inch is of sufficient strength, and we have all sizes between these two in use. This, our master car builders

and those in charge of construction can regulate, and they should help us to the extent of deciding what size is of sufficient strength to effectively do what is required. With this assistance, and constant attention on our part, much can be done to eliminate this defect, which has nullified, to a great extent, the efforts of our railroad companies to comply with the requirements of the safety appliance act.

We now come to the next defect, loose castings. I will again draw your attention to what the inspector says in his report—that he only noted castings that were very loose. I do not think it would be putting it too strong when I say that 30 per cent of all castings applied by the use of lag-screws are loose after being in service a short time. The lag-screw commonly used for this purpose is  $\frac{1}{2}$ -inch by 3, or  $\frac{3}{8}$  by 3. One-half inch of the length is used going through the castings, and one inch going through the soft pine sheathing, and the balance in the oak post or brace, if sufficient care is taken to locate casting over one of these solid parts. The rod is usually operated by jerking it, and every time this is done the rod is acting as a lever to pull the castings from its place. For the above reason, too much care and attention cannot be given to the application of castings, to see that they are located so that the screws will enter some solid part of the frame of the car, and, in this connection, we should at once stop the practice of driving the lag-screw in with a hammer. This is a common practice as we all know. A few taps of a hammer to get the screw in the proper position is all that should be done, and the wrench should then be used to complete the operation. If this is done, we will find a much more desirable condition of affairs in regard to castings. I will say further that, in my opinion, whenever possible, bolts should be used for the purpose of securing castings, in preference to lag-screws.

Next in importance comes the defect called, rods too close to car. This is something that can be remedied in several ways. First, off-setting castings further from the end of the car, and I will say I do not think this would be advisable, as it would be likely to increase the defect we have just considered—loose castings. Secondly, we could offset the rod so that sufficient room would be allowed for the operator to wear thick gloves. We will suppose this was done; does it not increase the chances for the rods becoming bent from poleing cars and from projecting loads?

And here the thought comes to me, have we got the best device for the purpose intended? Cannot American ingenuity devise something that will do the work and reduce the three defects noted to the minimum? I think we can find something, and just as soon as it is presented, our railroad managers will eagerly accept it, for they have shown their willingness to adopt anything that will minimize the danger that is necessarily connected with the operation of our railway equipment. We cannot get away from the cold fact that car repair men are responsible for the safe and proper application of uncoupling devices, and while the rod and chain continue in use we must try to make the very best of it. I think we will all admit that it is a very crude device, and it occurs to me that if it had been necessary to apply the automatic coupler to the Ark, Noah would have applied the rod and chain as we are doing to-day in this nineteenth or twentieth century, (I am not sure just where we are in regard to centuries).

I think we can pass the other defects shown, they are so few in number and do not indicate anything; as it will be almost impossible to get a device that will not develop defects owing to the severity of the service and the fact that all parts are exposed to the elements.

Gentlemen, I would ask that you, between now and our next meeting, when I hope this subject will be thoroughly discussed, take notes of the condition of uncoupling devices, and what defects you find, so that you will be prepared to give this matter the attention it deserves. You will then be doing your whole duty to your respective companies, and the army of fellow employes who are engaged in operating railway equipment. You are responsible, to the extent of seeing that all appliances in use are in the very best possible condition.

Before closing, I will refer briefly to a report submitted to this Association early last

year, when a recommendation was made that all movable parts of couplers be lubricated. In conversation with a master mechanic recently, we touched upon this subject, and he told me that he had been lubricating the couplers on their locomotives for a considerable time, and was satisfied with the results, and he thought it was something that could be extended to the whole equipment with advantage. It reduces the wear of the moving parts, and tends to lengthen the life of all parts.

I have incorporated in this paper a list of couplers in use, as shown by the Interstate Commerce Commissioners' report, lately issued. Number and kinds of couplers in service up to June 30, 1898:

Janney . . . . .	268,572	S. H. & H. . . . .	8,832
Gould . . . . .	211,058	Thurmond . . . . .	7,883
Chicago . . . . .	74,838	Smillie . . . . .	7,747
Buckeye . . . . .	58,103	Hinson . . . . .	7,503
Trojan . . . . .	54,406	Pooley . . . . .	5,144
Tower . . . . .	39,634	Little Giant . . . . .	4,864
Standard . . . . .	31,689	Dowling . . . . .	4,305
American . . . . .	24,768	St. Louis . . . . .	3,694
Missouri Pacific . . . . .	14,584	Washburn . . . . .	2,710
Hien . . . . .	13,861	Gallagher . . . . .	1,673
California . . . . .	12,855	Sams . . . . .	1,263
Williams . . . . .	10,369	Smith . . . . .	1,261
Lone Star . . . . .	8,922	Safety . . . . .	1,020

This makes a total of 881,558 out of 909,574 cars equipped. The balance of 28,016 is made up of kinds of couplers having less than 1,000 in service.

Discussion of the foregoing paper was deferred until the February meeting.

It was voted that the President be instructed to appoint a committee on revision of the interchange rules, to report at the March meeting, and the Association then adjourned.

The next meeting of the Association will be held Feb. 8, 1900, in Room 1741, Monadnock Bldg., at 8 p. m.

The following program has been arranged:

1. Discussion of Mr. Geo. Groobey's paper on "Defects of Uncoupling Devices," read at the January meeting.
2. How much labor should be charged for renewing a complete set of draft timber bolts at one end of a car, when all the bolts are broken and draft timbers down.
3. Should owners be charged for turning down a tapered journal?
4. Should a labor charge be made for replacing a missing knuckle or brake shoe on a defect card? If so, how much?

## A NEW HORSE EXPRESS CAR.

The Wells-Fargo Express Co. recently had built for it, by the Barney & Smith Car Co., a number of cars specially designed for the carriage of horses. These cars are quite models in their way, as is shown by our engravings. Fig. 1 shows the exterior of one of these cars; Fig. 2, an interior, shows the longitudinal arrangement of stalls, and Fig. 3 shows a gate arrangement for dividing the car into compartments for shipping horses without stalling them. A special system of removable stalls is employed; it is elastic, so that 24 stalls may be provided where the load is of small horses, or the number of stalls reduced



FIG. 1—A NEW HORSE EXPRESS CAR.

where larger horses are in the load. The stalls, which are arranged longitudinally, are padded. The horses in the end stalls face the center of the car; those in the middle stalls, between the car doors, are loaded back to back, one of the heavy gates separating the two bunches. Three pairs of heavy gates, swinging either way, provide for shipments where stalling is not required.

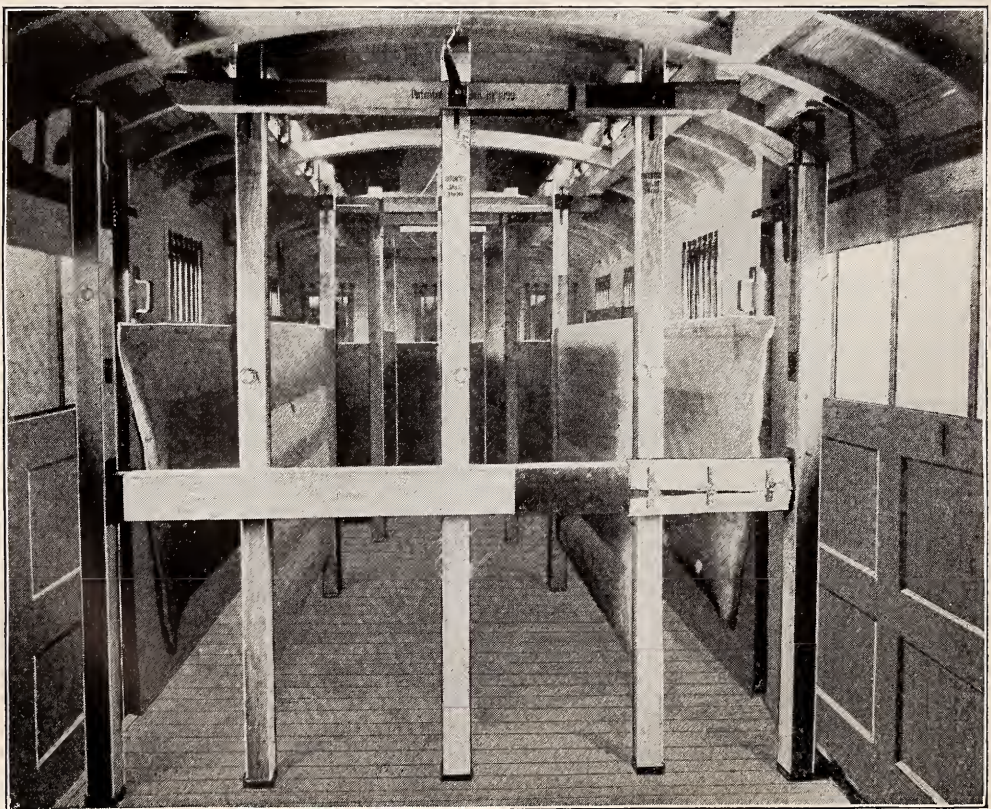


FIG. 2—A NEW HORSE EXPRESS CAR.

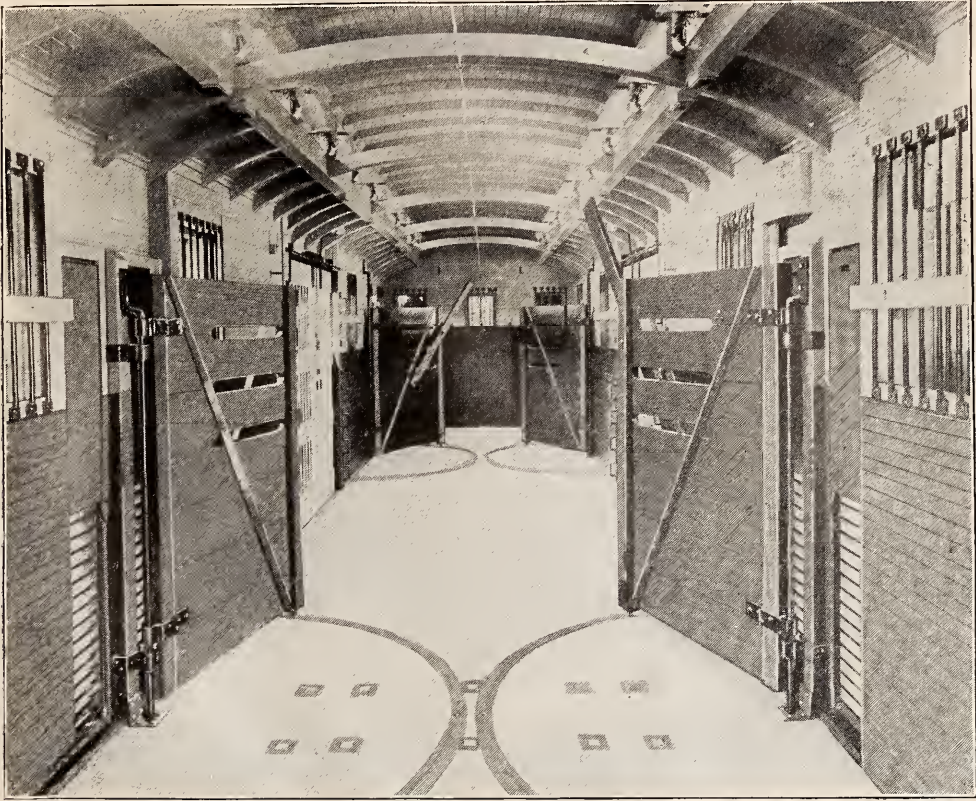


FIG. 3—A NEW HORSE EXPRESS CAR.

The side doors, of which there are two on each side of the car, are interchangeable screen and panel doors, the former being used during the summer, or when the panel doors will not give the desired ventilation. The openings of these doors are 6 feet 4 inches wide, and 6 feet 6 inches high. Ventilation is provided for by 8 ventilators near the floor, and 22 wire screen-covered windows, besides numerous small ventilators in the deck. The stall windows are protected by an iron grating on the inside. Steam heat can be provided when only a few horses are shipped and artificial heat is desired, but the steam can be easily cut out when not wanted. Portable lamps are provided, and suitable provisions made for feeding and watering. A loading bridge is carried beneath the car for use when chutes are not available. These cars weigh 90,000 pounds, are 9 feet wide and 60 feet long, inside measurement, and are carried on 6-wheel trucks.

## TOOL FOR CUTTING RUBBER GASKETS.

At the Conneaut shops of the New York, Chicago & St. Louis, there has been designed and built a neat tool for cutting gaskets from scrap air brake hose by compressed air. From a sketch fur-

nished to us by Mr. E. A. Miller, master mechanic at Conneaut, we have prepared the accompanying illustrations of this tool, Fig. 1 giving a side view of the complete machine, and Fig. 2 the detail of the cutter used, together with a sketch of the lever used for holding the hose in place. The operation of the machine is clearly indicated by Fig. 1. Referring to Fig. 2, A A are the cutting edges, B a coil spring in center to eject the piece cut from the center of the gasket, and C a ring between the cutting edges, which ring is connected to bolts passing through the body of the tool, the upper ends of which strike at the finish of the up stroke, thus knocking the gasket from between the cutting edges.

This tool has been found to work very neatly. An idea of the saving effected by its use may be gained by reflecting that the price of gaskets from new material is about 35 cents per pound, and that the price of scrap air brake hose is about 2 ½ cents per pound.

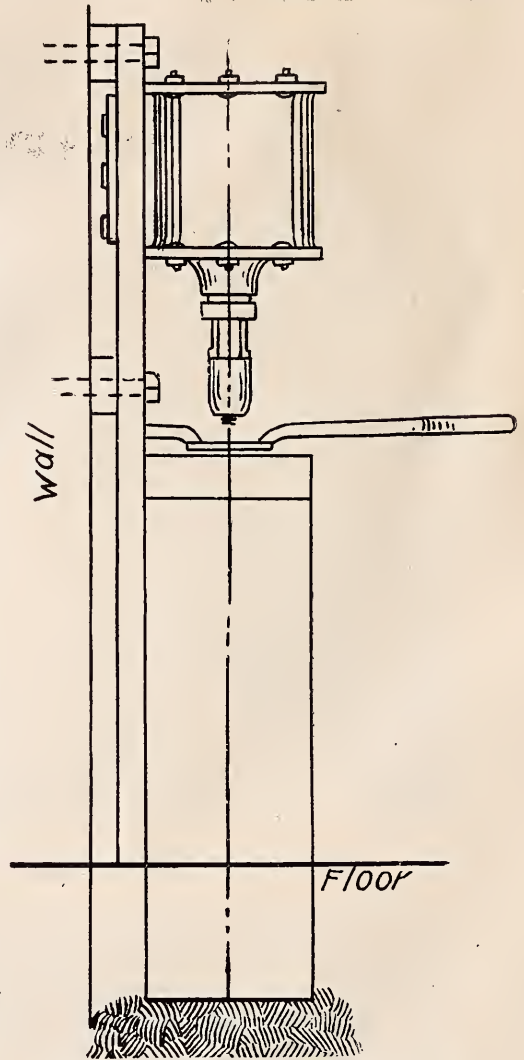


FIG. 1—RUBBER GASKET CUTTER.

## PERSONAL MENTION.

Mr. W. C. Cook has resigned his position as secretary of the Car Foremen's Association of Chicago, and Mr. Aaron Kline has been elected to succeed him. Mr. Kline is connected with the Chicago, Milwaukee & St. Paul Railway, and his address is 702 Maplewood Ave.

Mr. Robert White, general foreman Louisville & Nashville, at Birmingham, Ala., has been appointed master mechanic of the Birmingham Southern, with headquarters at Pratt City, Ala.

Mr. Columbus Phillips has been appointed master mechanic of the New Orleans & Northeastern, Alabama & Vicksburg and Vicksburg, Shreveport & Pacific Railways, with headquarters at Meridian, Miss.

Mr. B. Haskell, who has been appointed superintendent of motive power of the Pere Marquette road—the successor of the Flint & Pere Marquette, Chicago & West Michigan and Detroit, Grand Rapids & Western roads—has been for the last seven years

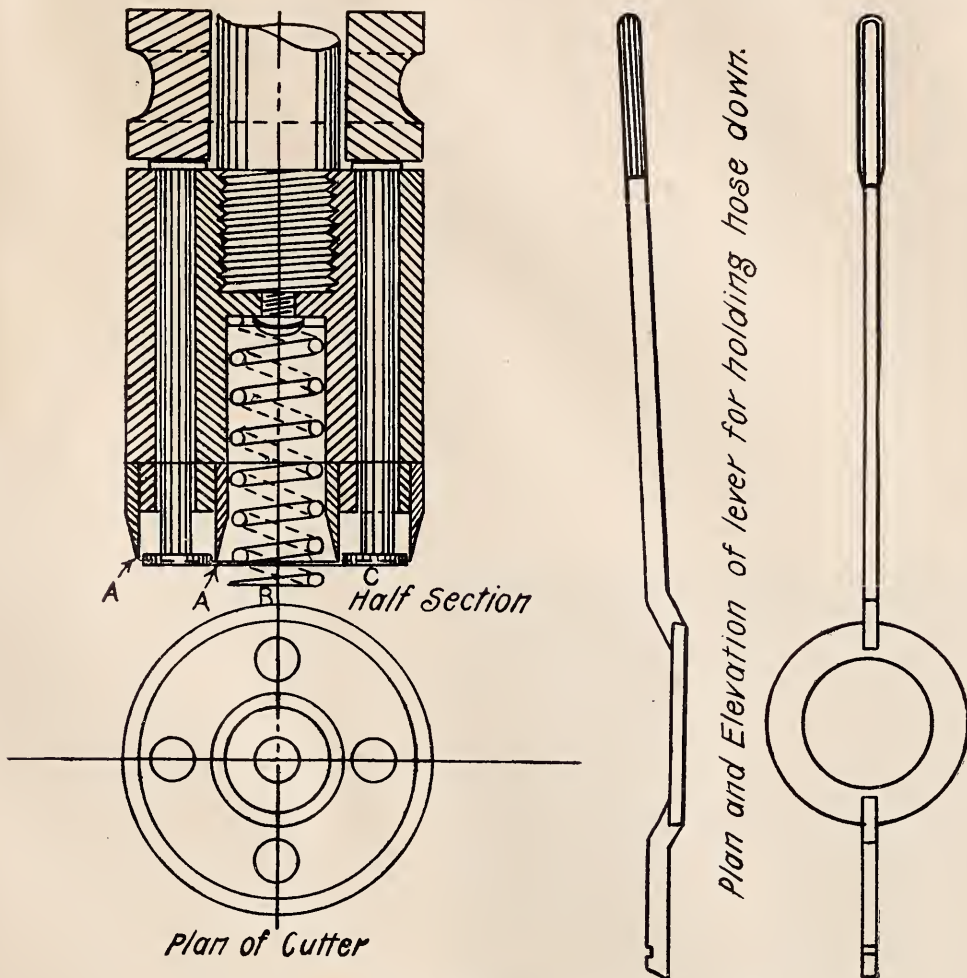


FIG. 2.—DETAILS OF RUBBER GASKET CUTTER.

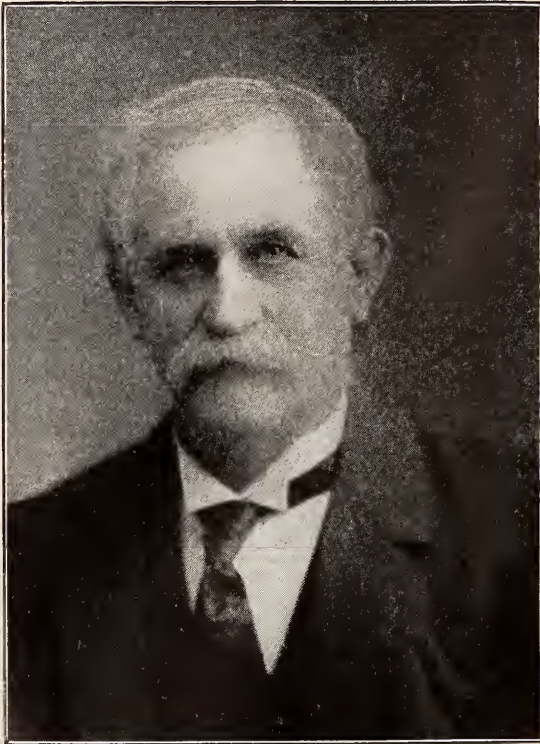
superintendent of motive power of the Chicago & West Michigan. His previous railway work was as follows: He entered railway service, in 1877, as clerk and machinist apprentice on the Kansas Pacific Railroad, since which he has been, consecutively, machinist same road and Denver Pacific Railway; machinist and foreman Hannibal & St. Joseph Railroad, to 1884; 1884 to 1888, machinist, gang boss and foreman Northern Pacific Railroad; 1888 to Aug. 1, 1893, master mechanic Rocky Mountain division same road at Missoula, Mont. In Aug. 1, 1893, he was made superintendent motive power of the Chicago & West Michigan Railway.

Mr. D. F. Crawford, the new superintendent of motive power on the Northwest system of the Pennsylvania Company, at Fort Wayne, Ind., has spent the entire 14 years of his railway service with the Pennsylvania Company. He was born at Pittsburg, Pa., Dec. 4, 1865, and was educated in the common schools and in the Pennsylvania Military Academy. He entered the Altoona machine shop as apprentice on Dec. 1, 1886, and has been successively, inspector of the testing department at Altoona from 1890; assistant master mechanic of the Fort Wayne shops from Feb. 1, 1892; and assistant to superintendent of motive power from July 1, 1895, until his recent promotion on Nov. 1, 1899.—*Railroad Gazette*.

Mr. F. E. Davisson, who was sometime ago appointed acting master mechanic of the Santa Fe, Prescott & Phoenix and the Prescott & Eastern Railways, was on January 1 appointed master mechanic of those roads.

On the Great Northern system, important changes in the motive power department have been made. The office of superintendent of motive power of the Great Northern, Montana Central, Willmar & Sioux Falls and Duluth, Watertown & Pacific was abolished January 1. All reports heretofore made to Mr. J. O. Pattee, superintendent of motive power of those roads, will hereafter, until further notice, be made to Mr. J. C. Morrison, motive power clerk, St. Paul, Minn. Mr. George H. Emerson, hitherto master mechanic of the Great Northern, at Larimore, N. D., has been appointed general master mechanic of the Great Northern and the Willmar & Sioux Falls companies, with headquarters at St. Paul, Minn. He will perform such duties as may be assigned to him from time to time by General Superintendent F. E. Ward. Mr. Max Toltz, hitherto bridge engineer of the Great Northern, has been appointed mechanical engineer of that road—a newly created position. Mr. Toltz still retains his position as bridge engineer.

Mr. J. O. Pattee, who is retired by these changes, has long been at the head of the mechanical department of the Great Northern system—for 12 years, in fact. Mr. Pat-



MR. J. O. PATTEE

Retiring Superintendent of Motive Power  
Great Northern System

tee's first work was undertaken in 1857, when he started to learn the trade of machinist at Manchester, N. H., with the Amoskeag Locomotive Works. In September, 1859, by the request of Mr. S. S. Merrill, who was a friend of Mr. Pattee's father, and who was then superintendent of the Milwaukee & Watertown Railway (now a part of the Chicago, Milwaukee & St. Paul) Mr. Pattee went to that road as a machinist, remaining there as such, and as locomotive engineer, and as foreman until 1870. He was then sent to Minneapolis as master mechanic of the divisions of the Chicago, Milwaukee & St. Paul west of the Mississippi river. He continued in this position until 1888, when, after 29 years' service with the Chicago, Milwaukee & St. Paul system, he resigned to accept the position of general master mechanic of the St. Paul, Minneapolis & Manitoba, later the Great Northern. Since 1892, he has been superintendent of motive power of the Great Northern system. Mr. Pattee retires from active service now, for a time, after some

40 years of hard work—continuous to the extent that even vacations find no place in their history—and he now proposes to completely take off the harness for at least one year, and rest. It is a part of his present program for the year to visit the Paris exposition. In this present retirement Mr. Pattee may rest assured that the entire railway fraternity will welcome him back to its ranks whenever he sees fit to take up work again.

The jurisdiction of Mr. George S. McKee, division master mechanic of the Wabash, at Fort Wayne, Ind., has been extended over the Detroit division.

Mr. F. C. Thomas has been appointed foreman of engines on the Pennsylvania Lines, vice S. D. Norrigan, who has entered political life.

Mr. T. W. McCarthy has resigned as foreman of the Union Pacific shops at Cheyenne, and is succeeded by Mr. Lomerine, who has been gang foreman in the shops.

Mr. J. B. Tennant who was general foreman of the Illinois Central shops at Memphis, has, it is reported, been appointed master mechanic of the New Orleans & Northwestern, with headquarters at Natchez, Miss.

Mr. J. P. Callahan has been appointed master car builder of the Chicago, Lake Shore & Eastern, with office at South Chicago, Ill., vice E. B. Smith resigned.

Mr. Joseph Townsend, for many years master car builder of the Chicago & Alton, has, it is stated, resigned.

Mr. Frank K. Irwin, mechanical draftsman on the Wisconsin Central Railway, has resigned to accept a position with the railway department of the International Correspondence Schools of Scranton, Pa.

Mr. Frank Ray, road foreman of engines on the Erie & Ashtabula division, Pennsylvania Lines, Southwest system, has been appointed to a similar position on the main line at Fort Wayne, and is succeeded by T. L. Baily, who had occupied a similar position on the Eastern division.

Mr. Thomas Baxter, foreman of the brass foundry at the Altoona shops, and Mr. Edmund Murphy, assistant foreman of the machine shop, have been retired under the Pennsylvania's pension plan.

Mr. S. K. Dickerson has been appointed master mechanic of the Toledo division of the Lake Shore & Michigan Southern, with headquarters at Norwalk, Ohio.

Mr. Jno. R. Gould, heretofore general foreman of the machine department, at Richmond, Va., of the Chesapeake & Ohio, has been appointed general foreman machine department at Huntington, W. Va., of the same road, vice A. G. Elvin, resigned to become master mechanic, at Montreal, of the Grand Trunk. C. H. Terrell succeeds Mr. Gould at Richmond, Va.

Mr. A. V. Hartwell, who recently resigned as general purchasing agent of the Chicago & Alton, is now engaged as president of the F. G. Hartwell Company, coal dealers.

Mr. George M. Burns, hitherto fuel agent of the Wabash, has been appointed superintendent of a new division of the Wabash, to be known as the Detroit division, with headquarters at Detroit.

Mr. E. H. Symington has been appointed assistant to the master mechanic of the Lehigh Valley, at Sayre, Pa.

Mr. F. C. Smith, hitherto foreman of locomotive repairs of the Fitchburg, at Keene, N. H., has been appointed division master mechanic of the eastern division of that road, with office in Boston.

Mr. Wm. Harrington, hitherto foreman of locomotive repairs of the Fitchburg, at Mechanicsville, N. Y., has been appointed division master mechanic of the western division of that road, with office in Mechanicsville.

Mr. John D. Sanson has been appointed traveling engineer of the Toledo, Peoria & Western, with headquarters at Peoria, Ill.

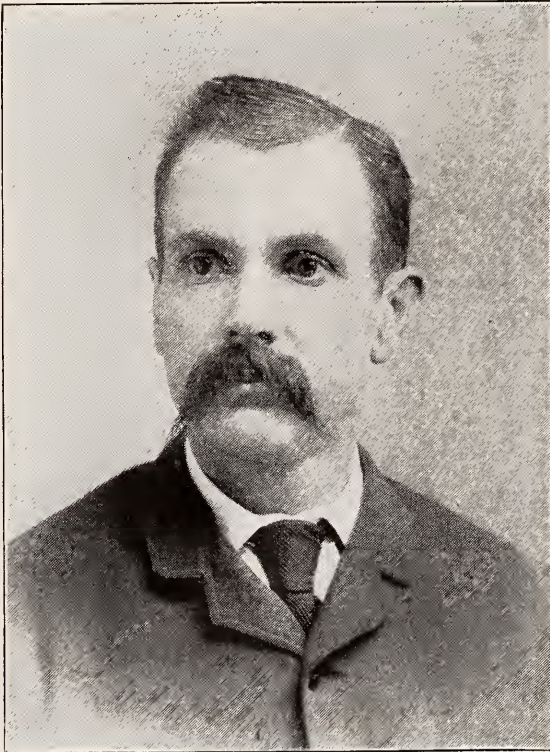
Mr. A. B. Corinth, hitherto foreman of car repairs of the Knoxville division of the Southern Railway, has been appointed assistant superintendent of motive power of the Seaboard Air Line.

On the Chicago & Grand Trunk, heretofore operated as the western lines of the Grand Trunk, the new receivers, E. W. Meddaugh and Henry B. Joy, have continued in office Mr. J. E. Muhlfeld, master mechanic, and Mr. John Hodgson, master car builder.

Mr. S. F. Forbes was, on January 17, appointed assistant superintendent of motive power of the Central Railroad, of New Jersey. Mr. Forbes' title on this road has hitherto been assistant to the superintendent of motive power.

Mr. George Paul, a prominent civil engineer residing at Cuyahoga Falls, Ohio, died suddenly Jan. 9, 1900, at the age of 62. While a machinist's apprentice, in his youth, Mr. Paul planned and worked upon an engine to propel the first steam canal boat in Ohio.

Mr. W. J. Bennett has been appointed master mechanic of the Chicago & Alton at Slater, Mo.



MR. JOSEPH COCKFIELD

Retiring Division Master Mechanic, Chicago  
& Northwestern Railway

Mr. Joseph Cockfield, division master mechanic of the Chicago & Northwestern at Clinton, Iowa, resigned his position January 1. Mr. Cockfield's entire railway life has been on the Northwestern system. After an apprenticeship of four years with Crane & Bros. at Chicago, he, in March, 1872, entered the service of the old Galena division of the Northwestern, in Chicago, as a machinist. He continued in this work until November, 1881, devoting most of his time to air brake work, and it was he who put on the first air brake on the Galena division. In 1881 he was sent to Eagle Grove as division foreman of the Northern Iowa division. In 1882 he was transferred to Belle Plaine as foreman. In June, 1883, he went to Boone as general foreman, remaining there until April, 1891, when he succeeded Mr. Robert Quayle as master mechanic of the Iowa and Northern Iowa divisions, at Clinton, which post he thereafter continuously held until his recent resignation. Mr. Cockfield will now, after 28 years' continuous service

with the Northwestern, take a well earned rest, after which he proposes to re-enter railway service.

It was Mr. Archibald Buchanan, Jr., who was appointed master mechanic of the Delaware & Hudson at Green Island, N. Y., and not James Buchanan, as we erroneously stated in our last. Mr. Archibald Buchanan was foreman of machine shops on the New York Central, at West Albany, when he resigned to go to the Delaware & Hudson.

Mr. George Gregory has been appointed division master mechanic of the Chicago Great Western, with headquarters at Dubuque, Iowa.

Mr. S. E. Cotter has been appointed fuel agent of the Wabash Railroad Co., vice Mr. George M. Burns, promoted. He will have charge of the purchasing, distribution, inspection and testing of all fuel for locomotives, reporting to the vice president and general manager. His headquarters will be in the Lincoln Trust Building, St. Louis, Mo. Mr. Cotter has hitherto been chief clerk in the general superintendent's office.

Mr. T. N. Kucher, assistant master mechanic of the Pennsylvania Lines, at Allegheny, Pa., has been appointed master mechanic of the Toledo, Peoria & Western, at Peoria, Ill., vice Mr. B. Warren, resigned. Mr. Kucher's entire railway training has been on the Pennsylvania. In 1886 he was an apprentice in the Fort Wayne shops, and in 1892 was made assistant foreman of the erecting department in those shops. He later went on the road as a fireman and was still later engaged on detail work for the motive power department. He has been at Allegheny, in the position which he relinquished to go to the Toledo, Peoria & Western, since 1898.

Mr. H. T. Bentley, master mechanic of the Chicago & Northwestern at Baraboo, Wis., has been transferred to the Iowa division of the same road, at Clinton, Iowa, to succeed Mr. J. Cockfield, resigned. Mr. Bentley is succeeded at Baraboo, by Mr. W. H. Whalen, who has hitherto been foreman of shops of the Northwestern at Janesville, Wisconsin.

Mr. E. S. Walker has been appointed master mechanic of the Southern Indiana.

Mr. P. T. Mooney, heretofore master mechanic of the Texas Central, has been appointed master car builder of that road, a position formerly held by Mr. Mooney. Mr. W. B. Warren has been appointed master mechanic of the Texas Central, with headquarters, for the present, at Walnut Springs, Tex.

Mr. F. B. Shepley has been appointed purchasing agent of the Fitchburg, with office at Boston, vice Mr. G. J. Fisher, resigned.

Mr. Thomas Roope, master mechanic of the Sioux City & Northern and the Sioux City & Western, has been appointed master mechanic of the Willmar & Sioux Falls, with headquarters at Sioux City, Iowa.

Mr. Gideon Hawley, the oldest engineer on the Lake Shore road, will, it is reported, soon be retired on a pension of \$97 a month. He has been actively engaged on the road as engineer for the last 50 years. His home is at Conneaut, Ohio.

Mr. M. E. McKee, for many years superintendent of air brakes on the Great Northern Railway, has resigned to enter the railway department of the International Correspondence Schools of Scranton, Pa.

Mr. A. Kline has been appointed chief clerk in the office of General Car Foreman Morris, of the Chicago, Milwaukee & St. Paul, at Chicago, vice W. C. Cook, whose resignation to accept the position of chief clerk in the office of the master car builder of the Swift Refrigerator Transportation Co. has been previously noted.

Mr. John L. Adams, foreman of the Rio Grande Western car repair tracks, at Salt Lake City, has been promoted to be car shop foreman.

Mr. John Kirk, recently of the Mexican Central, has accepted the position of master mechanic on the Colorado & Southern, with headquarters at Pueblo, Colo.

Mr. William O. Davies, Sr., for many years general car foreman of the Chicago, Milwaukee & St. Paul, died at his residence in Chicago, January 9. Mr. Davies had been in the service of the Milwaukee road since 1854.

Mr. F. W. Deibert, hitherto district master mechanic of the Chicago, Milwaukee & St. Paul, with headquarters at West Milwaukee, has resigned to accept the position of assistant mechanical superintendent of the Baltimore & Ohio, at Newark, Ohio, vice Mr. I. N. Kalbaugh.

To have achieved success as a physician, as an engineer, as a railroad executive, and as a partner in the largest establishment of its kind in the world; to have been wise and liberal in charity; to have won the affection of members of his family, associates and employes alike; to have remained serene and cheerful, knowing that he might die of a disease of the heart any moment for 40 years—this is an inadequate summary of the life of Dr. Edward Higginson Williams, who died December 21, in his 76th year, at Santa Barbara, Cal. Of the family from which he sprung were "the father of the town" of Rutland, Vt., the founder of its first newspaper, builders of the roads that still endure along the Connecticut and Queche rivers, a probate judge of Hartford, members of the Vermont Senate and House of Representatives. Edward Higginson Williams was born at Woodstock, June 1, 1824. A taste for mathematics and the desire to become an engineer led to preparation for this vocation under Hosea Doton and his uncle, Dr. Geo. P. Williams, now a professor in the University of Michigan. A severe attack of asthma seeming to forbid the active life of an engineer, he entered the Vermont Medical College, of which his father was dean, graduating in 1846. He practiced medicine for five years at Proctorsville, but despite success never took kindly to the profession. His constant injunction to his patients was, "Now, you are doing very well; be sure not to take any medicine." Perhaps his last case was that of a workman in a quarry, who had had a tamping bar blown through his head, but who lived for many years afterward without impairment of his faculties. In 1851, complete recovery from asthma left Dr. Williams free to follow his early ambition, and he became assistant engineer and then engineer in charge of construction of the road from Caughnawaga to Plattsburg, N.Y. In 1854 he became assistant to the superintendent of the Michigan Southern & Northern Indiana Railroad, at Adrian, Mich. From 1856 to 1858 he was division superintendent at La Porte, Ind., then assistant superintendent of the Milwaukee & Mississippi, at Janesville, Wis. From 1859 to 1864 he was assistant superintendent of the Galena & Chicago Union and superintendent of the division of the Chicago & Northern from Chicago to the Mississippi river. From 1865 to 1870 he was assistant general superintendent and general superintendent of the Pennsylvania Railroad. This position he left to become a partner in the firm of Burnham, Parry, Williams & Co., owning the Baldwin locomotive works. In the interests of this firm Dr. Williams traveled very extensively and sold locomotives in Russia, Central and South America, Australia and Japan. In 1861 he was made an honorary alumnus of the University of Vermont Medical College, his name being the fourth of his family on this roll. In 1876 he was elected a member of the Royal Academy of Sweden and created a knight of the order of the North Star. In 1879 he was commissioner for the United States at Sydney, New South Wales. Upon the site of his old home in Woodstock, Dr. Williams built the Norman-Williams Public Library and endowed it. He presented a memorial building to the University of Vermont; Williams Hall and a 16-inch equatorial telescope to Carlton College in Minnesota. In 1848, Dr. Williams was married to Cornelia Bailey, who is remembered as a woman of sweetness and simplicity, dressing with Quaker-like plainness. She died about 20 years ago, leaving two children, Mrs. William F. Dreer and Prof. Edward H. Williams, Jr., of Lehigh



THE LATE DOCTOR EDWARD WILLIAMS

University, who are both living. One of his boyhood friends says: "I never knew of anyone who was at all acquainted with Dr. Williams who did not love him, and this is as true of his employes as it is of his associates."—*Railroad Gazette*.

Mr. Beriah Warren, master mechanic and purchasing agent of the Toledo, Peoria & Western, has resigned and will, it is stated, retire from active service. Mr. Warren was born May 21, 1830, at Denmark, Oxford Co., Maine. He entered railway service in 1852, since which he has been consecutively: 1852 to 1857, mechanic Mariette & Cincinnati Railway; 1857 to 1859, general mechanic Ohio & Mississippi Railway, at St. Louis, Mo.; 1859 to 1868, with St. Louis, Alton & Terre Haute Railroad; 1868 to 1874, successively master mechanic same road and Missouri Pacific Railway, at St. Louis; 1874 to 1882, superintendent St. Louis, Alton & Terre Haute Railroad; 1882 to 1885, general master mechanic Indiana, Bloomington & Western Railroad, at Indianapolis, Ind.; 1885 to date, master mechanic and purchasing agent Toledo, Peoria & Western Railway.

Mr. R. P. C. Sanderson, master mechanic of the Norfolk & Western, at Roanoke, Va., has been appointed assistant superintendent of machinery of the Atchison, Topeka & Santa Fe, vice Mr. George A. Hancock, resigned. Mr. Sanderson entered railway service in 1882 as draftsman on the Norfolk & Western Railroad, with supervision of erection of buildings and machinery at Roanoke shops. He was afterward draftsman on locomotive and car work, inspector of supplies and materials and new equipment, and also engaged on experimental and test work; subsequently he was made assistant to the superintendent of motive power of the same road, in special charge of gauge work and later in charge of general change of road and shop work. In 1891 he was appointed division superintendent of motive power of the western general division of the same road. On Feb. 1, 1895, he was placed in charge of maintenance of locomotives and cars for the entire line. Of late he has been master mechanic of the same road, at Roanoke. Mr. Sanderson is noted as a bold and original thinker, and as an aggressive participator in club and convention work.

Mr. F. H. Greene, chief clerk of the motive power department of the Lake Shore & Michigan Southern, has been appointed purchasing agent of that road, vice Mr. C. B. Couch, resigned.

Mr. A. G. Elvin has been appointed master mechanic of the Grand Trunk, in charge of Montreal shops, vice Mr. William Aird, retired.

Mr. Thomas McHattie has been appointed master mechanic of the eastern division of the Grand Trunk, instead of acting master mechanic, with headquarters at Montreal.

Mr. William Hassman, formerly master mechanic of the Illinois Central at Paducah, Ky., has been appointed superintendent of motive power of the Central Vermont, with headquarters at Saint Albans, Vt., vice Mr. C. E. Fuller, resigned. The generally accepted statement that Mr. W. D. Robb, master mechanic of the Grand Trunk at Toronto, had been appointed as Mr. Fuller's successor, proves to have been incorrect. Mr. Hassman's previous career is as follows: He entered railway service Sept. 4, 1865, since which he has been consecutively: Sept. 4, 1865, to September, 1871, machinist's apprentice and machinist Philadelphia & Reading Railroad; September, 1871 to 1872, journeyman-machinist New Jersey Central Railroad; March, 1872, to autumn of same year, journeyman-machinist Philadelphia & Erie Railroad, Renova, Pa.; autumn of 1872 to April 1, 1877, successively locomotive fireman and engineer Philadelphia & Reading Railroad; April 1, 1877, to March, 1882, successively, journeyman-machinist and foreman St. Louis, Iron Mountain & Southern Railway, DeSoto, Poplar Bluff and Carondelet, Mo.; March, 1882, to July, 1886, foreman locomotive repairs, etc., Richmond & Allegheny Railroad; July, 1886, to March 25, 1887, traveling engineer Baldwin Locomotive Works; March 25, 1887, until the absorption of the road by the Chesapeake & Ohio, master mechanic Richmond & Allegheny Railroad; after the transfer of that road to the Chesa-

peake & Ohio, he was appointed master mechanic of the Richmond & James River division of the latter, which position he held until September, 1899; from that date to October, 1891, he was master mechanic Cincinnati & Huntington divisions, same road; October, 1891, to May, 1893, superintendent motive power Newport News & Mississippi Valley, and Ohio Valley. He was later master mechanic on the Illinois Central as above noted.

Mr. John L. Mohun, assistant to the master mechanic of the Pennsylvania Railroad at Juniata, Pa., has been appointed master mechanic of the Belvidere division of the United Railroads of New Jersey, with headquarters at Lambertville, N. J.

On the Pennsylvania Lines the following appointments have been made in the mechanical department: Mr. P. F. Smith, Jr., heretofore master mechanic of the Toledo division of the Northwest system, with office at Crestline, Ohio, has been transferred to the Southwest system, becoming master mechanic of the Logansport division, with office at Logansport, Ind., succeeding Mr. T. W. Demarest who, as noted in our last issue, was appointed superintendent of motive power of the Southwest system, vice S. P. Bush. Mr. Joseph D. Harris, hitherto assistant engineer motive power department, Northwest system, succeeds Mr. Smith at Crestline. Mr. L. S. Kinnaird has been appointed assistant master mechanic at Allegheny, Pa., on the Northwest system, vice T. N. Kucher, resigned to become master mechanic of the Toledo, Peoria & Western.

Mr. T. J. Hatswell, who by reason of the recent consolidation of the Flint & Pere Marquette, Chicago & West Michigan and Detroit, Grand Rapids & Western, into the Pere Marquette system, is retired from the position of master mechanic of the first named road, has given long and valuable service to that road. Mr. Hatswell first entered railway service Sept. 10, 1852, since which he has been consecutively, to 1859, in shops; 1859 to June 1, 1872, locomotive engineer; and June 1, 1872, to Aug. 1, 1875, foreman machine shops Flint & Pere Marquette Railroad. From Aug. 1, 1875, to Aug. 10, 1891, he was master mechanic of the same road in charge of locomotive department; and since Aug. 10, 1891, has been master mechanic of the same road in charge of locomotive and car departments. Mr. Hatswell has many warm friends who would like to see him "railroading" again before long.

On the Pere Marquette, (which is the title of the consolidated Flint & Pere Marquette, Chicago & West Michigan and Detroit, Grand Rapids & Western) the mechanical department has been reorganized as follows: Mr. B. Haskell, hitherto superintendent of motive power of the Chicago & West Michigan, with office at Grand Rapids, has been made superintendent of motive power of the new system, with office at Saginaw, E. S., Michigan; Mr. W. K. Christie, hitherto master mechanic of the Chicago & West Michigan, with office at Grand Rapids, has been made master mechanic of the new system, with office at Saginaw; Mr. W. T. Rupert, hitherto master mechanic of the Detroit, Grand Rapids & Western, at Ionia, Mich., has had his territory extended to include that hitherto covered by Mr. Christie. Mr. Edward F. Essick, hitherto general foreman machine shop, at Muskegon, of the Chicago & West Michigan, has been made general foreman locomotive department, with office continued at Muskegon; Mr. David McKinley, hitherto foreman car shops, at Muskegon, of the Chicago & West Michigan, has been made general foreman car department, with office continued at Muskegon. In this arrangement Mr. T. J. Hatswell, hitherto master mechanic of the Flint & Pere Marquette, with office at Saginaw, is retired.

Mr. George A. Hancock, who has resigned as assistant superintendent of machinery of the Atchison, Topeka & Santa Fe, has an enviable record as a successful mechanical official. His history, in brief, is as follows: He learned his trade on the Grand Trunk

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at Port Huron, and then went to the Lake Shore road at Elkhart. He later, about 1878, went to England and worked for some time at the Portsmouth dockyards. Returning to this country in 1881, he entered the service of the Atchison, Topeka & Santa Fe at El Paso as roundhouse foreman, becoming afterward division master mechanic at the same point. He was later, master mechanic of the California Southern, and then went to Topeka as division master mechanic and assistant superintendent of machinery. He was next made general master mechanic of the Atlantic & Pacific at Albuquerque. In 1893 he went to the San Antonio & Aransas Pass as superintendent of machinery, but resigned from this position to become superintendent of machinery of the Gulf, Colorado & Santa Fe. He was next made assistant superintendent of machinery of the Atchison, Topeka & Santa Fe, proper, which position he now resigns from. Mr. Hancock was, we understand, offered another very responsible post by the Santa Fe management when he resigned. He has been a very valuable man to his company and, while commanding the warm approval of his superiors, has become remarkably popular with the road and shop men of his department.

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## SUPPLY TRADE NOTES.

The Carborundum Company, of Niagara Falls, N. Y., informs us that it has changed its Chicago office from the Monadnock Block to No. 65 South Canal street (telephone main 1190). In the new quarters, which are under the charge of Mr. E. J. Eames, manager of the Chicago branch, a full line of the company's goods will be carried. The Carborundum Company is enjoying a very good business. In the current issue of *McClure's* there is a very interesting article, under the title of "Hottest Heat," describing the discovery and invention of carborundum.

Mr. R. C. Hallett, long well known in railway circles as the western representative of the Hildreth Varnish Co., has entered the firm of Julian L. Yale & Co., 1117 The Rookery, Chicago, which firm has hitherto consisted of Julian L. Yale and Townsend V. Church. Mr. Hallett's many friends are congratulating him upon this present advancement of his interests.

The many friends of Mr. Clarke Merchant, president of Merchant & Company, Incorporated, of Philadelphia, will deeply sympathize with him in the loss of his only son, Henry Watts Merchant, who died in Phoenix, Arizona, January 9, in the thirty-seventh year of his age. Mr. Merchant left Philadelphia about four months ago in a vain search for health in the dry climate of Denver, traveling from thence to Salt Lake City and to Pasadena, from whence came most gratifying reports of improvement. It was, therefore, a great shock to his relatives and friends to learn of his sudden decease. Mr. Merchant had been associated from boyhood with his father in the tin plate industry, managing the extensive works in Philadelphia, and traveling through Europe in the interests of the company. He was considered as one of the ablest young business men of Philadelphia. He was treasurer of Merchant & Co., Inc., and had recently been elected vice president of the International Sprinkler Co. of Philadelphia. He was also a member of the Loyal Legion and of the Philadelphia Club. Mr. Merchant is survived by one young daughter, his wife having died several years ago.

Merchant & Co., Inc., of Philadelphia, New York and Chicago, have gone into a new field of work. Our attention is just called to the International Sprinkler Co., 112 Orianna street, Philadelphia, who manufacture and install a complete system of wet or dry automatic pipe sprinklers. Mr. Clarke Merchant, president of the old established house of Merchant & Co., Inc., is also president of the International Sprinkler Co. Mr.

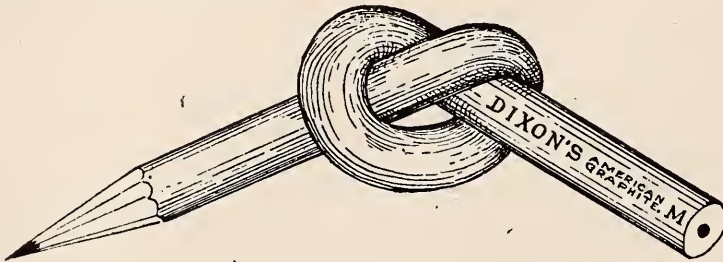
H. W. Merchant, Mr. J. A. McKee, Mr. Powell Evans, all of Merchant & Co., Inc., are also officers of the new company. Mr. Frank McNamee, superintendent, has been for 18 years identified with this line of work, and is recognized as one of the safest and most experienced manufacturers of, and contractors for, fire equipment in America, and insurance companies are, we understand, perfectly satisfied to accept risks which have been equipped by him. This system has been extensively employed in the largest and best class of buildings and has the entire approval of the insurance companies. The company is fully prepared with experience and capital to make a perfect success in this new field. The rate of insurance on buildings may be reduced from 10 per cent to 70 per cent by the introduction of the "International" system of automatic sprinklers. This saving is worthy of the consideration of all owners of property—reducing not only the insurance rate, but saving loss by fire from the outset, as it is guaranteed to stop fires from their incipiency, and also saving loss of time and business. The company will be much pleased to hear from anyone interested in the subject, and will furnish plans and full information about the equipment of mills, factories and stores with the International system of automatic sprinklers. The great number of disastrous fires that have been chronicled during the past business year, entailing such great drains and loss to the insurance companies, will make doubly welcome an approved device securing reduction of fire rates and security from fires.

One of our large Western firms recently made a most exhaustive test of Babbitt metals as submitted by a large number of firms, the result being that an order for two car loads of Babbitt metal was given Merchant & Co., Incorporated, of Philadelphia, as their product stood highest in the test. This speaks volumes in favor of the high grade of Babbitt metals manufactured by this firm.

The Industrial Works of Bay City, builders of cranes, transfer tables, etc., report that it has been necessary to run their plant night and day for the past two years to keep up with their orders.

Mr. Brown Caldwell, recently secretary of the Peerless Rubber Co., has assumed the position of general eastern representative of The Sargent Co., of Chicago, and will have offices in Pittsburg and New York City.

The following is scissored from *Graphite*, which is published by the Jos. Dixon Crucible Co. While it shows that some people are occasionally careless and even stupid, it also proves that advertisements are read and acted on :



We recently used the above cut in an advertisement in a leading school journal, which read about as follows : " You cannot tie a Dixon pencil into a knot, but by using a Dixon you can readily untie some of the hard knots in the problems which constantly arise in school work. "

In reply we have received requests for samples of Dixon's " knotted " pencils.

Another advertisement showed a cut of a school bag; the wording stating that " no school bag is complete without containing an assortment of Dixon's ' American Graphite ' pencils. "

In response we have had scores of requests for Dixon's school bags.

A postal card request for a sample of Dixon's " freezing " graphite was recently received; also for a price on Dixon's " snow-white " graphite.

Dixon's lubricating " lumbago " is often called for.

# RAILWAY MASTER MECHANIC

WALTER D. CROSMAN, EDITOR.

W. E. MAGRAW, ASSISTANT MANAGER.

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Vol. XXIV.

CHICAGO, MARCH, 1900.

No. 3

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## What Does it Cost to Run Trains at High Speeds?

The above subject in its particular relation to high speed passenger trains was brought to the attention of the Western Railway Club for discussion, by a paper prepared by Mr. F. A. Delano, which was given in our last issue; and although it was undoubtedly the intention to limit the question to high speed passenger trains, nevertheless its bearing on general train service was considered also. Mr. Delano said that the paper was hastily prepared; and for the good it has done he may well be thanked for risking some chance for criticism which too much haste is always likely to present; there is evidence also that much of the discussion by the members was prepared in haste.

First, let us answer the question broadly, and in a manner that will show that our understanding of it is as comprehensive as is that of others, by saying that, "it all depends." Then in explaining on what it all depends, let the question be limited, as undoubtedly the paper intended to limit it, to passenger trains at the present maximum speeds of such trains. It will be best to consider the subject in the order arranged in the paper.

Increased fuel consumption: If the same amount of work is to be done in less time, there must be an increase in fuel consumption, otherwise we would increase the speed of our trains and approach infinitely near the condition generally considered impossible—perpetual motion. The increase in fuel cost, which is to be considered chargeable to the high speed train, is only that much which is used to propel it at the higher rate; there should be no increased cost for fuel to other trains on account of the high speed train, because it will cost no more to clear a high speed train by ten minutes, on an unprotected track, or by the length of one block, on a protected track, than it will cost to clear a slower train. Indeed, on a single track road it may cost more, in fuel, to meet a slow train than to meet a fast one, because the meeting train

may have to wait while the slow train goes the length of a block or the distance between sidings—the delay would be greater and the temptation, at least, to make up lost time after being released would be greater. In the same way, on a two track or four track road, the cost for passing may be the same for the fast train as for the slow train.

Higher grade or standard of machinery, material and service: No higher grade of machinery and material should be required for the fast than for the slow trains; the formulas for axles, crank pins, side rods, piston rods, boilers, and so through the entire list, contain no factor relating to speed, and if the older cars and locomotives are used in the slower main line or branch trains it is not because the formulas for strength of parts say that they are serviceable for one and not for the other. No different material is used in freight locomotives than in passenger locomotives, and the conscientious builder will use just as good iron in freight trucks as in passenger trucks, and he will use all that the weight to be carried requires. The quality of the service, so far as speed is concerned, need be no different, if it is thoroughly efficient for the slower trains, but it must be acknowledged that the service for the high speed train does cost more, because so much more is expected of it. The cars cost more, because they always have some extra finish, and then it costs more to keep them in better condition than the other cars, but this is not chargeable to the speed. The locomotive will cost more, if it has extra finish, for the fast service, but it need cost no more per horse power developed than one for slow speeds; it costs more for inspection at the roundhouse, because a failure on the fast train means so much more to the officials; and shall this extra cost be charged to the higher speed or to, what—pride or fear?

Increased wear and tear to machinery, permanent way, etc.: Considering time as a unit, there is an increased *rate* of wear and tear to much of the machinery which would not show in the mile unit and, of course, there are, on the other hand, increased rates of wear per mile in some few parts, and this latter should be charged to the higher speed. The permanent way may suffer under the higher speeds, but at present there are many locomotives running at slow speed which, on account of being improperly counterbalanced, are more injurious to track and bridges than some of the high speed locomotives. Then, it is appreciated that the possibly injurious blows of the train on bridges, etc., must last for an appreciable length of time, and the shorter the duration the less the effect, so that a slow moving train may have a more serious perma-

ment effect on a bridge than will a train moving at a much higher rate of speed.

Increased risk of collisions: Whether this increase is material will depend upon whether the road is properly protected with signals and blocks. But if any cost is to be added to the fuel consumption on account of other trains taking extra precautions against the fast trains, then there should be a decrease in risks for collisions with the fast train.

Delay to traffic on account of keeping road clear: The amount of this item depends on whether there is one track or whether there are two, three or four tracks; on the latter there might be no such extra cost, and on a single or double track the item would vary with the distance between blocks or sidings.

But, after all is said, it appears that much of the additional cost of high speed trains is merely imagination; we would have two-, three- and four-track roads, even if we had no 60-miles-an-hour trains; we would have block signals; we would have the same effort to dispense with grade crossings; we would have elegant cars, on which to spend extra time in cleaning. And is not the extra fuel partly a child of imagination, because, do not the high speed trains generally make long runs without stops, and so are not called upon for the fuel necessary to accelerate the train? Are not the bridges strengthened, and heavier rails laid, to carry the heavy, slow moving freight trains? If a bridge was never strengthened, nor heavier rails laid, to carry a fast train, why charge these items to the fast trains?

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## EDWIN N. LEWIS.

When Edwin N. Lewis passed away from earth, on February 16, he left a void in the hearts of innumerable friends who are scattered all over this broad land. The heart whose failure finally closed his earthly career had beat warm and strong for nigh on the allotted three score and ten years and had, through cordial hand clasp, and kindling eye and cheery voice, inspired responsive throbs in the breasts of all who knew him well—I might say, almost, of all who knew him slightly. His was a rare nature. Kindly, even lovable, in disposition; gifted in intellect, in the powers of oratory, in personal magnetism, as a writer of both prose and verse, as a business man, as a strong, hearty specimen of robust manhood—gifted in all ways, he made friends wherever he went.

Mr. Lewis' strong trend toward the scholarly and philosophic attitude grew from a natural bent of mind, developed through the generous kindness of his parents, who gave him ample educational advantage in early life. Born in Tompkins county, N. Y., he, as a child, came west with his parents, and his first schooling was in Fowler Institute, at Newark, Ill.—one of those fine oldtime country-town academies which years ago turned out intellectual giants. He here lived in a scholarly atmosphere which indelibly stamped his character with



EDWIN N. LEWIS.

BORN SEPTEMBER 12, 1837.

DIED FEBRUARY 16, 1900.

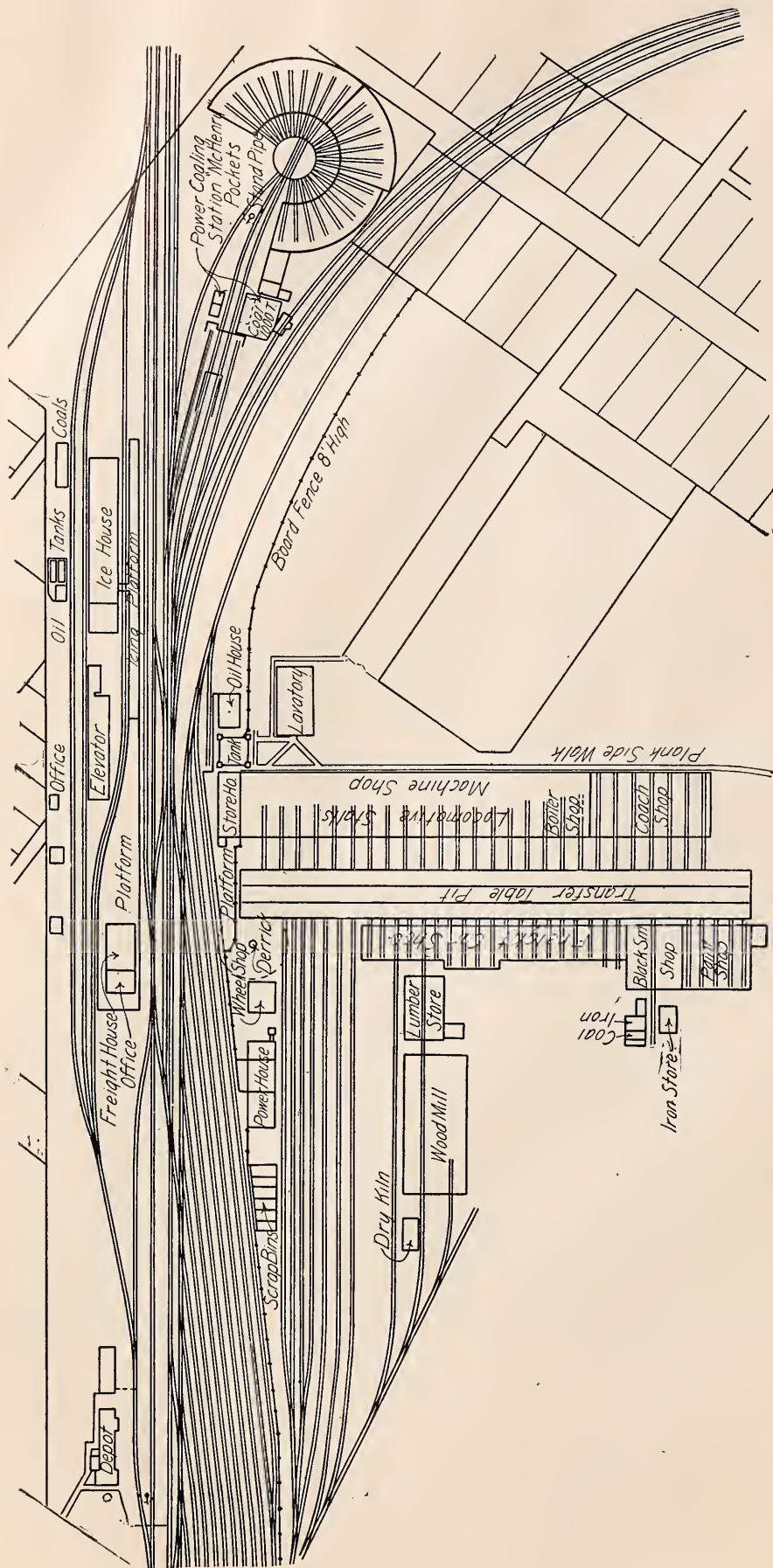
those fine intellectual traits that made companionship with him a joy and a help. The fine education here commenced was finished in Knox College, at Galesburg, Ill., in Beloit College, at Beloit, Wis., and in the Chicago Theological Seminary.

Mr. Lewis' first work was as a Congregational pastor, and members of his church have often spoken to the writer of his success and popularity in the pulpit—his congregation fairly idolized him. The Reverend Warren J. Day, now of Los Angeles, said of Mr. Lewis not many months ago, that had he continued in the ministry he would have acquired such fame that a letter addressed simply "E. N. Lewis, U. S. A." would have promptly reached him. But Mr. Lewis found the ministry not just to his liking and turned to the law, studying in the office of Cook & Glover, of Ottawa, Ill., to whose practice he finally succeeded. He speedily drifted into railway practice, and finally threw himself into the famous Ottawa Valley litigation, in which he won out. But his time had been so completely engrossed in this litigation that his private business became seriously impaired, and he therefore entered upon railway promotion and right of way work. Later, he joined the editorial staff of the *Railway Age*, and while on that paper did much to make the exhibit at the Railway Exposition a brilliant success. In November, 1885, he left the *Age* to become manager of the *Railway Purchasing Agent*, the name of which was, in January, 1886, changed to the RAILWAY MASTER MECHANIC. He, at the same time, became manager of the *Official Railway List*. He had held both positions continuously since. His work in these publications is too widely known to need review here. Until within the past few years he was a frequent contributor to the columns of the RAILWAY MASTER MECHANIC. He rarely essayed long articles—pungent paragraphing was more to his taste. In his writings, his direct forceful logic was habitually lightened with touches of either humor or poesy—and this was also markedly true of his conversation.

Mr. Lewis was fully as popular with railway men as with the railway supply men with whom, during the past 15 years of his life, he was thrown in contact. Though never a practical railway man, he yet had a good understanding of many of the problems with which railway men have to contend. He was well equipped to enter into a discussion with a railway president on questions of financing; with a general solicitor on legal points; with a general manager on operating problems; with a superintendent of motive power on car or locomotive or shop matters; with a roadmaster on track laying and maintenance. Not expert in knowledge of any of these fields (aside from legal questions) he yet so quickly and effectively applied his unusual analytic and deductive powers to the fruits of his observation and reading that he could always command an attentive auditor and a cordial informant among all classes of railway men.

In closing this brief tribute to my friend I will quote, as closely as may be, some words spoken over his bier by the Rev. Willard B. Thorp: "Mr. Lewis was throughout his life a student, a reader, a thinker, a man who looked beneath the surface of things and saw life in its larger and deeper aspects. My personal acquaintance with him was limited to a single conversation of an hour one afternoon not many weeks ago—an interview which neither of us thought would have to furnish the impressions upon which the remarks at his funeral would be based. But personality reveals itself even in conversation upon casual topics, and I left Mr. Lewis with a distinct feeling that I had met an unusual man and one whose acquaintance I should greatly enjoy. He impressed me as a man of philosophic temperament, of strong and independent convictions—one who had settled long ago his relationship to the realities of life. In his religious belief Mr. Lewis was an example of that reverent agnosticism which, reacting against the too confident dogmatism of the past, is yet not without faith and hope as it looks up into the mystery of God and out into the mystery of the future. If questioned as to his feeling about the life to come, Mr. Lewis would perhaps have replied, 'I do not know; I am not sure that I believe; I hope.' Death did not seem to him a great crisis, but only a change to a new and unknown environment where he would be, perhaps, not very far away from those who were left behind."

W. D. C.



THE OELWEIN SHOPS—CHICAGO GREAT WESTERN RAILWAY.

The general layout, showing how all the buildings are directly served by the transfer table; and how easily future extensions may be made in the main buildings, corresponding extension of the transfer table pit meeting all requirements. The round house was located rather remotely because the desired space encroached on cemetery property.



A PICTURESQUE OUT-DOOR BIT.

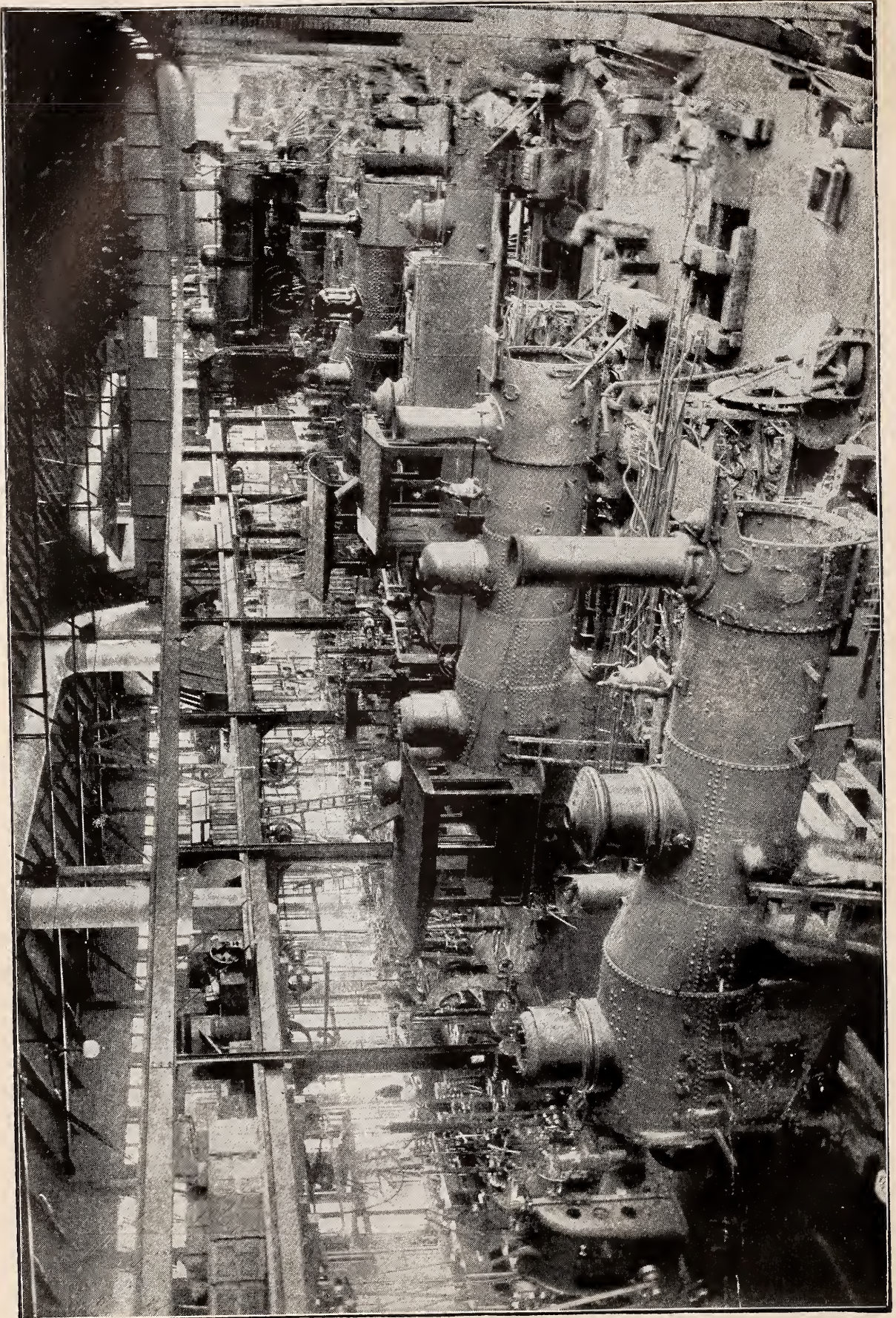
## THE OELWEIN SHOPS—CHICAGO GREAT WESTERN RAILWAY.

The new shops of the Chicago Great Western Railway, located at Oelwein, Iowa, are the most remarkable, in many respects, of any shops in the country—in fact as far as our observation goes, in the world. They are not so tremendously big, they do not handle such an extraordinary amount of work, but they are *modern*, and they combine in one plant several distinct characteristics that mark the thoroughly up-to-date shop. Without anticipating the story of these shops we may state that their chief features are (1) their novel method of arrangement with reference to the transfer table, which is constituted the main line of shop traffic; (2) the easily available provision for possible future enlargement; (3) the careful working out of architectural details with reference to such extensions, and with reference to lighting and ventilation and possible encounters with fires; and (4) the practically exclusive employment of electric and compressed air power for the machinery—the electric power however, being delivered not through motors independently operating single tools, but through motors operating short pieces of shafting serving grouped tools, in contradistinction to the practice introduced of late years in some other shops. These shops were designed by Mr. Tracy Lyon—until recently master mechanic, but now general superintendent, of the Chicago Great Western Railway—whose coadjutors in the work were Mr. C. A. Reed, of St. Paul, who looked after the architectural work, and Mr. Bion J. Arnold, of Chicago, who handled the equipment for making and distributing the heat, light, power and water. The following descriptive matter was prepared jointly by these gentlemen for use in our pages, and we use it substantially as it comes from their pens:

### GENERAL DESCRIPTION.

The Oelwein shops must be considered a part of Oelwein as a division point, and Oelwein the division point is a unique concentration of the work of a railway system.

The Chicago Great Western Railway was so planned that each mile of track, each division, is a part of three distinct lines of through traffic, with Oelwein the center from which they radiate. Every through coach or ear of freight passes Oelwein; 60 per cent of the motive power is



THE OELWEIN SHOPS—THE ERECTING SHOP IN ACTION.

regularly in its engine house; it is the point where freight is consolidated and refrigerators are iced; it is the largest coaling and water station of the system.

To secure the greatest advantage from such concentration requires: That common needs should have a common supply; that distances shall allow personal intercourse without waste of time; and that flexibility and chances for growth are not destroyed.

At Oelwein a circle with a radius of 1,000 feet encloses all important part of yards and buildings; from a single cabin all of the important switches can be operated; there is a common lead track for main yard and the repair yard of the shops; the Oelwein shops are at the end of each of its divisions, and are division, as well as the main, shops of the system.

The power house at Oelwein furnishes heat, light, water and power: heat to the passenger station, freight house, engine house and shops; light to the yards, passenger station, freight house, ice house, engine house, coaling station and shops; water for all purposes, and power for the engine house, ice house, coaling station and shops.

Its power, in the shape of electricity and compressed air, is easily transmitted and applied to any work in any part of the

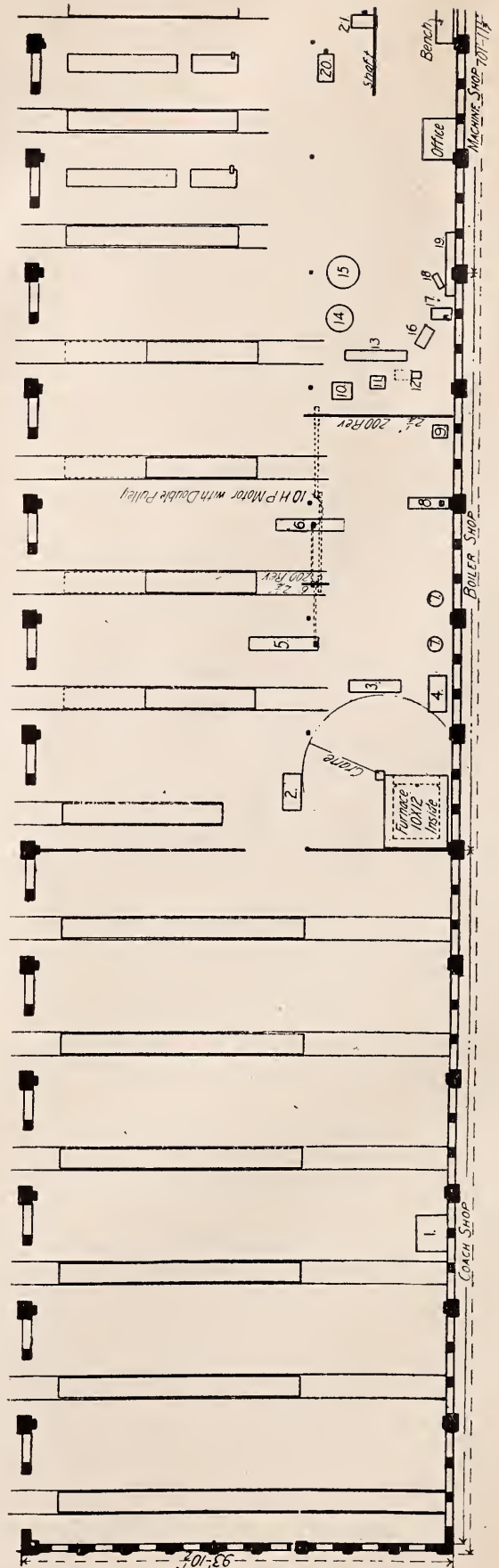


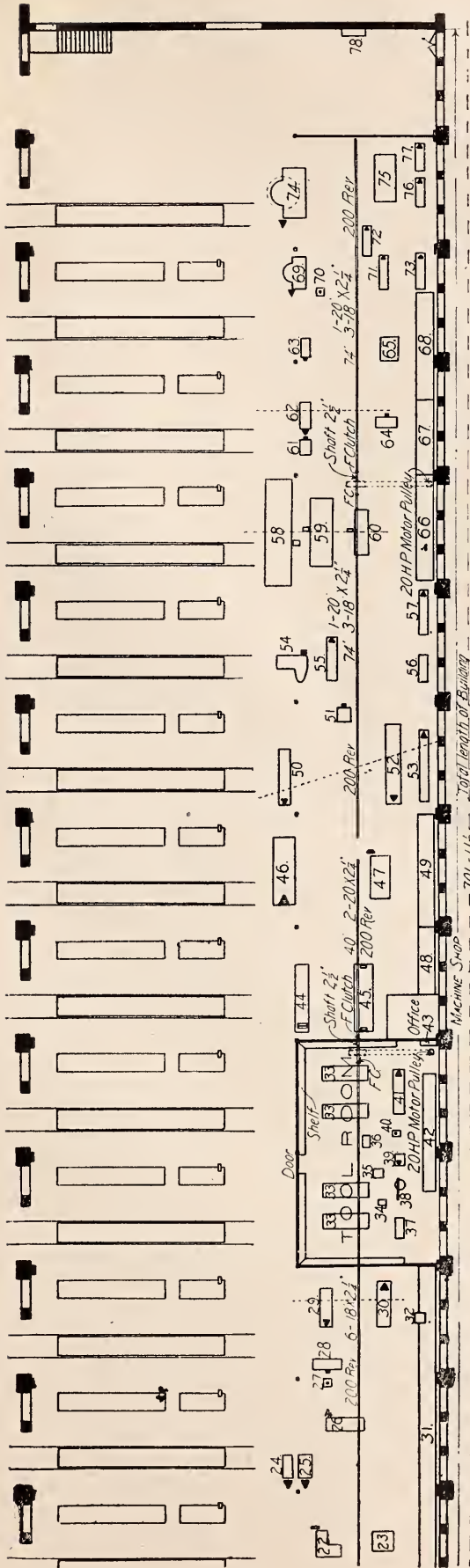
THE OELWEIN SHOPS—PANORAMIC VIEW FROM THE MAIN TRACKS.

buildings or yards, and its application to yard work will undoubtedly increase.

The main feature of the shops proper, is the use of one transfer table for all buildings, and its use for transferring material as well as cars and locomotives. It is the main line of shop traffic and plays the part of an elevator in a high building. This concentration of work gives constant employment for its crew. The transfer table was made by the Industrial Works at Bay City, Michigan, and has fulfilled all the requirements of the unusual amount of work planned for it. It carries the longest coach and heaviest locomotive, at a speed of 200 feet per minute, and has a second speed of 400 feet per minute, for use in transfer of freight cars or lighter loads of material. By means of the car haul, its crew handles cars and locomotives from yard to buildings without additional assistance. The shop tracks are on an elevation four feet below the main track and yards, and this difference in elevation is made to assist by gravity the movement of cars in the repair yard of the shops. The transfer pit is made shallow, so as not to impede communication between the buildings.

The grouping of all buildings on one pit makes the greatest distance necessary to travel between any two parts of the shop not over 750 feet.

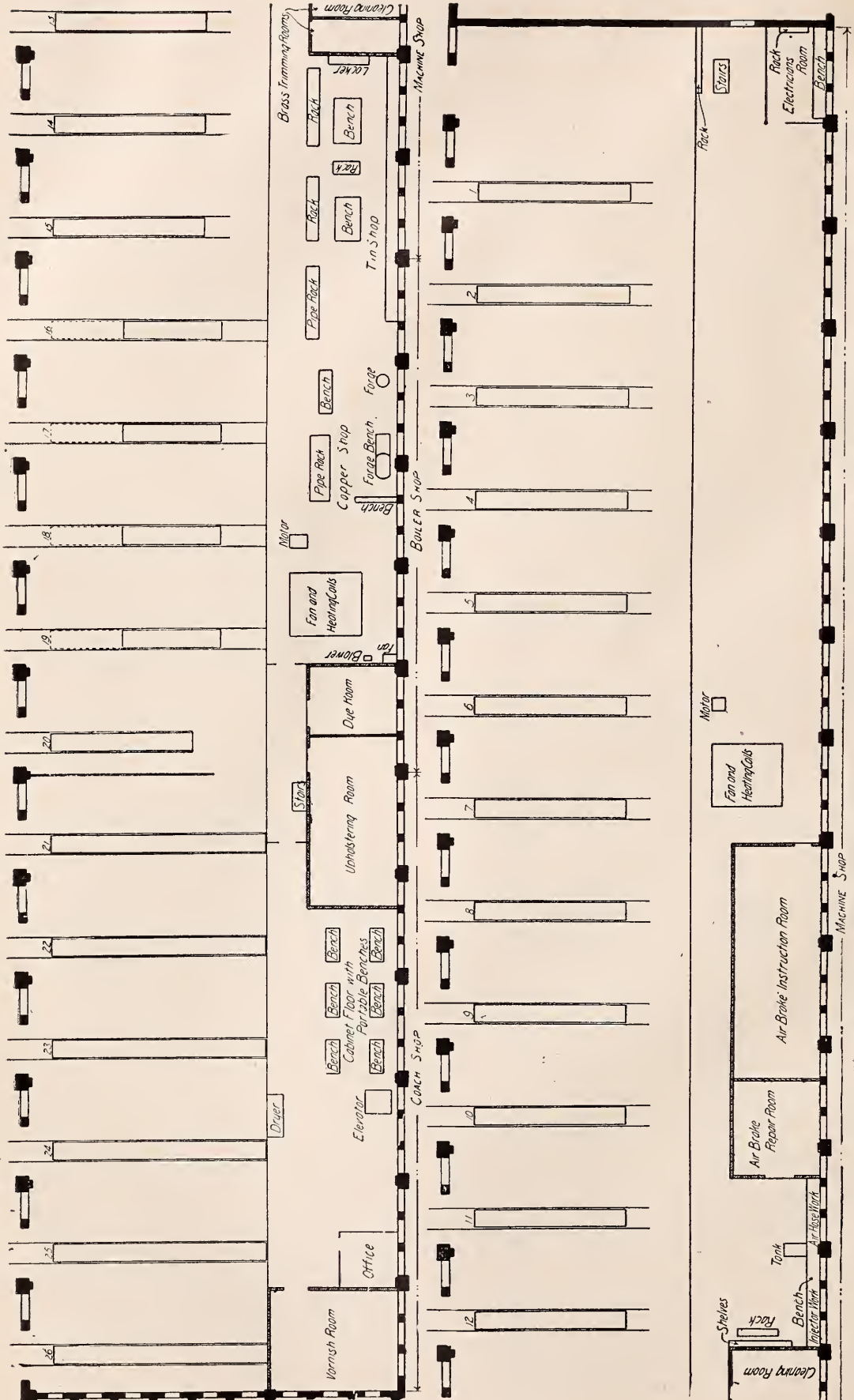




THE OELWEIN SHOPS—FLOOR PLAN OF MAIN BUILDING

The engraving on this page should be read as a continuation of that on the opposite page. The tools are indicated by numbers, the key for which follows:

- |                              |                                  |  |   |
|------------------------------|----------------------------------|--|---|
| 1 Freight elevator.          | 21 Grindstone.                   | 40 Grinder, 1/2 h. p.                      | 59 36-in.-x36-in.-x12-ft. planer, 3 h. p. |
| 2 Straightening plate.       | 22 Cold saw, 1/2 h. p.           | 41 24-in.-x10-ft. lathe, 1 1/2 h. p.       | 60 26-in.-x26-in.-x6-ft. planer, 2 h. p.  |
| 3 Flange clamp.              | 23 Screw press (hand).           | 42 Bench.                                  | 61 Drill press, 1 h. p.                   |
| 4 Flange fire.               | 24 Single head bolt cutter.      | 43 Cupboard.                               | 62 Slotter, 2 h. p.                       |
| 5 Power rolls, 8 to 10 h. p. | 25 Double head bolt cutter.      | 44 72-in. wheel press, 7 h. p.             | 63 Drill press, 1 h. p.                   |
| 6 Punch and shears, 5 h. p.  | 26 Shaper, 1 1/2 h. p.           | 45 Quartering machine, 3 h. p.             | 64 Grindstone.                            |
| 7 Forges.                    | 27 Emery grinder, 1 h. p.        | 46 Wheel lathe, 7 h. p.                    | 65 Hydraulic press (hand).                |
| 8 Flange punch, 2 1/2 h. p.  | 28 Guide grinder, 1 h. p.        | 47 Shaper, 1 1/2 h. p.                     | 66 Bench for link work.                   |
| 9 Drill press.               | 29 Horizontal borer, 1 h. p.     | 48 Bench, general uses.                    | 67 Bench for eccentric strap work.        |
| 10 Bevel shears.             | 30 30-in.-x10-ft. lathe, 2 h. p. | 49 Bench, piston and cross head fitting.   | 68 Bench for driving box fitting.         |
| 11 Drill.                    | 31 Bench for rod work.           | 50 36-in.-x12-ft. 6-in. lathe, 2 1/2 h. p. | 69 51-in. boring mill, 2 h. p.            |
| 12 Rattler (under floor).    | 32 Drill press.                  | 51 Small drill press.                      | 70 Emery grinder, 1 h. p.                 |
| 13 Flue saw.                 | 33 Racks.                        | 52 25-in.-x18-ft. lathe, 1 1/2 h. p.       | 71 Turret screw machine, 1 h. p.          |
| 14 Flue stand.               | 34 Grinder.                      | 53 30-in.-x16-ft. lathe, 2 h. p.           | 72 Stud lathe, 1 h. p.                    |
| 15 Annealer.                 | 35 Saw.                          | 54 Radial drill, 2 h. p.                   | 73 Flat turret lathe, 1 h. p.             |
| 16 Furnace.                  | 36 Small drill press.            | 55 18-in.-x10-ft. lathe, 3/4 h. p.         | 74 84-in. boring mill, 4 h. p.            |
| 17 Flue welder.              | 37 Universal grinder, 1 h. p.    | 56 Centering lathe, 1 h. p.                | 75 Rack.                                  |
| 18 Air swager.               | 38 Taper grinder, 1/2 h. p.      | 57 20-in.-x10-ft. lathe, 1 h. p.           | 76 Brass lathe, 3/4 h. p.                 |
| 19 Flue tester.              | 39 Milling machine, 1 h. p.      | 58 60-in.-x80-in.-x20-ft. planer, 5 h. p.  | 77 Brass lathe, 3/4 h. p.                 |
| 20 Double head bolt cutter.  |                                  |  |   |



THE OELWEIN SHOPS—PLAN OF THE BALCONY IN THE MAIN BUILDING  
 The lower engraving should be read as a continuation of the upper one.

The possible extension of the shops will be accomplished by increasing the length of buildings and transfer pit. Such extensions, large or small, are served efficiently by the present transfer table. The line of shop traffic is extended, but otherwise remains unbroken.

The lumber store, wheel shop and store house platform, with its electric derrick, are located so that the transfer table can conveniently transport material to all the shops.

Attention is called to this concentration of all shops on one transfer table, in distinction from the more general arrangement of grouping them about several separate and independent transfer tables. In the process of manufacturing, the cost of moving material is always large, and the facility with which this work can be done often represents the difference between profit and loss. In a railway repair shop, consisting of several groups of buildings, without the connecting link of a common transfer table, much heavy material must be moved to disadvantage and light material carried from place to place in small lots and at comparatively great expense. In the plan under consideration, the single transfer table crew is able to deliver a truck load or a car load of lumber, forgings or bolts from any one shop to any other, in an expeditious and economical manner.

It may be urged that the way to build railway shops is not on a transfer table at all, but that the locomotive and car work should be done on long parallel tracks with the tools located on either side. As applied to repair work, which does not progress at a uniform rate, this plan has many disadvantages, the inability to move or transfer equipment as completed without the use of heavy cranes and additional tracks being one of the principal of these. In locomotive work it will be found more difficult, with long tracks, to provide good and sufficient light, and material must be piled up alongside the engines, to a greater or lesser extent, raising a barrier between them and the tools. It is also a question if the tools themselves can be located as conveniently with reference to the delivery of both raw and finished material.

It has, perhaps, not been attempted before, to carry out the same arrangement of short tracks from a transfer table for a freight car shop, but here this has been done with the object of providing the best facilities for making light as well as heavy repairs in the shop instead of in the yard, it being considered better economy to bring the cars to the men, tools and material, than the latter to the cars; at the same time it being possible to handle each car independently in or out. Under nor-

mal conditions, each gang of four men is assigned to two of these short tracks, having their tools and a supply of standard material in racks between the tracks. Starting on one car, as soon as the repairs are made, a signal is given to the transfer table crew, and, without delay, the car already on the other track is commenced on, meanwhile the transfer crew removing the completed car and substituting another in its place.

The character of the construction of the different buildings has been governed by their use. Where the use did not collect material sufficient for a fire, the buildings themselves are constructed of incombustible material. Where the contents were to be inflammable, heavy timber construction was used in preference to steel.

The wheel shop, power house, oil house and blacksmith shop are of brick with Ludowici tile roofs laid directly on the steel frame, and glass tile used where light from the roof was required.

The main building and paint shop are the same, except that the roof is supported by steel trusses and purlins; but the rafters are wood and covered with plank and roofing felt under the tile. This form of roof construction was adopted because the radiation of heat through the unprotected tile of these large roofs would, in so cold a climate, add materially to the cost of heating the buildings.

The main building has a skeleton frame of steel, in order to resist the wind pressure due to the height necessary for a traveling crane, with the window space necessary to thoroughly light the building without skylights.

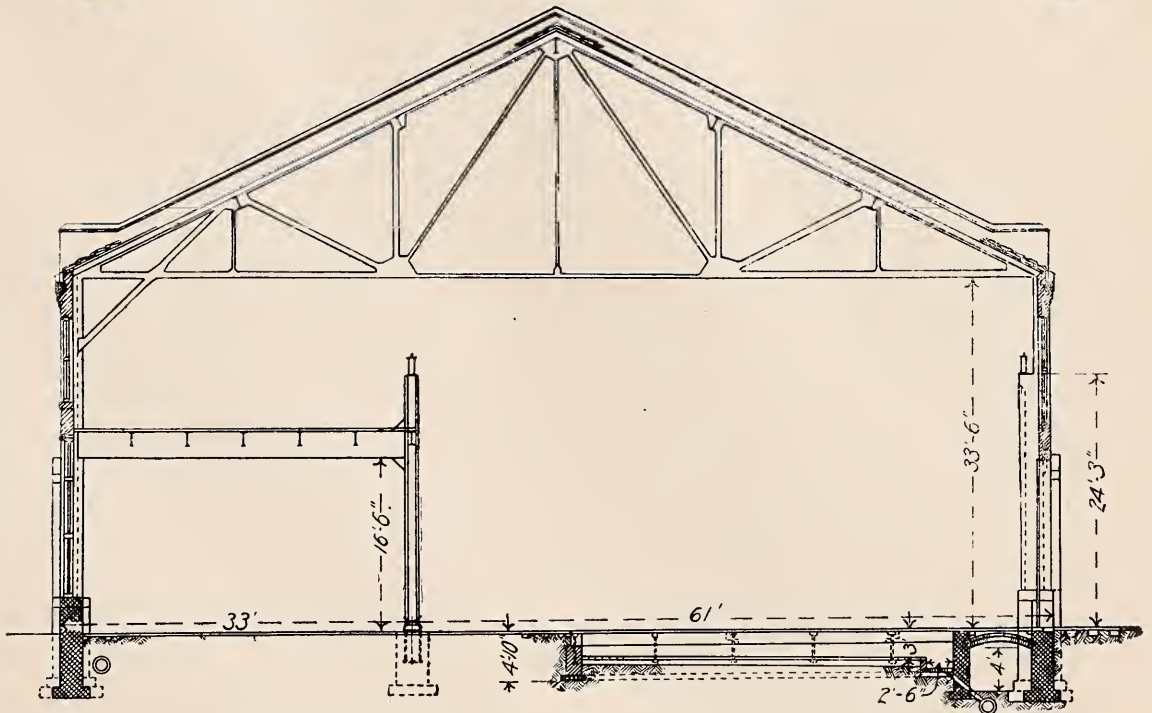
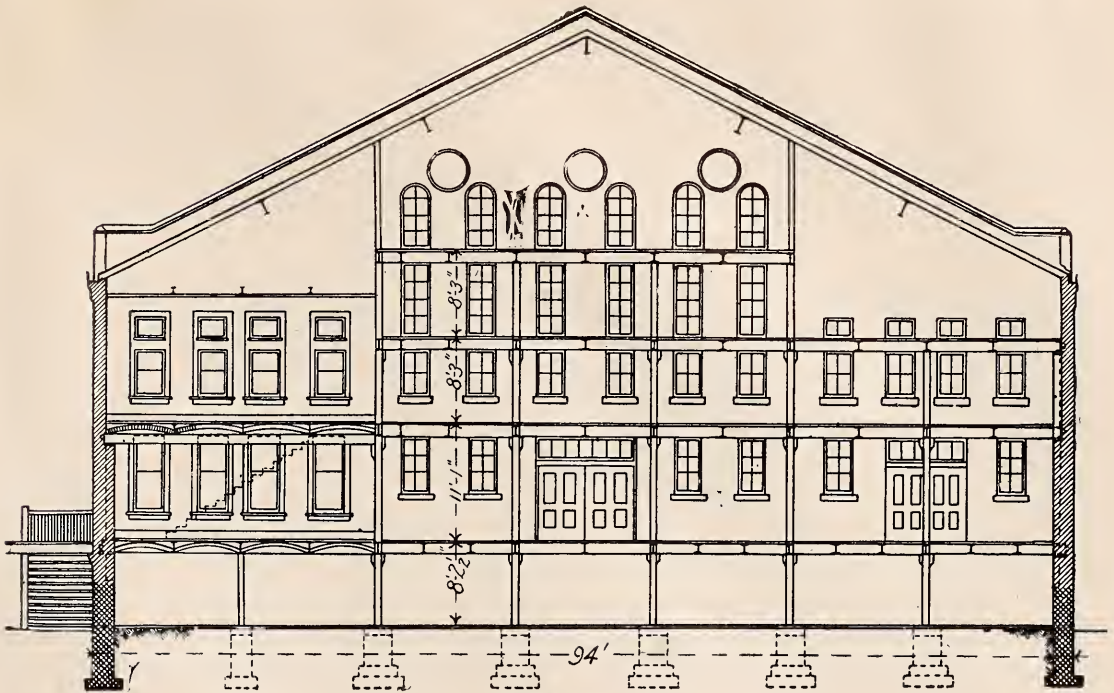
Skylights and all other details, that would break the surface of the otherwise perfectly plain gable roofs, have been excluded.

As the character of railway shop work is variable, and because any extension of the shops will be the extension of the present buildings, allowing the use to be re-arranged as future work may dictate, all buildings on the transfer table (excepting the freight car shop) are made of a standard section, carefully adapted to all classes of shop work.

The main buildings south of the transfer table are of a height that provide for a traveling crane; the buildings on the north side are of the same section without provision for a crane.

The freight car shop is a heavy timber frame building, covered with iron, cheap in construction, and temporary, in comparison with the other structures.

Any extra cost from space not required by present use, is considered



THE OELWEIN SHOPS—SECTIONS OF MAIN BUILDING.

The upper section shows the construction at the store house end; the lower section the construction as viewed looking toward the other end, revealing the balcony, the pit construction, and the crane tracks.

as being more than offset by economy from duplication of parts, particularly in the steel work of the roof.

THE MAIN BUILDING.

That part of the main building which is not traversed by the

crane is made of two stories by means of a balcony that extends the full length of the building. The construction of this balcony is of steel, attached to the skeleton frame so as to assist in resisting wind pressure, and made of a height that allows of all shafting to be attached to it. The floor is of plank, five inches thick, fastened directly to the flanges of the I beams with track spikes driven from below. This construction gives adequate support at any point for hangers or pendant jib cranes.

The crane, with its span of 60 feet, covers all the erecting part of the shop for its full length, the space under the balcony being used for machinery; and in this latter space all material is handled by pendant jib cranes with air hoists, placed wherever best suited for the machinery it serves, but overlapping the part traversed by the traveling crane so as to take its material from it. The traveling crane, besides its work on the erecting floor, is planned as a carrier of material to and from the machinery and equipment being repaired, and also of all new material from the store house. It can also deliver material to any part of the balcony, making a secondary line of traffic, similar to the transfer table, that will be extended with any increase in size of this building. This crane has a capacity of 15 tons, and a speed of 400 feet per minute; its high speed and small capacity is to adapt it to the purpose of errand boy and common carrier, while its capacity still allows it to carry the heaviest part of a locomotive.

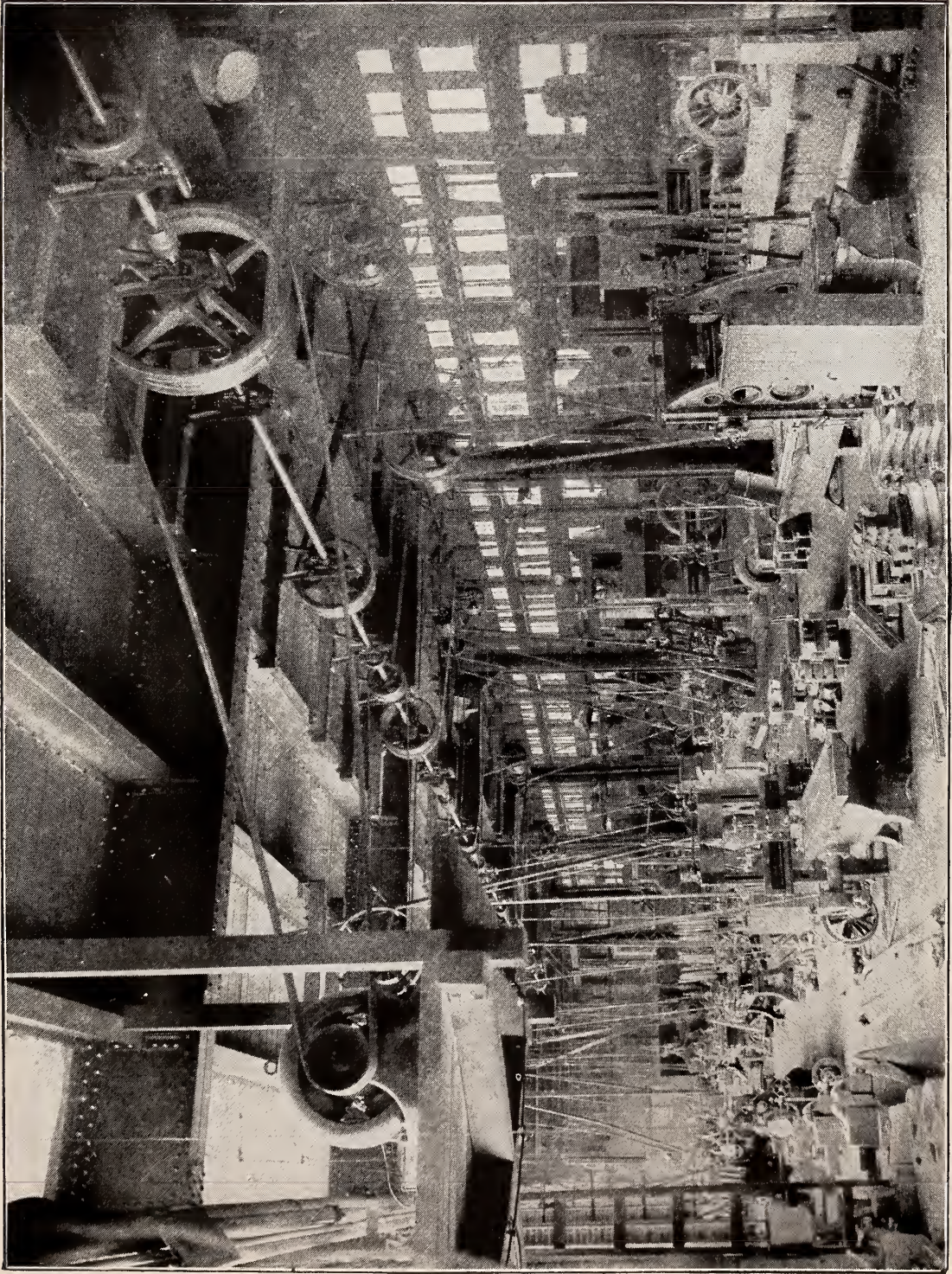
For use in removing the drivers from locomotives, a dummy crane of 65 tons capacity is erected on the same track and arranged so as to be moved from pit to pit by the smaller crane. As the pits occupy the same relative position to the columns that support the crane track it was possible, by increasing the wheel base of this dummy crane, to provide for lifting its load without increasing the strength of the track over that required for the small crane. This crane, when sustaining a load, cannot be moved. Both the traveling crane and the dummy crane were furnished by Manning, Maxwell & Moore.

#### *The Store House.*

Besides the store house, the main building is used for boiler and locomotive shops on the main floor, and the air brake repair shop, instruction room, lubricator and injector, babbitting and tin shops on the balcony.

A temporary partition in the main building cuts off, below, the last six tracks, which are used for coach work, and above, in the balcony, space for upholstering, cabinet, burnishing and varnish shops.

The store house is a section of the main building, which makes it possible to deliver material from it directly to the crane. The store house part is divided into five stories. The first floor is on the level of the main shop floor, and the second on the level of a platform four feet above the store house track (this is possible with the difference in ele-



THE OELWEIN SHOPS.—From beneath the balcony in main building, showing particularly the application of power from motor to shaft

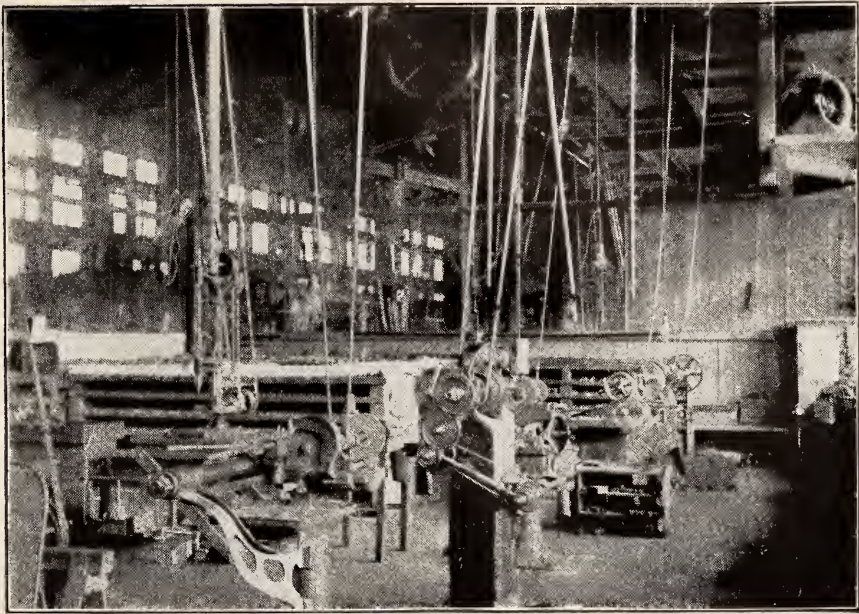
vation of shop and main track); and from this floor a pulpit extends out into the shop, allowing heavy material to be moved from cars to the crane. The third floor is on a level with the balcony, so that it can be used for stores and a direct passageway to the shops located on the balcony. The windows in the store house are arranged to give the greatest length possible of well lighted shelving, and the stories are of a height that allows the shelving to extend to the ceiling, and still be in reach of persons standing on the floor. The store house has an electric elevator for handling goods. The store house platform extends north to the electric derrick and south to the oil house. The space under this platform is used for storage of rough castings. A separate store for bar iron is placed at the rear of the blacksmith shop.

#### *The Machine Shop.*

Opposite fifteen pits in the main building and under the balcony are the machine tools, (see plan showing location of tool room, benches and tools) grouped with reference to the natural movement of material from the raw to the finished state, and the different classes of work. The new tools were, for the most part, furnished by the Niles Company. There is one line of light shafting ( $2\frac{1}{4}$ -inch) running at a speed of 200 R. P. M., and in two sections, each of about 75 feet in length, each section being driven by a 20 H. P. motor hung from the girders above. These two sections of shafting can be connected by flange couplings, so that both may be driven by either motor. In no case are single tools driven by independent motors, as there would seem to be no advantage in this for light tools, intermittently used, except where they are isolated, or the use of overhead belting is undesirable, and a very decided disadvantage in the increase in the first cost of the motors as well as in the lack of elasticity in power. The heavier tools, such as boring mills, planer and driving wheel press are placed outside of the balcony, where they can be served by the traveling crane, but are driven from the countershafts under the balcony floor. The heavy tools under the balcony are served by air hoists suspended from trolleys or cranes. The list of tools is shown on the plan,—portable pneumatic tools also being used extensively.

#### *The Boiler Shop.*

The boiler shop, in the same building, for which there are 5 pits, is supplied with power by means of a single section of light shafting, similar to that in the machine shop, and driven by a 20 H. P. motor. One of the heavy punches and the plate rolls are outside of the balcony,



IN THE TOOL ROOM.

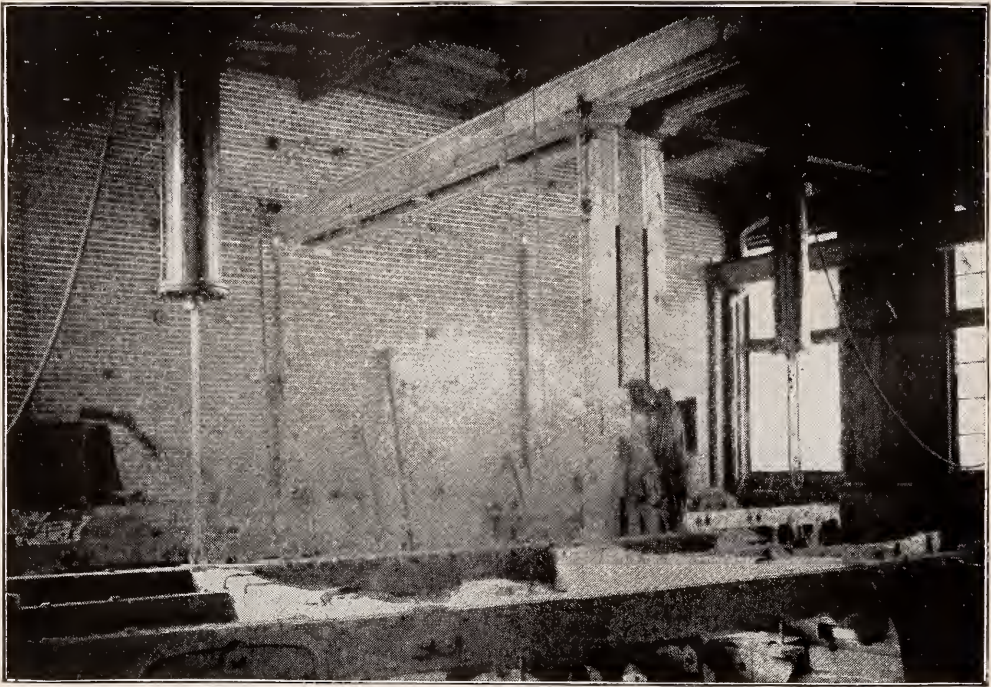
and under the floor is the tube rattler, provided with a water connection for washing out and a connection with the sewer. In one corner of the boiler shop is a large annealing furnace taking 120-inch by 140-inch plates, oil sprayed by air pressure being used as fuel. Over this furnace is an air hoist running on a radial crane suspended from the ceiling. The tube welding furnace is also heated with fuel oil. Both these furnaces were designed and built by R. Ferguson, of St. Paul. A list of tools in the boiler shop is shown on the plan and, in addition to these, there are in use a Baird pneumatic mud ring riveter, staybolt cutter and tank riveter, as well as numerous pneumatic drills and hammers.



IN THE BOILER SHOP—THE ANNEALING FURNACE CORNER.

*The Coach Shop.*

In the coach shop each of the six tracks holds one car. There are no machine tools here and no power (except for the electric elevator to the balcony above) but compressed air, which is used for large jacks, cleaning, etc. All upholstery, cleaning of brass work and varnishing of sash, etc., is done on the balcony. When heavy truck work is to be done, the cars are lifted with the air jacks and the trucks taken by the transfer table to the truck shop.

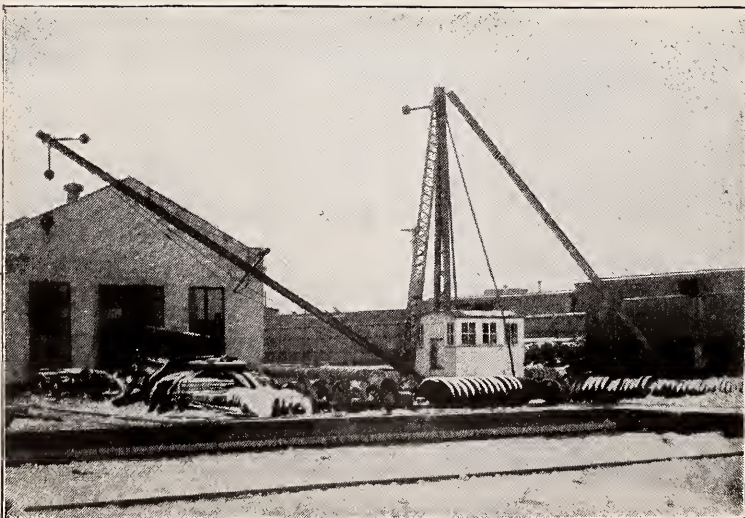


TRUCK WORK CORNER IN FREIGHT CAR SHOP.

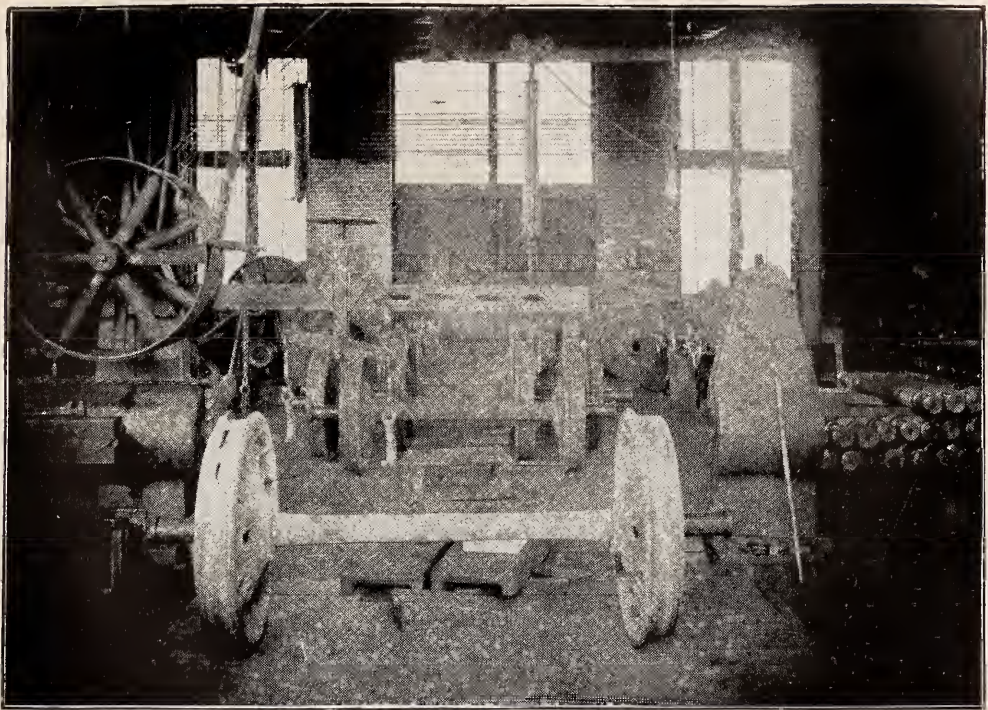
## TRUCK AND WHEEL WORK.

All heavy truck work, both for passenger and freight cars, is done on

two tracks in one end of the freight car shop. Over these tracks are two hand traveling cranes with 16-inch air hoists, used singly or together, to lift and turn over the truck frames. The wheels to be pressed off or turned are de-



THE ELECTRIC DERRICK.



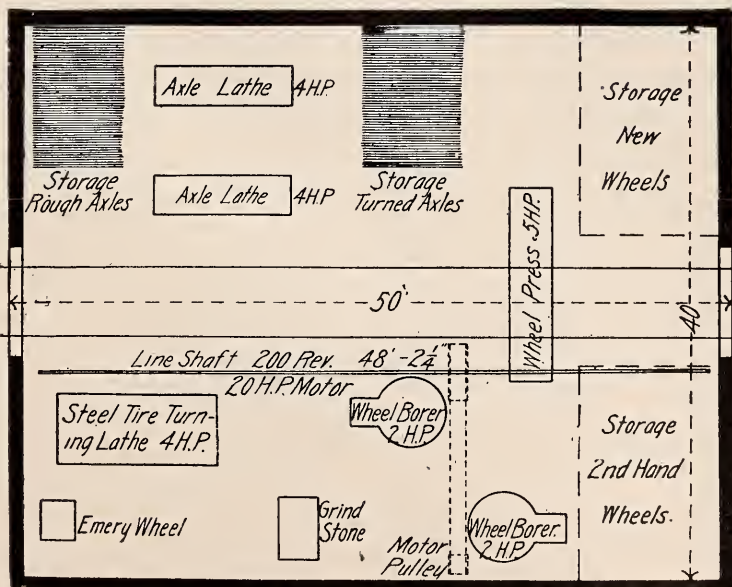
IN THE WHEEL HOUSE.

livered to the transfer table, to be taken to the wheel shop, while those to be replaced are rolled out on storage tracks through doors in the other side of the building.

In order to get adjoining space for storage of wheels and the use of the electric derrick, the wheel work is done in a separate building, across the transfer table from the main building, in which there are two axle

lathes, one car wheel lathe, two car wheel borers (driven by a 20 H. P. motor) and a hydraulic press.

The electric derrick, of five tons capacity (built by the American Hoist & Derrick Co., of St. Paul) is all of steel, the mast being supported by two stiff legs. The 50-foot boom is raised

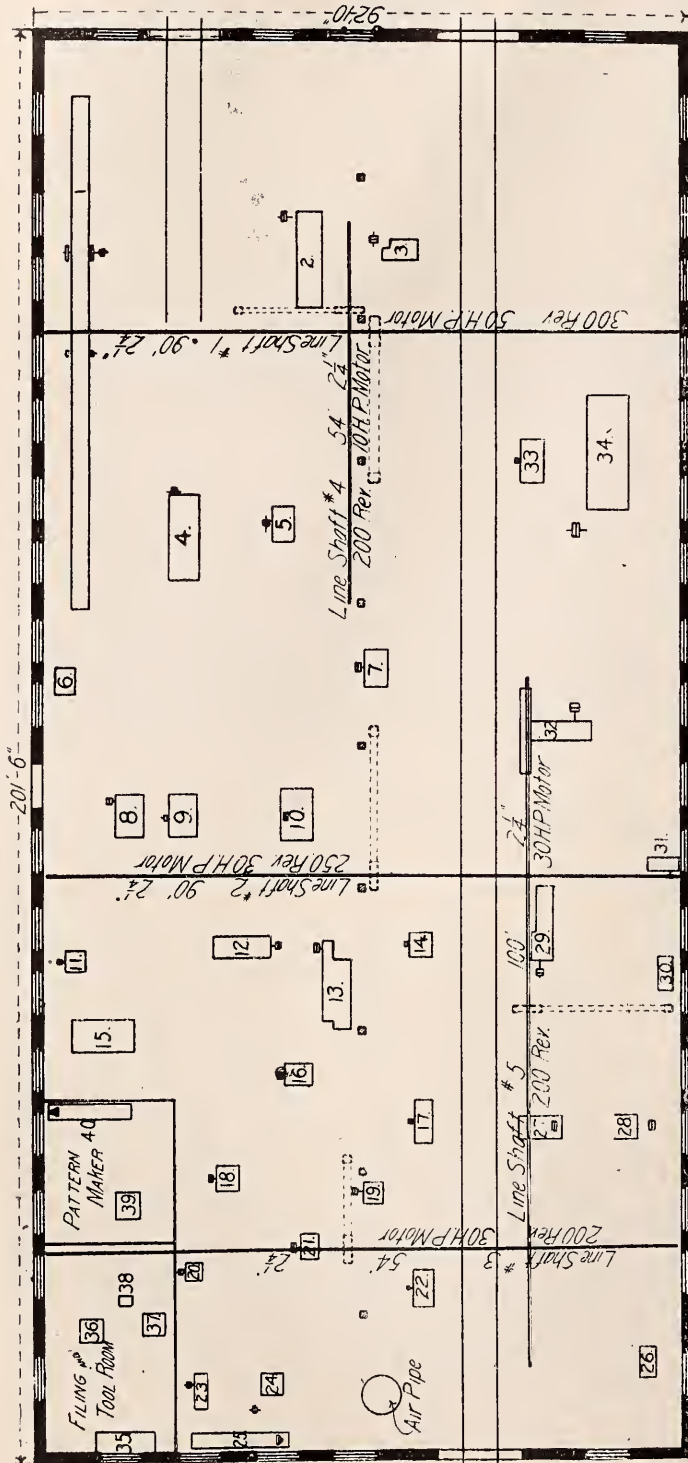


PLAN OF THE WHEEL HOUSE.

and swung by a 20 H. P. street railway motor, which is operated from a cab supported on the mast and swinging with it. The derrick serves the wheel yard, store house, platform, two unloading and loading tracks and, by means of push cars, the transfer table.

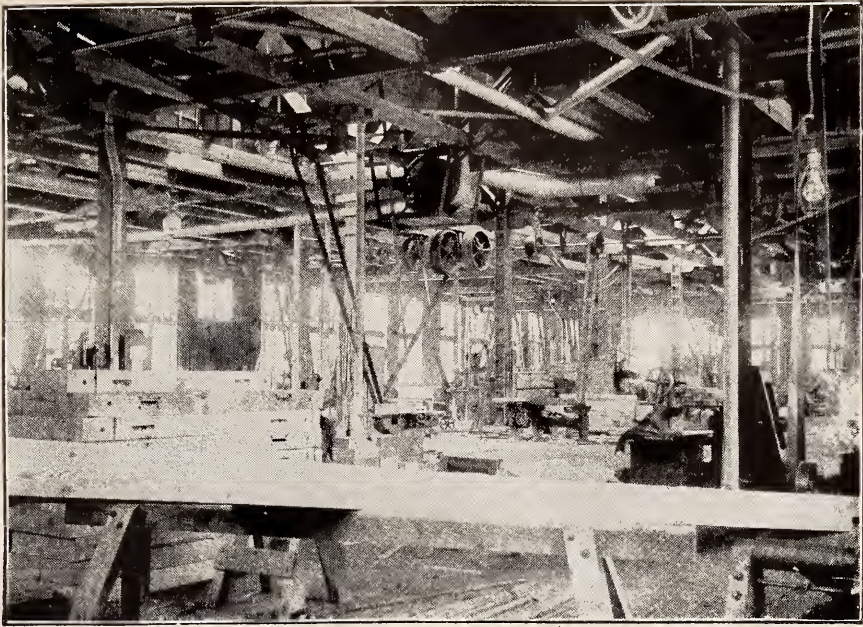
THE WOOD MILL.

The wood mill has its roof supported by Howe trusses with heavy purlins on lower chord. All motors, heating pipes and pipes for shaving



THE OELVEIN SHOPS—THE WOOD MILL.

- |    |                                |    |                                   |
|----|--------------------------------|----|-----------------------------------|
| 1  | Dimension planer, 25 h. p.     | 27 | Large mortiser, 4 h. p.           |
| 2  | Planer and matcher, 30 h. p.   | 28 | 5-spindle borer.                  |
| 3  | Cut-off saw, 10 h. p.          | 29 | Large tenoner, 15 h. p.           |
| 4  | Endless bed surfacer, 20 h. p. | 30 | Grindstone.                       |
| 5  | Vertical cut off saw, 10 h. p. | 31 | Cut-off saw, 7 h. p.              |
| 6  | Drill press.                   | 32 | Cross gainer, 15 h. p.            |
| 7  | Three spindle borer, 6 h. p.   | 33 | Large rip saw, 10 h. p.           |
| 8  | Pony planer, 2 h. p.           | 34 | Four side timber planer, 15 h. p. |
| 9  | Rip saw, 10 h. p.              | 35 | Band saw.                         |
| 10 | Band re-saw, 4 h. p.           | 36 | Saw grinder.                      |
| 11 | Scroll saw, 2 h. p.            | 37 | Grinder. 38 Grinder.              |
| 12 | Small tenoner, 3 h. p.         | 39 | Trimmer.                          |
| 13 | Moulder, 16 h. p.              | 40 | Wood lathe, 4 h. p.               |
| 14 | Small cut-off saw.             |    |                                   |
| 15 | Tenoner.                       |    |                                   |
| 16 | Sand paper machine, 4 h. p.    |    |                                   |
| 17 | Jointer, 8 h. p.               |    |                                   |
| 18 | Mortiser, 4 h. p.              |    |                                   |
| 19 | Small mortiser, 2 h. p.        |    |                                   |
| 20 | Dove tailer, 3 h. p.           |    |                                   |
| 21 | Band saw.                      |    |                                   |
| 22 | Small rip saw, 5 h. p.         |    |                                   |
| 23 | Blind stile mortiser, 2 h. p.  |    |                                   |
| 24 | Shaper.                        |    |                                   |
| 25 | Wood lathe, 5 h. p.            |    |                                   |
| 26 | Pipe cutter.                   |    |                                   |



A GLIMPSE INTO THE WOOD MILL.

collectors are above these purlins, so as to leave the space free underneath for shafting and belts. The Allington Curtis Company have installed a system of collectors that remove the dust and shavings from all machines and feed them to the boilers in the power house.

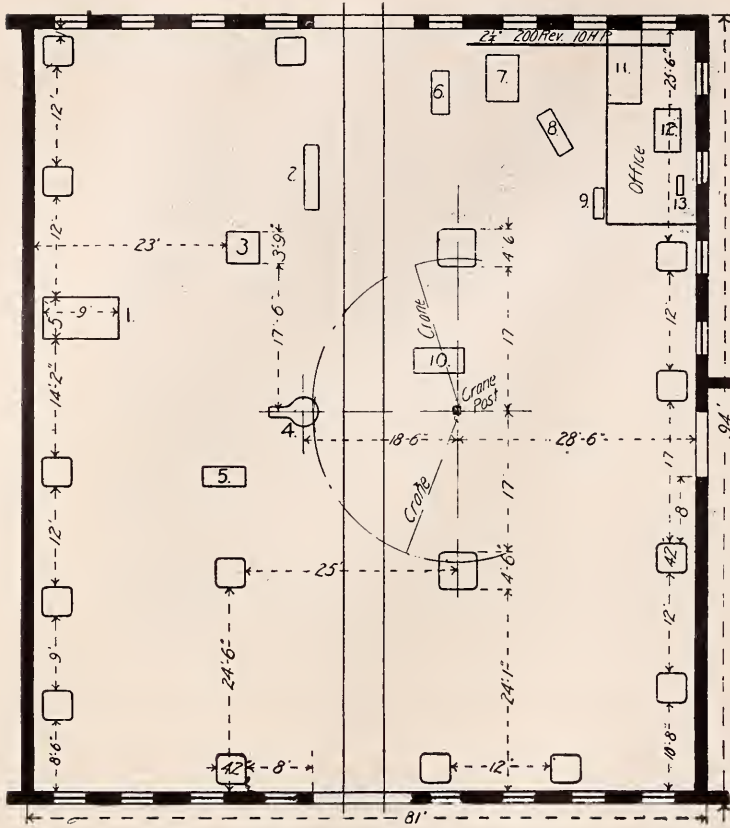
Each of the five shafts in the wood mill is driven by a separate motor, the advantages of this being very apparent in the absence of heavy belts and mule stands. The arrangement of the mill and the tools is shown on the plan.

The dry kiln receives its lumber on trucks which are transferred from a car of standard gauge operated on the regular yard tracks. The kiln is divided into three independent apartments for standard lengths, but doorways in the partitions allow of timbers 48 feet long being dried, extending along the rear of the three apartments.

The store house for finished lumber is placed so as to be between the mill and the shops, where it is used so that kiln-dried material can always be kept under cover without extra transportation. Provision for keeping this building heated, summer and winter, is described under "Heating." Finished lumber is trucked to the freight car shop on planked ways extending from the mill and store house along the south side of this building.

#### THE BLACKSMITH SHOP.

The blacksmith shop is equipped with down draft forges, with exhaust and blower connected by underground piping. It was equipped by the



PLAN OF THE BLACKSMITH SHOP.

- |                             |                                     |
|-----------------------------|-------------------------------------|
| 1 Spring furnace.           | 8 Furnace.                          |
| 2 Furnace.                  | 9 Grindstone.                       |
| 3 Small steam hammer,       | 10 Water vat, 6-ft. x 3-ft. x 3-ft. |
| 4 Large steam hammer.       | deep.                               |
| 5 Furnace.                  | 11 Exhaust fan.                     |
| 6 Shear and punch, 2½ h. p. | 12 Pressure fan.                    |
| 7 Bolt header.              | 13 Motor.                           |

Sturtevant Company. There are two "big fires" for heavy work and 14 other forges. The two large forges and the heavy steam hammer are served by a swinging crane and air hoist. There is a smaller steam hammer, an oil burning spring and case hardening furnace, and a punch and shear and 1½-inch forging machine driven from a single shaft by a 10 H. P. motor. The furnace serving the forging machine is of boiler plates, water jacketed, and burns coke. Special store rooms for bar iron and assorted scrap are placed in the rear of this shop.

THE PAINT SHOP.

Adjoining the blacksmith shop (and separated by a dead wall) is the paint shop, a room remarkably well lighted, both by windows and glass tiles in the roof, between the steel trusses. The floor is of brick, there being a pit under each of the five tracks. The brick walls are white-washed, and there is no inflammable material within reach of fire, excepting the window frames and doors. There is a separate mixing room, also as nearly fireproof as may be. Compressed air is used in the paint shop for cleaning and blowing out passenger equipment. Much of the freight car painting is done by compressed air.

THE OIL HOUSE.

The oil house has been previously described as a fireproof building, constructed entirely of brick and steel, with a tile roof. On the first floor are steel tanks, each holding a car load of the various kinds of oil

used, and storage rooms for waste and empty barrels. This floor, on the same level as the shops, is below that of the delivery tracks, so that oil is delivered from the tank cars by gravity. On the second floor, which is of the same level as the store house platform, are the shipping and storage rooms for barreled oil. The barrels are filled by means of air pressure, no pumps being used. The oil is allowed to flow into 50-gallon tanks placed below the large storage tanks, through a check valve, these small tanks then being emptied by the air pressure. The operator filling the barrels controls these operations by means of valves above the floor.

The lavatory is a two-story building; the first floor is provided with wash sinks, urinals, water closets, shower baths and lockers, and the second floor is one large and very handsome room, intended for use of the employes as a library and club room.

The entire grounds are enclosed with an 8-foot fence, there being a very pretty lodge house on the south side, where the gardener and gate-keeper live. The unoccupied part of the grounds, being well wooded, has been preserved as a park until needed for additions to the shops.

POWER, HEAT AND LIGHT.

The power house has a basement which connects by tunnels with the different shop buildings. These tunnels are used for the heating, compressed air and water pipes and electric wires.

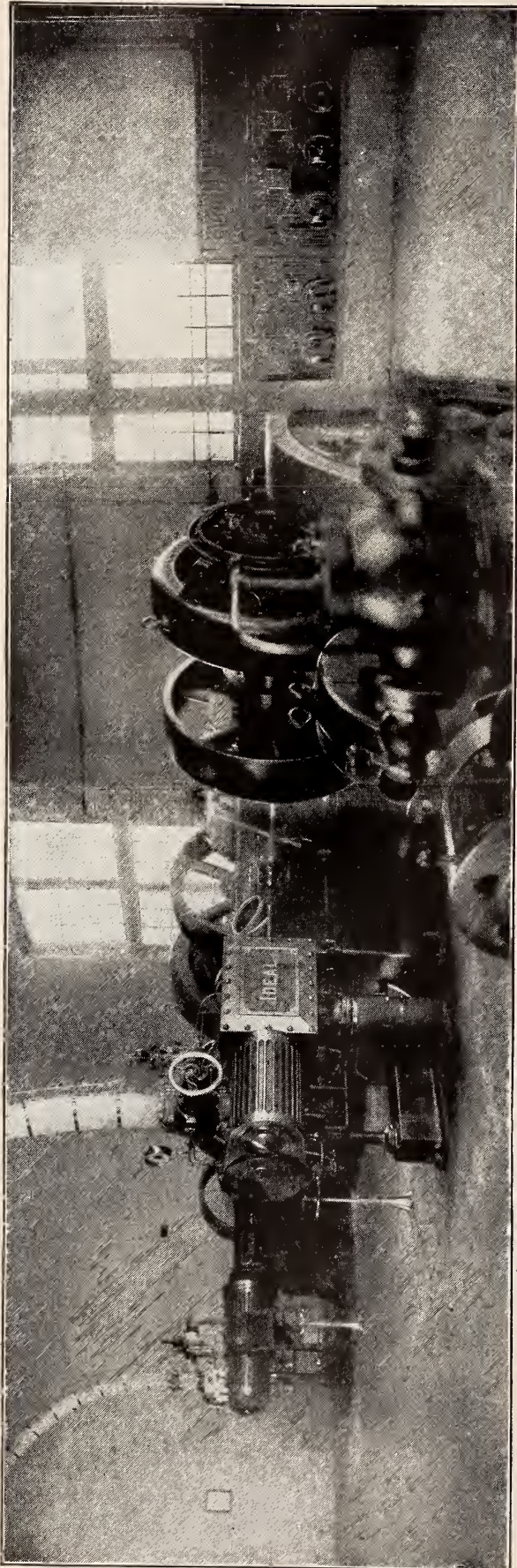
The power now furnished at Oelwein for shop and other purposes includes steam for two steam hammers, 100 to 125 H. P. used by the steam actuated air compressor, and for electrical energy as follows:

Average electrical horse power in winter (including heating fans but no lights).....	325
Maximum sustained load (including lights).....	450
Night load.....	65

The nominal capacity of the generators is 450 H. P., and there are 525 H. P. in motors, divided as follows:

		Mean Load.
Under continuous full load.....	65 H. P. (blowers and fans).....	65 H. P.
Under av. load of 60% (estimated).....	240 " (machinery).....	144 "
Under av. load of 25% ".....	145 " (elevators, cranes, hoists, etc.).....	36 "
Under full load in winter.....	75 " (heater fans).....	75 "
	<u>525 H. P.</u>	<u>320 H. P.</u>
44 arc lights.....	45 H. P. ....	45 H. P.
800 incandescent lights (50%).....	80 " .....	40 "
	<u>650 H. P.</u>	<u>405 H. P.</u>

It may be stated that the estimated percentages given above of the



THE OELWEIN SHOPS—GENERAL VIEW OF THE POWER HOUSE INTERIOR.

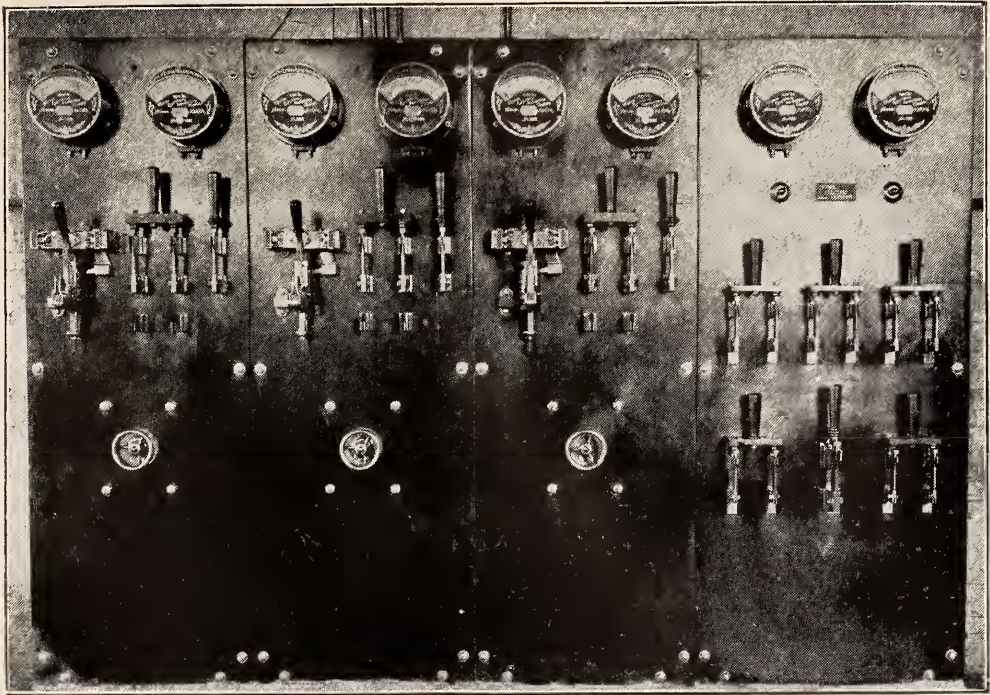
average load developed, were made before the plant was built. The sizes of the motors used are 3, 10, 15, 20, 40 and 60 H. P.

The steam required to heat the buildings will average 500 H. P. for over half the year, and a maximum of 750 H. P. in the coldest weather.

The possibilities of saving in labor by making the use of power convenient, is greater than any possible saving in the making of so small a quantity of power, especially when planned so that it is obtained for half the year from the steam required for heating.

The furnishing of power which can be most conveniently distributed requires the use of electricity and compressed air. The entire equipment for making and distributing heat, light, power and water to the various buildings and yards, was furnished by the Arnold Electric Power Station Company under a guarantee of certain results; results that could be obtained with standard machinery, operated under normal conditions.

The guarantee was as follows:



THE SWITCH BOARD IN THE POWER HOUSE.

“The contractor shall guarantee that the plant he installs shall consist of apparatus of design and capacity that will obtain the following results when operated under normal conditions, and that it shall be free from mechanical and structural defects.

I.

The generating of steam, for all the purposes specified, with an economy, when operated at 80 per cent of the greatest possible demand, equal to the evaporation of eight (8) pounds of water into steam containing not more than 3 per cent moisture, from and at  $212^{\circ}$  Fah. for each pound of lump coal consumed, containing 11,500 B. T. U., or its equivalent, with a draft of six-tenths of an inch at the base of the stack. The boilers shall be divided so that the failure of any one shall not decrease the maximum output more than  $33\frac{1}{3}$  per cent.

II.

The heating of the buildings as specified hereafter, utilizing for this purpose the exhaust steam from all sources (purified through grease extractors), and returning all water of condensation to the boilers, which, with all additional water necessary, shall be at a temperature of not less than  $200^{\circ}$  Fah. when entering the boilers.

III.

The generating of 300 kilowatts of electrical energy delivered at the switchboard for eighteen (18) hours per day, with provision for an increase of 375 K. W. for two hours and 450 K. W. for one hour.

The generators shall be in three units of equal size, and the engines and connections shall be so arranged that the failure of one engine or one generator will not reduce the maximum output more than  $33\frac{1}{3}$  per cent.

This electrical energy shall be generated with a total consumption of steam per kilowatt hour (including leakage, condensation and steam for back pressure and feed pumps) as follows:

When one generator is operated at full load, 48 pounds; at three-quarters load, 58 pounds; at one-half load, 80 pounds.



THE BOILER ROOM.

When two generators are operated by large engine at full load, 44 pounds; at three-quarters load, 54 pounds; at one-half load, 72 pounds.

#### IV.

The measuring and controlling of the current by proper instruments arranged to show voltage and current from each generator, and prevent automatically its overload; to distribute it by switches to various circuits; to so arrange its distribution that the lights may be least affected

by varying loads; to give proper information as to the probable duration of loads; and to convey the current to the lights and motors at an average loss not to exceed 5 per cent.

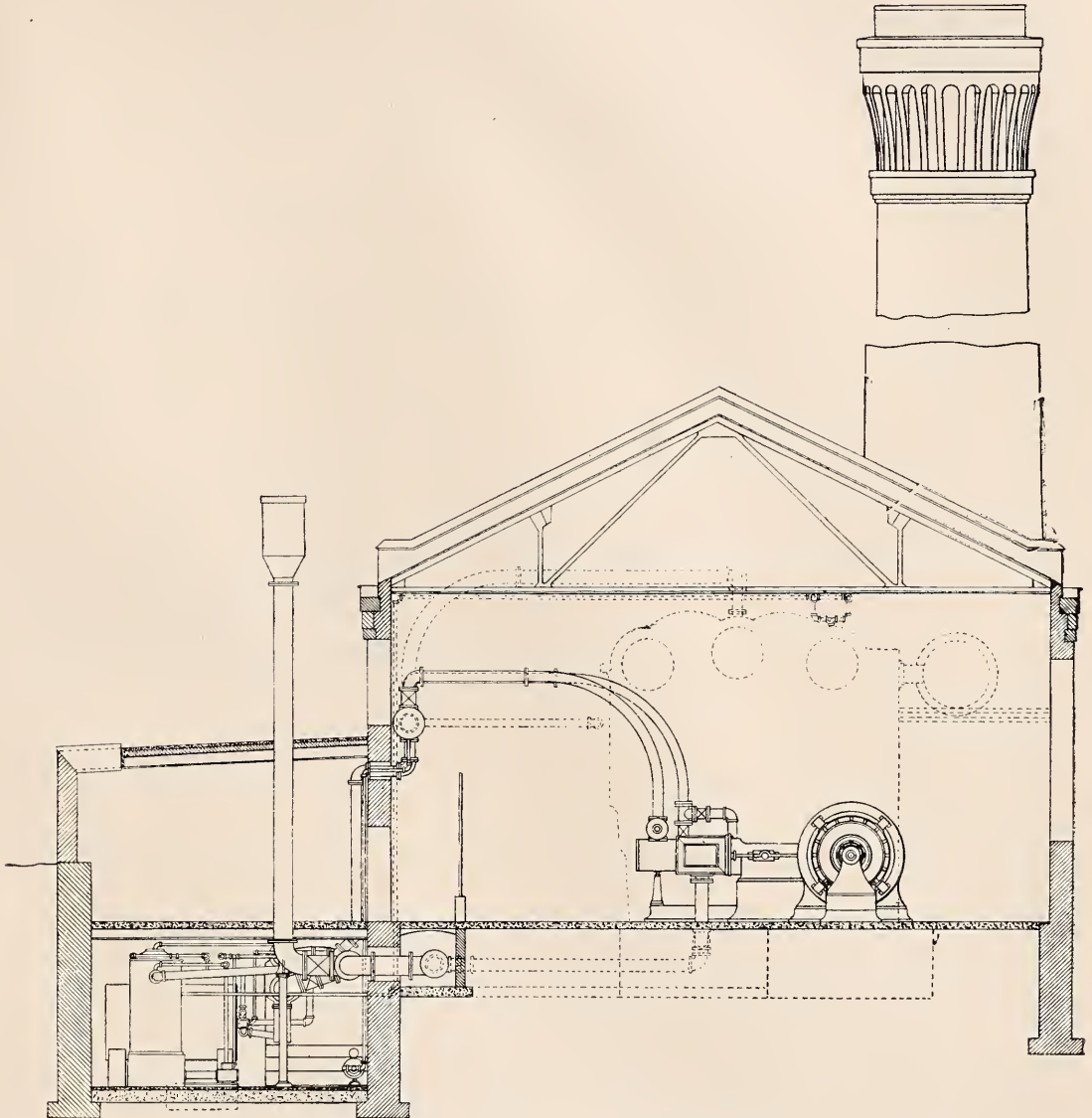
#### V.

The converting of a part of the electrical energy into motive power through motors that will furnish to their shaft the horse power specified for 18 hours per day, with an average efficiency for all sizes not less than 88 per cent with full load, 86 per cent three-quarters load, 83 per cent one-half load. The motors to be capable of carrying 25 per cent overload for two (2) hours without injury; and in starting be able to develop a power 50 per cent greater than rated capacity, and shall be provided with automatic cutouts that limit their overload to this amount.

The installing of electric lighting mains for fifty-one (51) 1200 C. P. arcs and six hundred (600) 16 C. P. 220 volt incandescent lamps, or their equal, located as specified hereafter.

## VI.

The compressing of five hundred (500) cubic feet of free air per minute and delivered to the mains at a pressure of one hundred (100) pounds, and distributing it as specified hereafter.



CROSS SECTION OF THE POWER HOUSE.

## VII.

The pumping of 10,000 gallons per hour from the well in power house into a 100,000 gallon tank to be located on the 80-foot tower provided therefor, and its distribution through the water mains as specified hereafter.

The providing of a fire pump that will fulfill the requirements of the National Board of Underwriters, and capable of delivering 1,000 gallons per minute, with 100 pounds pressure in the mains when there is a discharge through four lines of 500 feet each, of 2 1/2-inch hose and 1 1/2-inch smooth nozzles.

Providing an electrically driven pump in round house capable of maintaining a pressure of 100 pounds with a discharge through fifty (50) feet of 2 1/2-inch hose and 5/8-inch nozzle.

#### VIII.

To provide a drying apparatus for lumber kiln capable of drying 30,000 feet of lumber at a time."

In connection with this abstract from the specifications, the conditions which determined the provisions are worthy of note. The low cost of fuel, on account of the use of locomotive coal and the burning of the wood mill refuse, limited the requirements in regard to the efficiency performance of the boilers and engines, while the fact that the exhaust steam could be utilized for heating purposes for five months of the year, determined that the extra cost of condensers and water cooling equipment would not be a good investment.

Electricity was naturally selected as the power transmitting agency for most of the work, and the 220 volt direct current was adopted, as it allowed the use of standard lamps and apparatus, while the copper required for the distributing mains at this potential did not require too great an original outlay. For some purposes, such as the pneumatic tools and air lifts, compressed air is desirable, which accounts for the air compressor system.

The various makes of apparatus selected to carry out the provisions of the contract were as follows :

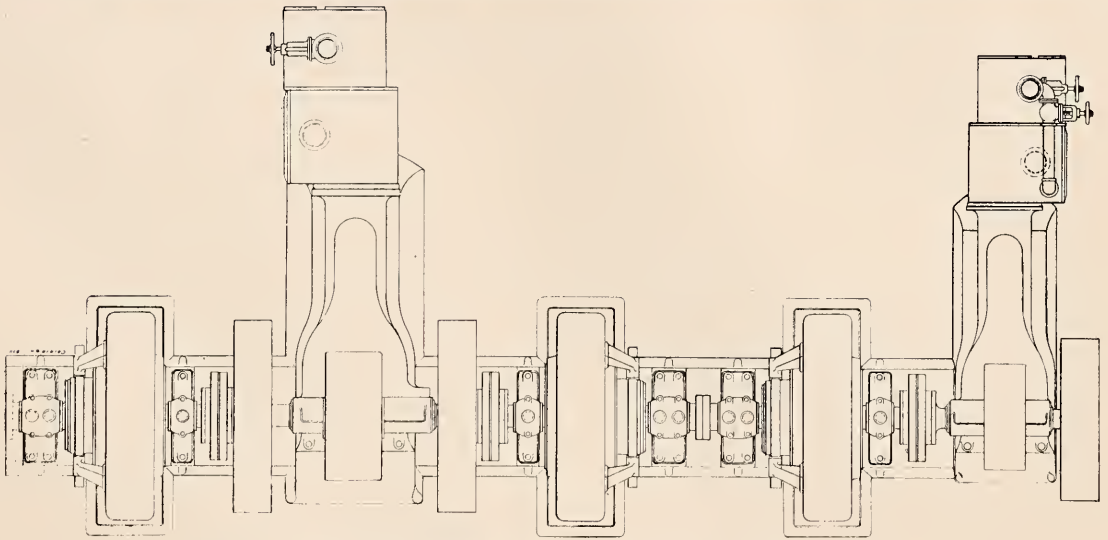
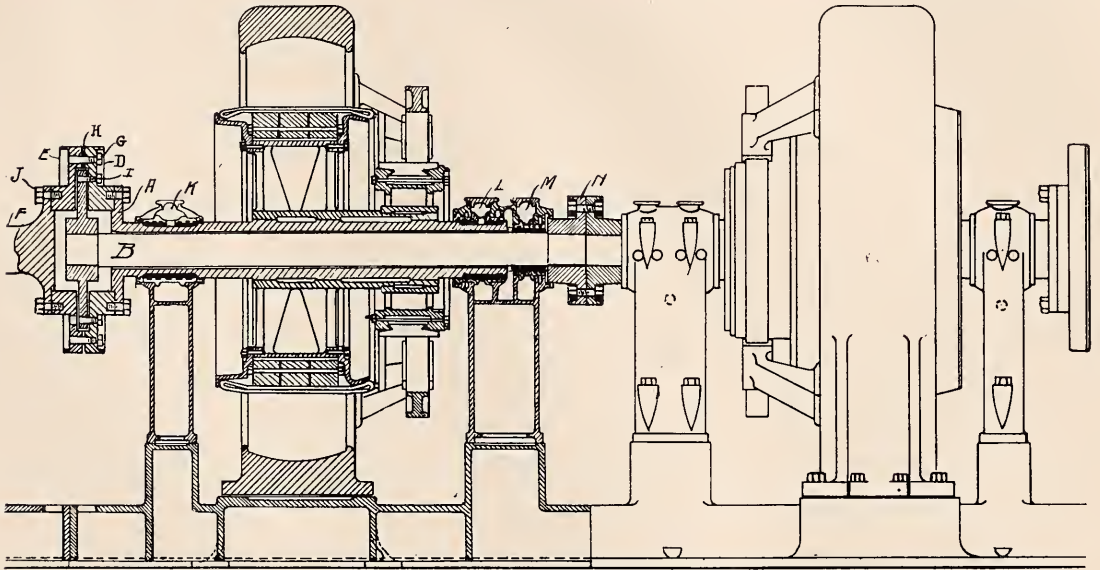
Three high pressure water tube boilers, made by the Stirling Company, were installed.

The heating of the main building (except store), the freight car shop, wood mill and lumber store, is accomplished by the Sturtevant fan system. All other buildings are heated by direct radiation. For the fan system there are two 25 horsepower motors operating blowers in the machine shop. These motors are connected so that they can be run in series when the weather is mild, thus cutting the speed down and materially reducing the amount of air moved and the power required. A similar arrangement is carried out in the electrical connections of the two 10 H. P. blower motors in the wood mill and freight car shop. The vacuum system of the Western Paul Company has been installed, in order to remove the back pressure from the engine during the heating period.

The three 100 K.W. generators and all the motors, with the exception of those on the crane and transfer table, were furnished by the Crocker-Wheeler Company, of Ampere, N. J.

The two engines are tandem compound of the Ideal type, running at

250 R.P.M., and were built by A. L. Ide & Son, of Springfield, Ill. One engine has an economical capacity sufficient to drive two of the generators, while the other engine is one-half this size. The latter engine, however, is provided with an auxiliary steam connection which allows live steam to be introduced into the low pressure cylinder through a reducing valve, thus furnishing a means of carrying an overload of 100 per cent



THE ARNOLD SYSTEM OF CONNECTING GENERATORS.

in case of emergency, all the parts having been designed for this extra strain.

That part of the guarantee which specifies that the failure of one engine or generator will not reduce the maximum output more than  $33\frac{1}{3}$  per cent was fulfilled by connecting the engines and generators by means of the Arnold system. This system mounts the generators upon hollow quills and provides a solid interconnecting shaft in such a way that

each generator can be operated by more than one engine. Thus, if the large engine should become crippled, the small engine could still operate two generators by taking advantage of the extra steam connection already described, while, if any one of the generators or the small engine should become disabled, the large engine would still be in position to drive the other two generators. This arrangement secures the specified reliability without an excessive investment in reserve machinery, and without requiring floor space, foundations and piping for an extra independent unit.

The switchboard is of highly polished enameled slate. As usual, each generator is provided with a panel, and an extra feeder panel is added for the circuit switches, the three upper switches controlling the power mains and the two lower double pole switches connecting the lighting circuits. The single pole switches on the feeder panel are for the purpose of connecting the power and light bus bars, so that both classes of service can be operated from one generator if desired. A unique feature of this board is that it has but three bus bars, a common negative bar doing duty for both the power and the lights.

The air compressor was furnished by the Norwalk Iron Works Company, of South Norwalk, Conn., and the electrically driven deep well pump by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio.

The piping for the heating system was put in place by George Morton, of St. Paul, who was sub-contractor for the heating. The electrical construction work was done by the Mutual Electric Company, of Chicago.

The feed water pumps, the return tank for the heating system and the Cochrane feed water heater are placed in the basement under the coal storage bins. The coal is unloaded directly from the cars into the coal room, which is within easy reach of the firing space in front of the boilers, making coal handling machinery unnecessary.

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## COMMUNICATION.

### THE ECONOMY OF PISTON VALVES.

BUFFALO, N. Y., Feb. 16, 1900.

*To the Editor of the Railway Master Mechanic:*

I have read with interest the two articles entitled, "The Rehabilitation of the Piston Valve," in your late numbers, and I do not think the full amount of economy is laid out in them. Would it not be feasible to increase the life of these valves by chilling them, or, if cast of ordinary

gray iron, by heating them and dipping in water? This procedure will make some grades of gray iron quite hard. Then fit the valves on a grinding machine, instead of a lathe. Then, if a variation is allowed in size, the valve, when too much worn for its place, may be re-ground and fitted for use in another engine. In this way the cost of the keeping up of the valves will be mostly the labor; the cost of one casting serving for a dozen or twenty usages.

GEO. B. SNOW.

## THE CAR FOREMEN'S ASSOCIATION OF CHICAGO.

### FEBRUARY MEETING.

The regular meeting of the Car Foremen's Association of Chicago, was held in the rooms of the Western Society of Engineers, 1741 Monadnock Building, Chicago, February 8, 1900.

President Morris called the meeting to order at 8:00 p. m. Among those present were:

Bush, S. P.	Groobey, G.	Manchester, A. E.	Saum, G. N.
Bates, G. M.	Hansen, A. P.	Marsh, Hugh	Swift, C. E.
Blohm, Theo.	Jones, A. A.	Morris, T. R.	Schutt, W. F.
Cardwell, J. R.	Jones, R. R.	Miller, Wm.	Schultz, F. C.
Callahan, J. P.	Kroff, F. C.	Mercatoris, M.	Smith, E. B.
Depue, J.	Kamen, Fred.	McAlpine, A. R.	Stagg, C. S.
Deen, C.	Kline, Aaron	Miner, W. H.	Thomson, Geo.
Grieb, J. C.	Kuhlman, H. V.	Olsen, L.	Wentsel, Geo.
Gilman, C. R.	Longfellow, Fred.	Roy, D. G.	Wensley, W. H.
Guthenberg, B.	La Rue, H.	Schmeckpiper, R.	

Secretary Kline reported the following new members: John Bates, A. R. T. Co.; Chas. Schumacher, Standard Oil Co.; W. B. Hall, Mather Stock Car Co.

He also reported that he had received a letter from the Car Foremen's Association of Cleveland, Ohio, asking for information in regard to the Chicago organization, and a similar letter from the chief joint car inspector at East St. Louis, in which it was stated that it was the intention to form a Car Foremen's Association at that place. He had answered each party fully, and explained that this made three communications received from other towns asking for information about the Chicago Association. He considered it flattering to know that this association had attained such prominence, and was meeting with such good success that other associations wish to pattern after it.

The Committee on Resolutions on the death of Mr. W. O. Davies, Sr., handed in the following report:

*To the Members of the Car Foremen's Association:*

Your committee, appointed to present resolutions upon the death of Mr. W. O. Davies, Sr., beg leave to present the following:

*Resolved,* That in the death of Mr. Davies we have all lost a friend; one whom we have all trusted, and one whom his business associates held in the highest esteem. That the car department interests of Chicago, and the Chicago, Milwaukee & St. Paul Railway, in particular, have lost one who has been prominently identified with their management.

*Resolved,* That the Car Foremen's Association of Chicago, realizing their loss, do

hereby tender to the family of Mr. Davies its sincerest sympathy in their bereavement; and be it further

*Resolved,* That a copy of these resolutions be presented to the family of our late member, and spread upon the records of the Association.

T. R. MORRIS,  
W. M. MILLER,  
E. HEDRICK.

Upon motion of Mr. Cardwell, it was ordered that the report be accepted and printed in the RAILWAY MASTER MECHANIC, and that a copy be furnished to the family of the late Mr. Davies.

### UNCOUPLING DEVICES.

The discussion of Mr. Groobey's paper, which was presented at the last meeting, was then commenced.

Mr. Groobey: I believe it is customary for one presenting a paper of this description to open the discussion. I would rather wait, however, until the discussion takes some definite line. In my paper I made certain statements, and if the members here tonight cannot corroborate what I have said, I want them to get up and criticise freely. If they will do this, we will, without doubt, succeed in finding out what causes these defects to exist, and then we can devote our energies to finding a remedy. I think we will all agree, however, that it is necessary that something be done to get the full benefit of the undoubted superiority of the M. C. B. coupler. The statements that I have made in my paper are, I believe, in the main true; but if the wider experience of any gentleman here shall result in showing me to be right or wrong, I shall cheerfully agree and believe the object of the paper has been accomplished. The present defects we all know to be of a serious character and numerous.

Mr. Deen: Since our last meeting I have been watching this thing pretty closely. I find a great many railway cars—private line cars, too—running with lifting levers not operative; on some of them the chain is too long, and won't unlock at all; on others I find in the rear end attachments 7-inch springs where there should be 8-inch. There are a great many defects that a person can find in looking over the coupler.

Mr. Bush: My attention has been called to this matter by our general manager, who handed to me the report of the Interstate Commerce Commission. You are aware that since it became a law to equip cars with automatic couplers the time has been twice extended, and it seems in their endeavor to ascertain whether the law has been complied with in that respect, that they have taken up this very defect—calling the attention of the railway companies to the defects in uncoupling devices, as well as other defects. But the report announces that the defects in uncoupling devices constitute a major portion of the whole defects. Now, I think that nearly all of the railways, at least, realize that it is an important thing, and that the difficulty must be overcome as best they can. There are a good many things that stand in the way, one of which is, possibly, inherent defects in some of the couplers themselves. Some of the couplers require a rather awkward form of uncoupling device and, owing to that fact, it becomes almost impossible to apply anything substantial in the way of a bracket to support the uncoupling rod. Now, so far as our road is concerned, we are going to do the best we can. Our cars are entirely equipped, and we are going to take the equipment as it is and try to keep it in as good condition as possible; but I can see, at least I think I can see, that we have got to make some changes, possibly, in the design of the uncoupling apparatus. Now, what I would like to know from you gentlemen that are in daily contact with this work is, in what direction those changes should be made. I have not read Mr. Groobey's report through; I don't know whether he undertakes to provide remedies for these difficulties or not. But that certainly is one of the things we would like to know—how to provide remedies.

President Morris: Mr. Kroff, from an inspector's point of view, what do you think of this?

Mr. Kroff: I have looked into the matter, since the last meeting, and I find there are a great many conditions which cause these defects. In the first place, I do not think the spring is stiff enough at the rear end to take up the slack. Take the Pennsylvania cars. We have a good overhead-keeper fastened with four big bolts; two  $1\frac{1}{8}$ -inch and two  $\frac{7}{8}$ -inch bolts. I find that when a switchman unlocks the coupler, that the bracket being about two inches from the end sill will have a tendency to shorten the slack of the chain and bend the uncoupling rod. If you have your uncoupling lever open, so coupler is unlocked, there is a stress upon the chain, and consequently the weakest point will give, which I think is the lever. I tried one of our levers, that was made of inch round iron, and I could bend it simply by jerking on it,—which the switchmen often do in uncoupling cars. I would suggest that levers be made out of  $1\frac{1}{8}$ -inch iron. I think that is one of the main causes of the apparatus being out of order.

Mr. Bush: You will excuse me if I do a great deal of talking on this particular subject, but this gentleman speaks of the Pennsylvania cars. I have just come from the Pennsylvania; and he has brought up two or three points now that are interesting. He speaks of that being a very substantial gear. Now that was put on there to be safe. It is very expensive, and it is a question in my mind whether the railway is going to get any benefit from it. It is the most expensive gear in the market. They did it with this object in view. They wanted that unlocking apparatus, the overhead-keeper, the bracket, the rod and the chain to be strong enough so that if the coupler parted they would be strong enough to lift the pin out of the Janney coupler. The Pennsylvania uses the Janney coupler. That is the reason why they made it so expensive and strong. Now, I will say this; that that will not always pull the pin. Sometimes the pin sticks so hard that it will pull that bracket—will tear the end sill—the piece will pull out.

Mr. Kroff: I have never found the bracket torn off. About 75 per cent will not uncouple properly because the levers are bent, and the chain will not lift lock high enough. And now the question is, Should we provide a chain heavy enough to stand that? Should we provide a keeper heavy enough to stand it? A rod heavy enough to stand it? I think we should, for this reason: If your center from the lock to the uncoupling lever is 8 inches, and your lock is stationary, what will it do if you allow slack in the overhead-keeper, or the frame for the overhead-keeper droops and the drawbar droops down? This will change the center. I think you dare not change that center. You have got to allow slack. I would prefer the Pennsylvania cars to have a slotted locking pin; that is, the top to be slotted so as to allow slack for the drawbar. We will say, for example that the switchman is shoving a train of cars back into the yard, and he says "Cut off ten," and his helper makes a cut of 10 cars, and he still shoves them into the yard. Now, in doing that he will shove the bracket up to the end sill, and that makes a stress upon that center. The center has not sufficient slack to carry that bracket back to the end sill. Now, for that reason, I would prefer a slot in there, so as to give it a chance to move back and forward. Then I would make the locking pin  $1\frac{1}{2}$  inches longer, so at no time there would be stress upon that lever or the chain or the lock; that is, I would allow the locking pin to be long enough so the drawbar could droop down and still unlock. But I do think the levers ought to be  $1\frac{1}{8}$ -inch, because I can bend an inch lever. I find a good many levers on Pennsylvania cars that are bent, and the majority of them are bent from those defects—from uncoupling levers being too weak and the slack in the drawbar.

Mr. Bush: I would like to ask the gentleman if he thinks the overhead-keepers should be fastened with lag screws?

Mr. Kroff: No sir, I don't; for the simple reason that half the time they are not put in properly. And take those that are put on with lag screws, they are frequently lying on the head of the coupler; they are never where they should be.

Mr. Bates: I have noticed in the past month or so that there are quite a number of those defects existing. But it seems to me that they are not properly looked after. It seems to me that, as it is everybody's duty to repair them, nobody takes the trouble to do the work. In my opinion this condition is going to exist until special men are delegated to do that work only. I think if that were done it would hardly be necessary to put on big heavy lifting rods to weight car down. I think they could be kept in shape just as well by having lighter ones if properly looked after.

President Morris: Are you satisfied, Mr. Bates, with the chains that are in general use?

Mr. Bates: A great many of them are too light, but generally they are heavy enough. They get broken, as Mr. Kroff says, when switchmen cut off cars. They fasten the levers up, and when they strike another car it always bends the lever.

President Morris: Don't you think that could be overcome?

Mr. Bates: Not unless there could be a lockset to coupler. I believe some roads have it.

Mr. Kroff: I don't see how you could have a coupler with a lockset that will allow you to shove the cars back into the yard and make a cut off without following up the car. I think the switchmen want a coupler to be unlocked when it is unlocked. I don't think that the coupling arrangement ought to be that way.

Mr. Jones: The most defects I find are the chain or the clevises. You put in a  $\frac{3}{8}$ -inch clevis pin; some stick a nail through it and bend it over; the first thing you know the pin is out and the clevis no good. Oftentimes the chain is too light. The lever seems to be satisfactory enough.

Mr. Bates: The great trouble with too long chains is that when a fellow gets a broken chain he puts in a split link or two. Of course nobody knows who did the job. If one man was delegated to do that work, you would know who to hold responsible for such bad work, and in that way you could cut down these defects considerably.

Mr. Manchester: We have some couplers in use in which the locking device is never set. The pulling of the lever uncouples and at the same time leaves it, as a gentleman said, like a door, to lock again; and that would seem to be a very desirable remedy for the trouble if all the locking devices could be worked in that way. The fact that the lever is hung up and locked, must of itself be quite an annoyance to switchmen where they have to follow the car along and let the lever down again before it is in position to couple. The question of making this device so strong that nothing can occur to it—that it won't break in any ordinary work, or won't bend, seems to me is going to be quite a difficult problem. Now the electric light people would overcome a difficulty like that by putting in a fuse, and when you had pulled so hard, out would go the fuse and you would have to quit pulling. How would that work with a coupler? Would not that save a whole lot of defects that now occur in our coupler devices? I can see plainly that what the gentleman said about rods bending is a fact. A switchman comes along and the strain is on the pin and he is going to uncouple the car if he can. He wants to uncouple pretty bad, right then and there, and I don't know that he would not bend the rod if it was a good deal heavier. They would carry clubs with them and use them like they did on the old hand brakes. If a brake didn't set quite hard enough, they would put in a club and screw the brake up with it. That gave them a great deal longer leverage. I imagine that the first thing we know, in making our lifting levers strong enough so we can't bend them, the switchmen will be coming around with a piece of gas pipe and raise it up if possible.

Mr. Marsh: In my opinion a lifting lever is strong enough when made of inch round iron. That should stand any strain. It is sometimes a matter of negligence or carelessness on the part of the men who make repairs. As we all know, each coupler has its own standard, and if those standards are maintained, there will be no trouble; but if you put in anything heavy enough to pull the train you don't need any coupler.

Mr. Kroff: I would like to say this for the Pennsylvania Company: I know the Pennsylvania has spent many a dollar trying to get the thing to work all right. I know that they have changed five or six different times since I have been with the company, and they haven't got it yet. When a switchman is weighing cars he has to uncouple them, and if there is a little strain on the lock he gives it a jerk, and this is bound to bend the lever. So every time a car is cut, if you bend the lever a thirty-second of an inch, how long will it take to bend it so the unlocking device would not unlock after you had it up in position? I have tried it myself, and know that they can be bent, and that is why I say they are not strong enough.

Mr. Mercatoris: I think a 1-inch rod is heavy enough for a lifting lever. A man that can bend an inch rod can bend an inch and an eighth rod, and there is not one man in ten that can bend an unlocking lever. We do not bend many of them; we don't have much trouble.

Mr. Longfellow: I think our appliances are plenty heavy enough; but a great deal is in keeping them in repair. I know a great many times when reports reach me, or when I am on a train riding over the road, the trainmen will say a certain car didn't uncouple, or it has uncoupled in a train, and ask me to come forward and look at it. I invariably find that the keeper is out of place or the casting bent. I don't think I have ever found a lifting rod bent, unless where it has been struck by timbers, rails, or something projecting from another car. I have found a great deal of trouble from a source that does not appear to have been mentioned here tonight, and that is our locking pin and knuckle pin being bent. There is a great deal of trouble arising from that. I have noticed that one of the members of this Association has suggested that the parts be oiled occasionally. I know that to be a good thing. On the line of cars running out of Stone City I tried that on the knuckle pins, and I don't know that we ever had a case of a bent knuckle pin on a car that was oiled, running in and out of that place.

Mr. Cardwell: I think that lag screws, if used as lag screws and not as nails, are all right. But in observing the men constructing some new cars, recently, when the foreman was absent (I suppose it was piece work) I noticed that the lag screws were not screwed in but driven in.

Mr. Groobey: The inspector for the Interstate Commerce Commission says that in his opinion 25 per cent of the cars inspected had defective uncoupling devices. While he was out on this particular business he found 1,266 defective cars. That would mean that he inspected 5,000 cars, and that he found one-fourth of them defective. Out of the total number of defects he found 546 broken chains. This is the principal defect. Now, if we admit that his inspection was in the main correct, why does this form the principal defect? There are a good many reasons why chains should break. It may be due to the diameter of the iron used, and, if this is so, we should arrive at some standard size. Mr. Kroff speaks of drawbar springs being responsible for a great many broken chains. A drawbar spring should have a certain compression, and travel just so far, and in adjusting our uncoupling device we should know how far that spring will travel. That is going to help us. Very often the same kind of a spring is not applied; very often an old spring, with all of its elasticity gone, is applied. This has some bearing on broken chains. It is quite easily understood that if we have a certain sweep, and anything is done to alter that sweep, the chain is going to be too short or too long. If the chain is too long, it won't do anything at all; if the chain is too short, it is going to break under a certain strain when the train is going up grade and the spring is compressed. My idea is not to use chains at all. I should like to suggest a remedy but, unfortunately, the rules of the Association won't allow it. Under another head we have "rods bent," 77 out of 1,266. How far this goes to substantiate Mr. Kroff, I do not know. Possibly some of these rods have been bent by overhanging loads or by poleing. Referring to loose castings, the inspector says he only noted those that were very loose. From my experience (and I am always watching closely when I am

around railroad tracks) I would not object to saying that 75 per cent of the castings are loose, and it is safe to say that one-third are very loose.

Mr. Bush: How large in diameter should a chain be made?

Mr. Groobey: A  $\frac{1}{2}$ -inch chain ought to do the work; if it won't we ought to turn to something else.

Mr. Kroff: I would like to know how many roads apply their overhead-keepers with bolts. I would like to hear from some of the members whether they use bolts or lag screws, and then we will get at the lever business.

Mr. Mercatoris: Our equipment is applied with bolts—about 60 per cent of them. I don't think there is any standard. We have cars running over every line in the country, and it seems every line shoves off its old stuff onto us. I think that most of the lag screws are driven in with sledge hammers.

Mr. Jones: Our castings are applied with lag screws.

President Morris: Do your castings become loose?

Mr. Jones: Very few. Most of our work is piece work and we have to watch the men close or they will put them in with a hammer. It takes too long to screw them in. We use  $\frac{1}{2}$ -inch chain.

Mr. Bates: We use lag screws when applying our castings, and we use a three-eighths chain.

Mr. La Rue: One of the first speakers stated that his keepers were fastened with bolts and that they are always loose. Now I will say that ours are fastened with lag screws and they are not always loose. If you fasten your keeper with bolts, how are you going to bolt it, and always have it tight, with the shrinkage on a new car? I think that an inch rod is heavy enough, because if the switchman finds there is an inch and an eighth rod on there, he is going to uncouple with a gas pipe, as Mr. Manchester says. We use a three-eighths chain; and for all ordinary purposes I would think that with a coupler that would not uncouple with a three-eighths chain there is something else wrong. The opinion has been given out tonight that only those lag screws that are put in by piece work are driven in. I beg leave to differ. It is inborn, I think, in most of the mechanical men of the country, to drive the lag screws in, no matter whether they are working by piece work or day work.

Mr. Kroff: I think I will agree with the rest of the gentlemen. So long as the overhead keeper is secured with lag screws, an inch rod is strong enough; but when you make your overhead-keeper strong enough to do the work, your inch rod is too light. The gentleman says that 60 per cent of the Erie's keepers are put on with bolts; the other percentage is put on with lag screws. Then I say the lever is strong enough.

Mr. Deen: I will venture to say that on 75 per cent of the cars we handle in the yards—and there are a great many during the month—the keepers are put on with lag screws, and 50 per cent with  $3\frac{1}{2}$ -inch lag screws.

Mr. Wensley: Two or three years ago I was putting on some castings and using  $3\frac{1}{4} \times \frac{1}{2}$ -inch lag screws, and a monkey wrench to do it with. The master mechanic came along and said, "Do you know what that is you have in your hand?" I answered, "Yes, sir." He said, "What is it?" I said, "A monkey wrench." He asked, "What do you use it for?" I replied, "To put on lag screws." "That is not what it is for," he said. I asked, "What is it for?" "To take them out with," he replied.

#### LABOR CHARGE FOR RENEWING DRAFT TIMBER BOLTS.

President Morris: If there is no further discussion on this, we will pass to the second subject—"How much labor should be charged for renewing a complete set of draft timber bolts at one end of car, when all the bolts are broken and draft timber is down?"

Mr. Grieb: On the face of it, it seems to me that the question as propounded in the program is very simple and one that ought to answer itself by reference to the M. C. B. rules

which govern on this point. I should judge from the fact that this question has been brought before the Association, that some one has had experience somewhat similar to ours in receiving bills. When they find the bolts broken and the draft timber down, instead of confining themselves to the charge of three hours for replacing all bolts, somehow or other, through some course of reasoning that is not entirely clear to me, they make it six hours. I asked one of the gentlemen present this evening, who represents a large western road, what his practice is. His idea seemed to agree with mine, but strange to say I have a bill from that same road in my pocket, in which, instead of charging two hours for renewing three bolts they have charged six. The bill is composed entirely of charges of this kind; they are all from three to five hours in excess of what we think is right. If there is anybody who can possibly defend such action it would be interesting to hear from him.

Mr. Jones: When we apply draft timbers, when bolts are broken and draft timbers down, we merely charge for the bolts alone.

Mr. Bates: I think the question is settled by the rules. Three hours is all that can be charged, in my opinion, for removing a complete set of draft timber bolts at one end of car.

Mr. Mercatoris: The rules define it very plainly; three hours is all that can be charged. I don't see how they could charge five hours.

Mr. Bush: It seems to me that it is barely possible that the rules may have been misconstrued in this way: That replacing a draft timber may, to one, mean putting up a new draft timber, and, to another, the replacing of the old draft timber. Of course, there is a very great difference there. I imagine that it is the intention of the rules, when referring to replacing draft timbers, to mean *renewing* draft timbers. I may be wrong in that. Where new bolts are applied it has got to come under the head of replacing draft timber bolts. Probably some confusion has arisen; but I think the rules contemplate putting up new draft timbers.

Mr. Bates: Were those draft timbers down at the back end; down on the axle and the bolts all broken?

President Morris: The draft timbers were not damaged; the only thing to do was to put them up, I believe.

Mr. Bates: In that case I think three hours ought to be sufficient.

Mr. Deen: I think three hours is all that should be charged for putting up the draft timbers and putting in the bolts.

President Morris: Have any of the members had any experience similar to that which Mr. Grieb describes, in being charged six hours?

Mr. Cardwell: I have been charged six hours, and five hours, and I never questioned the bills, because I have been in the yard time and again when old draft timbers have been taken down on freight cars to replace the bolts, and in many instances it has required a great deal more time to take out the old bolts which are broken, twisted and rusted in the wood than to put up new draft timbers altogether. But under our present rules, three hours is all that should be charged, because the rules simply say so. Whether the rules should be modified or not, I am not able to say.

Mr. LaRue: I am of the same opinion. It is very often the case that three hours does not nearly cover the time for replacing bolts in old draft timbers at one end of car. But, then, between man and man, between railroad companies, as Mr. Blaine used to say, "there is reciprocity in it," and we all get even in the end, except the private car lines.

Mr. Grieb: It seems to me that we are all of one opinion; nobody, it seems, will take the other side. If the understanding which the Association has this evening were general, this point would never be raised.

Mr. LaRue: I do not think there is any other side to the question. The rules say three hours, and that settles it. There is nothing to do but to send the bill back for correction.

Mr. Bush: Does anyone think there is any possibility of misconstruing it, so far as the wording is concerned?

A Member: I don't think there is.

Mr. Stagg: If anybody misconstrued the wording would they not be entitled to charge nine hours and not six, as stated?

Mr. Grieb: It seems to me that the whole difficulty lies in the fact that the folks who make these bills don't put the same significance to the word "replace" as we do; and in order to make it more clear, and acting on Mr. Bush's suggestion, would it not be well in the recommended changes in the M. C. B. rules, to change the word "replace," when it applies to draft timbers, to "renew?"

[It was decided that a three hour charge was proper, and that the changing of the rule be referred to the outstanding committee on recommended changes in M. C. B. rules.]

### LABOR CHARGE FOR REPLACING MISSING KNUCKLE OR BRAKE SHOE.

President Morris: It was intended that Mr. Parish, of the Lake Shore, would open the discussion of the third question—"Should owners be charged for turning down a tapered journal?" He is not here, and I think it advisable to postpone it until our next meeting. We will pass to question No. 4—"Should a labor charge be made for replacing a missing knuckle or brake shoe, on a defect card? If so, how much?"

Mr. Bates: I believe that all of us know of the decision authorizing a labor charge for applying brake shoes on a defect card. But the question comes up principally with reference to the amount of labor that should be charged for applying a brake shoe and, if possible, we ought to arrive at some understanding as to what the proper charge should be. Quite a few railroads charge one-half hour's labor for applying a shoe, while others charge but one-quarter of an hour, and of course this is disagreeable for the man who makes the bills, as well as for the man who checks them. It is difficult to remember who charges the half hour or the one-quarter hour, and as we always aim to charge our neighbor as he charges us, it is necessary for the bill clerk to keep a record of the charges made by the different railways. I am of the opinion that one-quarter of an hour is sufficient for applying a brake shoe. In regard to the labor charge for applying a knuckle on a defect card, although the Arbitration Committee has never decided a case of this kind under the present rules, I believe that it is proper to make such a charge. In deciding case 549, the Arbitration Committee held that the notes on page 28, under Section 10, Rule 5, and on page 32, under paragraph 17 of the same rule (now Section 20 of Rule 5), applied to owner's defects, so that if a car is delivered from one road to another with a missing knuckle it is not an owner's defect, and requires a defect card from the delivering line, and, as stated before, I believe that a labor charge is proper in such a case. An M. C. B. card is a voucher authorizing work to be done, and if it is more convenient for a railway to give its M. C. B. card than to make the repairs, I think that it is just and proper for the receiving road to be fully reimbursed for the material and labor it has expended.

Mr. Cardwell: I agree with Mr. Bates on the last statement that he made. If a railway company finds it more convenient to apply a defect card than to do the work, it is authorizing the work to be done and they should pay a liberal remuneration. Of course, it is impossible to do this when a defect card is applied—a road will probably not receive a car with a knuckle missing, and if the knuckle is lost after it is on their line they have the knuckle.

Mr. Mercatoris: I don't know whether we are billed or not. I took the matter up with the head of our department a short time ago, about billing on a defect card when we received a defect card for a brake shoe or a knuckle, and he told me not to bill.

President Morris: For neither brake shoe nor knuckle?

Mr. Mercatoris: No.

Mr. Deen: We do not make any labor charge for applying a knuckle or brake shoe on a defect card.

President Morris: Do you find that your neighbor charges you?

Mr. Deen: Some do. Some charge as much as a half hour for applying a brake shoe. I think that is a little steep, but I have never returned any of their bills.

Mr. Wensley: I think I can safely say that we put on from twenty-five to thirty brake shoes a week, not saying anything about knuckles and missing material. When the delivering line has not got the brake shoe we apply them on defect card right along with a labor charge. I think they should be charged half an hour for every car. Generally, we have to take the brakes down to put on the shoe.

President Morris: I will say for Mr. Wensley's information, that I think this question refers to the Christie shoe, provided with a key.

Mr. Kroff: We bill on defect card for missing material. As long as the defect card does not say "material furnished," we bill.

President Morris: How much do you charge for brake shoes?

Mr. Kroff: One-fourth of an hour for brake shoes; one-half of an hour for knuckles.

Mr. Bates: The Pennsylvania charges one-half hour for applying brake shoes.

Mr. Bush: Considering a question of this kind, I think there is one principle we always ought to bear in mind. I happened to be one of the sub-committee of the Car Builders' Association that drew up the present rules, and the principle which is involved in this question that you have brought up tonight, was one that was very carefully considered when we went into the revision of the rules, and when we made the radical change from the old rules to the new, it was felt that two things were desirable—one was that every road should do to the car of another, everything that was necessary to make it safe and serviceable, and the other was to avoid the use of defect cards just as much as possible. So, in many cases, you will observe that the rules state that where a railway company has a car belonging to another road, they are privileged to bill against the owner; but if that road delivers a car with defects to somebody else, then they have not that privilege. In some cases the rules govern in that way. The idea is this: We don't want to give defective cars to our neighbor. The proper thing to do is to make repairs as far as we can ourselves, so our neighbor will get the car in good condition, and in that way hope to maintain a better standard. So that penalty was generally imposed in cases of that kind. A defect card applied means that you have the privilege of billing, and while the labor charge is a small one, yet a knuckle needing renewing is quite an important thing, and sometimes after car has been delivered to another road it is an awkward thing to have to renew even a knuckle. On general principles, however, it seems to me that it is not desirable to bill for the labor.

Mr. Marsh: The practice of making a charge for renewing a knuckle or brake shoe is a pretty ticklish question. Now it would be almost impossible to charge less than one-fourth of an hour for either job, but two cents will renew a brake shoe any time. A man would get rich doing it by piece work. A knuckle can be renewed for five cents. Of course, there are some cases where it is hard to get the knuckle pin out, but, on an average, I think a quarter of an hour would be enough for them. I think the company gets enough without charging anything.

Mr. Bush: There is one point that Mr. Marsh has overlooked—the difference between charging on a defect card and otherwise. The rules have considered that point. If you are going to charge for renewing brake shoes and knuckles, you might get rich at it, as Mr. Marsh says. The committee realized that; but this covers cases where somebody has failed to do his duty.

Mr. LaRue: Take a road where they have got lots of cross roads; the traffic is light and they are merely feeders for the main line, and the supply of knuckles is small. I have had to send a man almost a hundred miles to put in a knuckle before we could receive a

car. It seems to me, that a charge of one-half hour for renewing a knuckle in all cases is just merely a turn around all the time—it would be mutual to everybody.

Mr. Kroff: If they can get rich applying brake shoes, why don't the company that is delivering the cars with the missing shoes put them on itself and get rich, too? It is a good way to get rich.

Mr. Wensley: I move that it is the sense of this meeting that half an hour should be charged for replacing brake shoes or knuckles on defect cards.

The motion was carried.

The meeting then adjourned.

## NOTES ON TRACTIVE POWER OF TWO CYLINDER COMPOUND ENGINES.

BY C. J. MELLIN.

One of the subjects in modern locomotive engineering that is not generally clearly defined is that of the calculation of the tractive power of compound locomotives. It is customary to make the high pressure cylinder of the compound a certain proportion larger than the cylinders of a corresponding simple engine, which method, while serving the practical purpose, is not satisfactory when the problem is handled independently for the compound, and is subject to error as the cylinder proportions vary.

The fundamental principle for calculating the tractive power of a compound locomotive is based on the low pressure cylinder and the amount of steam used per stroke of the piston. This determines the number of expansions, and with them the average pressure. The former is obtained from the volume of steam that enters the high pressure cylinder plus the cylinder clearance less the amount of compression. Calling N=number of expansions; A=area of low pressure cylinder; a=area of high pressure cylinder; C=cut-off in high pressure cylinder; b=clearance, and f=compression in high pressure cylinder, we have

$$N = \frac{A + a(b-f)}{ac + a(b-f)} \dots\dots\dots 1$$

Since N is found, we find the theoretical average pressure

$$p_r = \frac{P(1 + \text{hyp. log. } N)}{N} - 15 \dots\dots\dots 2 -$$

Where P=the initial pressure, which at slow speed is=to boiler pressure+the atmosphere, but as the cut-off pressure necessarily falls below the initial pressure and there are other causes of loss the actual average pressure  $p_{..}$  will be about 80 per cent of  $p_r$ . Then the tractive power

$$T = \frac{d^2 P_{..} S}{2D} \dots\dots\dots 3$$

in which  $d$ =diameter of low pressure cylinder ;  $S$ =stroke of piston and  $D$ =diameter of drivers.

By applying these formulas to a given engine, say 21x33x26-inch cylinder, 56-inch diameter of drivers, and 200 pounds boiler pressure ( $p=215$  pounds)  $C=85$  per cent ;  $b=8$  per cent and  $f=2$  per cent of  $a$ .  $A$  being 850 square inches, and  $a=340$  square inches, we have from formula No. 1 :

$$N = \frac{A + a(b-f)}{ac + a(b-f)} = \frac{850 + 340(0.08 - 0.02)}{(340 \times 0.85) + 340(0.08 - 0.02)} = 2.81 \text{ expansions.}$$

The hyperbol. logarithm for 2.81 = 1.0332 we get from formula No. 2:

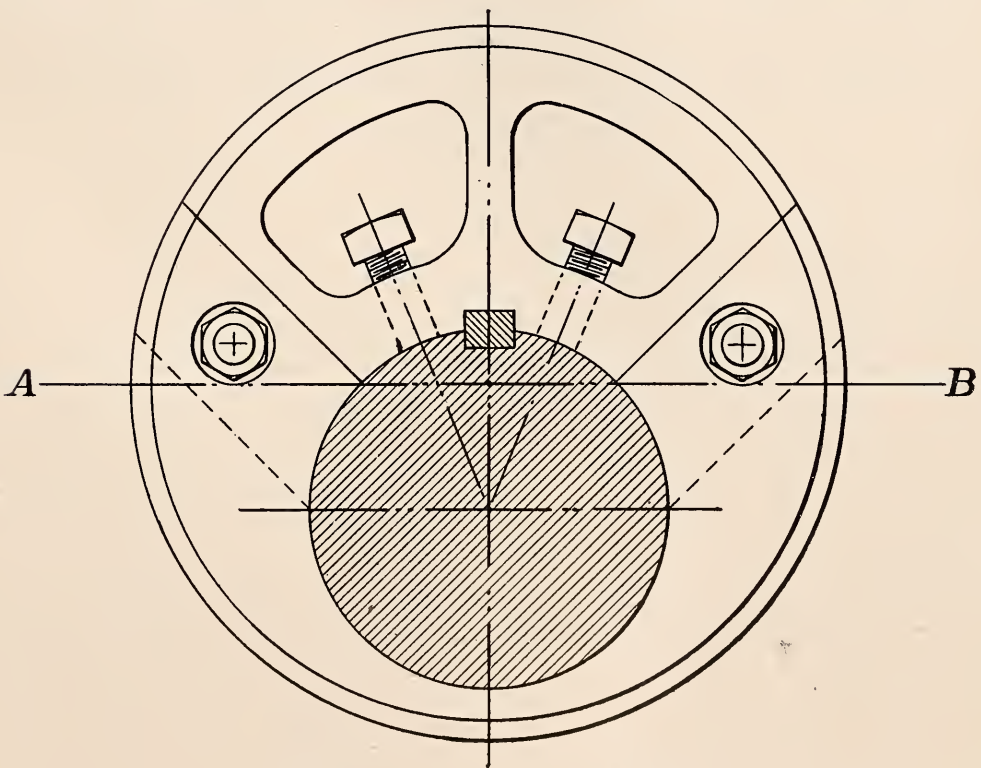
$$p_r = \frac{P(1 + \text{hyp. log. } N)}{N} - 15 = \frac{215(1 + 1.0332)}{2.81} - 15 = 140.5 \text{ pounds, and the actual average pressure } p_{r,r} = 140.5 \times 0.80 = 112.4 \text{ pounds.}$$

By inserting the value of  $p_{r,r}$  in the third formula, we get

$$T = \frac{d^2 p_{r,r} S}{2D} = \frac{33 \times 33 \times 112.4 \times 26}{2 \times 56} = 28,411 \text{ pounds tractive power.}$$

## ECCENTRIC WITH ANGULAR SPLIT.

The accompanying cut shows a new form of eccentric for locomotives, which is being tried with success on the Pennsylvania lines west of Pittsburgh. Eccentrics of this type are generally split along the line



ECCENTRIC WITH ANGULAR SPLIT.

A.....B, and the holes for the bolts which hold together the two halves are then located some distance below this line. It will readily be seen, however, that by splitting the eccentric on two lines above A.....B, which form an angle with each other, as shown, more metal will be obtained around the bolt holes, and as eccentrics generally break through these bolt holes, it is important to strengthen them at this point as much as possible. Another advantage secured by the angular split is that with it the metal is not exposed to tensile stress as with the straight line split, for in every position successively attained during a revolution of the axle the pressure from the eccentric strap will tend to press one part against the other, instead of trying to separate the two halves, as occurs with the ordinary split when the eccentric is at certain angles with the line of strain.

The principal objection to the form of eccentric shown in the cut is the increased expense for machine shop work in planing them up, as a large number of them cannot be clamped down on the same bed and finished up in one operation. By the use of special jigs allowing 90° rotation, however, the expense can be considerably reduced, although not to the same figure as for eccentrics split straight across.

This eccentric was designed by Mr. Edward Grafstrom, mechanical engineer of the Illinois Central, while he was connected with the Pennsylvania lines.

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## SOME NOTES ON THE MOTIVE POWER DEPARTMENT.\*

BY R. H. SOULE.

I have a great deal of respect for the profession of railway mechanical engineering. The problems are very varied and very complex, and the situation on a large railway, or even in a single large shop of a railway, is constantly changing. There is such a large variety of labor and material involved that there are new combinations every day. In a large railway shop you come to the shop in the morning and you are certainly sure to find a new combination different from that which existed twenty-four hours previously. I think it is also true that in the motive power department of a railway there are more varieties of labor and material in use, under one control, than will be found in almost any other business. It can readily be imagined that this is true in regard to the variety of labor, for you have already gone far enough to know

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\*Extracts from an address delivered by Mr. R. H. Soule at Purdue University.

that a railway shop must be organized to meet every one of a great variety of problems, but the great variety of material is not so apparent. The last railway that I was connected with was the Norfolk & Western. I was there six years, and, through the courtesy of the superintendent of motive power and chief engineer I have obtained some statistics bearing on the variety of material that has to be used in the operation of that road.

#### *Variety of Material Used.*

I shall deal only with approximate figures, and the facts are these: That in the maintenance of way department they use about five hundred different kinds of material, but in the motive power department they use about five thousand. In analyzing the operating expenses of a railway, it is found that what is known as the "Conducting Transportation Account" shows the largest consumption of material, but the reason is that that large amount of material is almost entirely made up of coal for locomotives. The fact remains, however, that it is the motive power department which uses the greatest variety of materials.

#### *Organization of the Motive Power Department.*

An assistant engineer on a large railway is necessary, because the superintendent of motive power gets so overrun with work that he has to unload on some one, and, therefore, it is convenient at least, to have one foot-loose man whom you can detail for special matters in order to relieve the congestion. And another particular in which the assistant engineer is valuable is because it is absolutely necessary to be able to produce close estimates of all sorts of improvements and even of current work, and it is very rare, unusual indeed, to find in the average railway man any ability to make close estimates; and so this condition of things and this necessity has brought to the front these assistant engineers, who, by being furnished with special facilities, are accordingly trained to produce very close estimates at short notice; I cannot overstate the importance of that work, and I think that is equally true in any business—the importance of making close estimates.

#### *Shop Location.*

The location of the shops on a railway is something which has to be determined very carefully and in which, nevertheless, a great many mistakes have been made; but, in general, owing to the fact that the master mechanic is a connecting link between the mechanical department and the transportation department, it is important to have the shops and the

master mechanic located at what might be called the operating centers of the railway. I think it is also conceded that it is good practice, under most conditions, to concentrate the control of the engine work and the car work under the same head. The old way was to have a master car builder and give him charge of the car work all over the road, and then there was a master mechanic to have charge of all the engine work. But there is no doubt about it that the tendency in recent times, and the best accepted practice, is to put all the shop work at each principal shop point under the control of the master mechanic. On a large railway, one main shop for construction work will usually be sufficient, with other shops arranged for repair work and maintenance work only. In general, it can be said that the main shops should be so located that it will not be necessary to haul engines more than 350 miles for heavy repairs. The same is true of passenger cars, but in freight cars it is desirable to have facilities at closer intervals, say 250 miles.

### *Shop Design.*

The matter of designing shops for railways is a very important one and I think it is true that no railway shop was ever built which was found to be just right, and the reason is that we have to make so many assumptions. You must know in what proportion the work is to be divided between construction and repair work, and between locomotive and car work; the wisest railway men often fail to make reliable predictions, so that the man who designs a shop has to base his designs upon a series of assumptions which are very likely to be wrong in some respect. The design of modern shops also introduces many nice questions in the use of compressed air and hydraulic plants and electricity. As an example, the Chicago, Burlington & Quincy people built new shops at Burlington, Iowa, in 1883. I was one of a party to visit those shops just after they were opened, and I went there a second time about one month ago. There was an engine in the shop then; it was new and yet the cab of the engine was lifted off and standing on the floor, and I asked why they had the cab off. They said: "With these big modern engines we have to lift the cabs off, as the head room between the floor and the overhead traveling cranes is so limited that we cannot lift one of these big modern engines off its wheels without first removing the cab"; and yet this particular shop was designed by a man who stood very high in his profession at that time, and was quite the peer of his fellows in every respect. This only illustrates the extreme difficulty of making correct assumptions when designing a railway shop.

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*Coaling Stations.*

One of the problems that is closely allied, is the provision of suitable stations along the road for coaling engines, and improved practice has brought great changes. I know of one road where the average cost of handling coal is from 12 cents to 14 cents a ton, but by introducing improvements it expects to bring that cost down to 4 cents.

*Locomotive Design.*

Treating locomotives as either passenger, freight or switching, it may be said, in general, that in a switching engine, no matter what the type, because we have 4-wheel, 6-wheel and 8-wheel switching engines, the whole weight is on the drivers; and switching engines are equipped with only moderate sized boilers, the reason being that a switching engine is always working hard with a late cut-off, and with little possibility of using its steam expansively, as a road engine may do, after the desired speed has once been attained. The fire of the switching engine is therefore always stimulated by a very sharp exhaust blast, and a relatively small boiler will without difficulty develop the required amount of steam. In a freight engine, the conditions being that it shall haul as heavy a load as possible, at the desired speed, it then becomes necessary to throw all the weight possible on the drivers; but the desire for safe practice has compelled the use of a guiding truck for freight engines, although foreign practice, which we may make up our mind to follow later, does without guiding wheels. Throughout England and her colonies, and in other foreign countries as well, freight engines are to be found running on the road with no guiding truck whatever, and if it is safe practice in those countries, why is it not here in our own? The answer may be that up to the present time our tracks have not been so good as in England and on the continent, but if our tracks are not now as good they soon will be. I feel safe in predicting that it will be a feature of future practice in this country to use freight engines without any guiding truck, and of correspondingly increased tractive power.

In the case of a passenger engine, the conditions are usually such that the engine must exert only a moderate amount of tractive power but must make a very high speed. The tractive power being a function of the weight on the drivers, you proceed to figure out the necessary weight on the drivers, and we will assume that it is thus found to be necessary to have two pairs of driving wheels; you must then figure out the proportions of the boiler in order that it shall furnish steam enough to supply the cylinders at the desired speed; that brings you to the ex-

act type of the passenger engine, which is generally two or three pairs of driving wheels with truck wheels in front, and now and then with additional truck wheels behind.

The horse-power of modern locomotives ranges from 750 to 1,750, and it may perhaps be something of a surprise to you to hear it stated that fast passenger engines in heavy service develop more horse-power than heavy freight engines do.

There are no end of details in the different elements which go to make up a locomotive, and which we cannot even touch upon now. The most important single feature is, however, undoubtedly the firebox. It has become pretty well understood that we have been forcing our locomotives too much, and Professor Goss has helped railway men very much by some experiments on the locomotive testing plant. The experiments showed that when the engine was burning about 50 pounds of coal per square foot of grate area per hour, 8 pounds of water were evaporated per pound of coal burned, but when the engine was forced until it was burning 180 pounds of coal per square foot of grate area per hour, the evaporation of water per pound of coal burned fell of from 8 pounds to 5 pounds; this has had the effect of turning the attention of locomotive designers to the necessity for providing fireboxes with a large grate area, and that has led to the more extended use of what is known as the wide firebox, originally known as the Wootten firebox. The original Wootten firebox was open to a great many objections, but the modern wide firebox has been re-designed so that the flat surfaces have been completely eliminated and all the elements of the cross sections are now segments of circles although it is not possible to make them of one radius.

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## PERSONAL MENTION.

Mr. Edward Grafstrom has been appointed mechanical engineer of the Illinois Central R. R., with headquarters in Chicago. Mr. Grafstrom's previous railroad experience has been entirely with the Pennsylvania, in the shops and drafting room of which he served his time. During Mr. S. P. Bush's time as superintendent of motive power of the Pan Handle system, he had charge of the mechanical office in Columbus, Ohio. He is a graduate from Boras Technical College, in Sweden, and a member of the American Society of Mechanical Engineers.

On the Great Northern Mr. Geo. H. Emerson has been appointed general master mechanic of the western district, with headquarters at Spokane, Wash.; he will perform such duties as may be assigned to him from time to time by Assistant General Superintendent P. T. Downs. Mr. Emerson was formerly master mechanic of the Great Northern at Larimore, N. D., and on January 1 was made general master mechanic of the

Great Northern and Willmar & Sioux Falls companies, with office at St. Paul. Coincidentally with the first named change Mr. T. Roope was appointed general master mechanic of the Great Northern's eastern district, and of the Willmar & Sioux Falls Railway, with headquarters at St. Paul; he will perform such duties as may be assigned to him from time to time by Assistant General Superintendent J. M. Gruber. Mr. Roope was formerly master mechanic of the Sioux City & Northern, and of late of the Willmar & Sioux Falls. These appointments of Messrs. Emerson and Roope date from February 22.

Mr. J. T. Robinson, master mechanic of the Southern Railway at Selma, Ala., has been appointed master mechanic of the same road at Spencer, N. C., vice Mr. W. H. Hudson, resigned.

Mr. Charles E. Patterson has been appointed foreman of car repairs of the Southern Railway at Knoxville, Tenn., vice Mr. A. B. Corinth, resigned.

Mr. A. J. Edmons has been appointed general foreman of the Chicago, Milwaukee & St. Paul at Sioux City, Iowa.

On the Norfolk & Western the following changes in the mechanical department have been made: Mr. J. E. Battye is appointed division master mechanic of the eastern general division, vice Mr. R. P. C. Sanderson, who resigned, as previously noted, to become assistant superintendent of machinery of the Atchison, Topeka & Santa Fe. Mr. H. F. Greenwood is appointed general foreman of the locomotive department at Roanoke shop, vice Mr. J. E. Battye, transferred. Mr. C. N. Sanders is appointed chemist, vice Mr. W. W. Davis, resigned, to accept service with another company. Mr. H. F. Staley is appointed general foreman at Kenova, vice Mr. F. P. Hickey, resigned, to accept service with another company. Mr. J. H. Snider is appointed foreman at Shenandoah, vice Mr. H. F. Staley, transferred. Mr. L. D. Gillett is appointed general foreman at West Roanoke, vice Mr. S. K. Dickerson, who, as previously noted, resigned to become division master mechanic of the Lake Shore & Michigan Southern. Mr. G. I. Fairbrother is appointed road foreman of engines on the Radford division, vice Mr. L. D. Gillett, transferred. Mr. L. B. Murray is appointed road foreman of engines on the Scioto Valley division, vice Mr. J. J. O'Rourke, transferred.

Mr. H. C. Anderson has been appointed round house foreman of the Iowa Central at Oskaloosa.

Mr. J. W. Libby has been appointed engine dispatcher of the Lake Shore & Michigan Southern at Elkhart, Ind., vice Mr. J. C. Calkins.

Mr. Patrick Stack has been appointed air brake inspector of the Union Pacific.

Mr. L. C. Ames has been appointed foreman of the car and locomotive department of the Chicago, Rock Island & Pacific at Phillipsburg, vice C. E. Holtz, transferred to Caldwell.

Mr. I. N. Kalbaugh, heretofore assistant superintendent of machinery of the Baltimore & Ohio at Newark, Ohio, has been appointed master mechanic of that road at Greenwood, Pa., vice Mr. Joseph Billingham, transferred.

Mr. V. B. Lang, master mechanic of the Cincinnati, New Orleans & Texas Pacific at Chattanooga, Tenn., has resigned to become master mechanic of the eastern division of the Chicago & Alton at Bloomington, Ill.

Dr. James H. Smart, president of Purdue University, died at his home in Lafayette, February 21. He had been ill for several years owing, it is thought, to overwork. Dr. Smart was a warm supporter of Professor Goss in the latter's valuable researches into railway mechanical problems.

Mr. John Bean, master mechanic of the Wheeling & Lake Erie, at Canton, Ohio, has resigned. Mr. Bean has been, since 1884, master mechanic and master car builder

of the Cleveland & Canton and Cleveland, Canton & Southern, until the Wheeling & Lake Erie absorbed them. His previous railway work was, in outline, as follows: He entered railway service in 1863, as a brakeman, on the Cleveland & Pittsburg. In 1864 he went to the Cleveland & Canton, as locomotive fireman, and served on that property thereafter as machinist, locomotive engineer, and machine foreman until, in 1884, he was made master mechanic and master car builder.

Mr. W. J. Hemphill, formerly master mechanic of the St. Louis, Peoria & Northern, and for some months past master mechanic of the Chicago & Alton shops at Bloomington, Illinois, has resigned to enter private business in St. Louis.

Mr. Frank G. Benjamin, general foreman of the shops of the Chicago & Northwestern, at Clinton, Iowa, has been appointed general foreman of the shops at Boone, Iowa, vice E. G. Taylor, resigned. Mr. W. G. Wallace succeeds Mr. Benjamin at Clinton.

Mr. E. A. Gilbert, hitherto master car repairer of the Southern Pacific, at Oakland, Calif., has been appointed assistant master car builder of the Southern Pacific, in charge of all construction and repair work, and employes at the Sacramento car shops, and will perform such other duties as may be assigned him by the superintendent of motive power. Mr. H. Englebright succeeds Mr. Gilbert at Oakland.

Mr. William Shone, general foreman of the East Buffalo car shops of the New York Central & Hudson River, has resigned to become assistant superintendent of shops of the Brooklyn Rapid Transit Company at Brooklyn, N. Y.

Mr. R. Moran has been appointed master mechanic of the Louisville & Nashville.

Mr. Robert H. Dowling, the inventor of the Dowling car coupler, died at Newark, Ohio, February 7.

Mr. J. J. Shea has been appointed general storekeeper of the Lehigh Valley, vice Mr. H. S. Montgomery, promoted.

On the Pennsylvania Railroad changes have been made as follows: R. K. Reading, master mechanic at Sunbury, Pa., transferred to Baltimore, to succeed J. M. Coale, pensioned; C. H. Potts, master mechanic at Erie, transferred to Sunbury; John S. Mengel succeeds Mr. Potts, at Erie, and J. B. Thomas becomes assistant master mechanic, at Renovo.

Mr. Jacob Miller, formerly general foreman locomotive department of the Chicago, Milwaukee & St. Paul shops, at Dubuque, has been made district master mechanic of the same road, at West Milwaukee, Wis., vice F. W. Diebert, who, as previously noted, resigned to become assistant mechanical superintendent of the Baltimore & Ohio, at Newark, Ohio.

Mr. Daniel Floyd has been appointed fuel agent and traveling engineer of the Ohio Southern.

Mr. W. J. Bennett has been appointed master mechanic of the Chicago & Alton, at Slater, Mo.

Mr. J. R. Van Cleve, heretofore master mechanic, at Kalispell, Mont., of the Great Northern, has been appointed master mechanic of the White Pass & Yukon.

Mr. J. T. Robinson, formerly master mechanic of the Southern Railway, at Selma, Ala., has been appointed master mechanic at Spencer, N. C., vice W. H. Hudson, resigned. J. F. Sheahan, formerly foreman at Alexandria, succeeds Mr. Robinson at Selma, Ala.

Mr. C. M. Daucett has been appointed air brake instructor of the Chicago Great Western, with headquarters at Oelwein.

Mr. Joseph Billingham, master mechanic of the Wheeling division of the Baltimore & Ohio, has been appointed master mechanic of the second, third, fourth and fifth divis-

ions, and will make Cumberland his headquarters. He succeeds P. J. Harrigan and P. Hayden, hitherto master mechanics at Cumberland, Md., and Grafton, W. Va., respectively, who are assigned to other duties.

Mr. H. M. Pflager, heretofore chief mechanical inspector of the Pullman Company, has been appointed mechanical superintendent of that company, with headquarters at Chicago, Ill.

Mr. John W. Fitzgibbon, superintendent of motive power and machinery of the Delaware, Lackawanna & Western, has resigned.

Mr. R. F. Hoffman has been appointed mechanical engineer of the Atchison, Topeka & Santa Fe.

Mr. E. D. Bronner, hitherto assistant superintendent of motive power and equipment of the Michigan Central, has been appointed superintendent of motive power and equipment of that road, vice Mr. Robert Miller.

Mr. Geo. A. Hancock, whose resignation as assistant superintendent of machinery of the Atchison, Topeka & Santa Fe, we noted last month, has been appointed superintendent of machinery of the St. Louis & San Francisco, vice Mr. J. R. Groves.

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## SUPPLY TRADE NOTES.

Notwithstanding the Michigan Lubricator Co., of Detroit, Mich., have increased their capacity three times within the last two years, there has been such a tremendous demand for, and unprecedented adoption of, their Improved Michigan Triple Locomotive Lubricator with Automatic Steam Chest Plugs, for the purpose of overcoming "hold up" of oil in the tallow pipe, that since last November they have been compelled to run their works nights. Consequently, they are again increasing the capacity of their foundry and works generally, and adding many new, costly tools. The Improved Michigan Locomotive Lubricator has been paid a high compliment by its adoption, within the last two years, by many of the largest and most important railways in this country, as well as in Europe. We can call to mind no better example of the result of persistent energy than the wonderful success of this company, who have followed closely to the line that "a superior article of high class workmanship will win in the end," and are today reaping the reward of their faith in this truism. The address of the Company is 663-671 Beau-bien St., Detroit, Mich.

Concerning the recent brake beam litigation, the Chicago Railway Equipment Company sends us the following communication: "Our attention has just been called to a circular issued by the Interchangeable Brake Beam Co., referring to the patent suits between this Company and that, and we beg to call attention to a material omission in their circular, viz.: They omitted referring to the fact that the case, prior to the date of their circular, was appealed to the United States Court of Appeals and the decision of which court will determine whether 'the railroads can use the Interchangeable Brake Beam freely' or not. We think it only proper that attention should be called to the fact that the question is yet to be finally determined, and is still 'in the court.'"

The Brooks Locomotive Works, in summarizing its output for 1899 and comparing it with that of former years, finds it presents some interesting features particularly as showing the marked tendency on the part of railway companies for heavier locomotives. This is amply demonstrated by a comparison with that company's output for 1891, its best previous year as regards number of engines completed, as follows:

Engines completed 1891, 226; 1899, 300. Total weight engines and tenders in working order 1891, 41,726,350 pounds, 20,863 net tons; 1899, 81,123,600 pounds, 40,562 net

tons; increase  $94\frac{1}{2}$  per cent, increase about 20,000 net tons; average weight of each, 1891, 184,629 pounds; 1899, 270,412 pounds; average increase 85,783 pounds per engine. Total weight engines only, in working order, 1891, 25,455,100 pounds, 12,728 net tons; 1899, 49,730,400 pounds, 24,865 net tons; increase  $95\frac{1}{3}$  per cent, increase about 12,000 net tons; average weight of each, 1891, 112,633 pounds; 1899, 165,768 pounds; average increase 53,135 pounds per engine. Total weight engines and tenders empty, showing actual weight material produced 1891, 29,778,410 pounds, 14,889 net tons; 1899, 57,681,300 pounds, 28,841 net tons; increase  $93\frac{3}{4}$  per cent, increase about 14,000 net tons.

Basing the output of engines and tenders in working order for 1899, at the average weight produced in 1891 would equal 439 complete locomotives.

The lightest locomotive built during the year was a mogul engine and tender weighing in working order 97,014 pounds; the heaviest, a 12-wheeled engine and tender weighing in working order 364,900 pounds. The latter has 23x30-inch cylinders and is the largest locomotive in the world.

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## BOOK NOTES.

An Index to the M. C. B. Book of Rules has been issued by the Sargent Co., of Chicago. The index covers rules 3 to 9, which with their numerous sections and various subjects are the ones most referred to. The various subjects treated in these rules are in this index grouped alphabetically. The index is of such form that it may be readily pasted into the book of rules, and is gummed for that purpose. The back of the index is utilized for the presentation of the Sargent Company's famous knuckle chart. Copies of this index will be furnished by the Sargent Co., 675 Old Colony Building, Chicago, upon application from any one interested in it.

The Proceedings of the Master Car Builders' and Master Mechanics' Associations, comprising the full story of the work done at the Old Point Comfort conventions, were issued some time ago in their usual handsome clothing. The Master Mechanics' Proceedings came early and the book of the other association somewhat late—but this latter fact was due to no lack of diligence on the part of the secretary, for the delay was occasioned entirely by non-receipt of material from one of the committees. The Proceedings of both associations, taken together, form an invaluable compendium of information as to the current problems of the day in railway mechanical circles. The essence of what was said and done at these conventions was given in our issue of July, 1899, but in these Proceedings the reports, and the discussions thereon, are, of course, given in full, and the Proceedings should therefore be in the library of every man interested in the mechanical side of railroading. An adequate index makes their contents readily available. Mr. Joseph W. Taylor, the new secretary of these associations, has, in point of both thoroughness and promptitude of his work on these Proceedings, shown himself a worthy successor of Mr. Cloud.

The Brooks Locomotive Works have just issued a new catalogue, which is in every respect as creditable to the company as is their high class locomotive product. The book gives, in ample detail, but in concise form, illustrated and statistical information regarding the various types of Brooks locomotives, their construction and their performance. A valuable feature is a series of tables and diagrams showing the tractive power of locomotives, the number of feet of piston travel per mile, mean available pressures at different piston speeds and boiler pressures, the number of revolutions of drivers per mile, train resistances for different grades and speeds, the resistance of curves, hauling capacities of locomotives, mean effective pressures, etc., etc. There is also given an illustrated history of the works. In fact, the 336 pages of this handsome book are replete with facts and figures that make it of direct value to all who are interested in the subject of motive power for railways.

THIS ISSUE GOES TO EVERY RAILWAY OFFICIAL INTERESTED IN THE FIELD  
OF THE RAILWAY MASTER MECHANIC IN EVERY COUNTRY THE WORLD OVER

# RAILWAY MASTER MECHANIC

WALTER D. CROSMAN, EDITOR.

WILLIAM E. MAGRAW, MANAGER.

Vol. XXIV.

CHICAGO, APRIL, 1900.

No. 4

## Variations in the Use of Steel Sheets for Locomotive Fireboxes.

Although steel plates have been used quite generally in the United States for locomotive fireboxes for more than twenty years, there is still a variation in the requirements as to quality and also in the manner of working the sheets. Both acid and basic steel are in general use for shell sheets, but the majority of railways use acid steel for fireboxes. One of the largest locomotive works and a large railway company use either acid or basic steel for fireboxes, depending upon careful examination tests and analyses for the detection of defects. There is a general impression that basic steel is more liable to have laminations in the sheets than the acid—though we are unable to say whether this idea is well-formed or not.

A majority of railways use the Master Mechanics' standard specification for firebox sheets, with tensile requirements of between 55,000 and 65,000 pounds, while several roads make the upper limit 60,000 pounds, and one road does not allow it to exceed 56,000 pounds.

It is the practice of some railways and locomotive builders to flange steel sheets with a metal sledge, while others require it to be done with a wooden maul. Some locomotive works anneal only those sheets which are hand flanged, machine flanged sheets being unannealed. Other locomotive works anneal all flanged sheets. Some railways anneal all flanged sheets, while others do not anneal *any* sheets.

As the annealing process is an expensive one, requiring the time of a number of men who earn high wages, it is a question whether this expense is justified by the results obtained. There are two good reasons why it could be abandoned: First, because the per cent of carbon in firebox and boiler sheets is so low that they are not injured in flanging, if the work is done at a proper temperature, and before they cool down to blue heat. Second, the successful practice of several roads which

have dispensed with annealing altogether ought to be a strong argument in showing that the process is unnecessary.

There is also a diversity of practice in regard to punched and drilled holes. Some railways punch all rivet holes full size, while others punch within 1-16 inch diameter and ream out the balance, and in some railway shops it is the practice to drill all rivet holes.

Where a number of boilers of the same class are built at the same time, it is possible to clamp the similar sheets together and drill through all at once. In this way the work can be done almost as cheaply as by punching, and the quality of the work is undoubtedly better. In seams exposed to maximum strains, rivet holes should be drilled; and all holes which are punched should be reamed out at least 1-16 inch in diameter.

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## SOME POINTS ABOUT STAYBOLT INSPECTION.

BY W. J. EDDINGTON.

The care of the staybolts in the locomotive boiler is probably one of the most important duties of the railway master mechanic. The renewal of broken or defective staybolts, and the time an engine is held out of service, constitute a large item of expense. Much of this can be avoided by renewing bolts when an engine is shopped for general repairs, particularly those bolts that are located under the frame fastenings and other inconvenient places, and all that are considered uncertain. The service which an engine has to perform has much to do with regulating this work.

Staybolt breakage in boilers of recent construction is more frequent than formerly, for several reasons. Among these reasons I may name the following: the increased size of the firebox; the thicker sheets; the irregularity and reduced area of the water space; the different shapes of fireboxes, and the higher pressures of steam. Doubtless, also, the quality of staybolt material has not improved. The frequency with which this subject is referred to in mechanical papers indicates that its importance is fully understood.

The method of detecting broken or defective staybolts is important. The general practice is to drill detector holes in the center of the bolt through the outside sheet, so that when broken it will leak. Some depend on the hammer test only. My experience has convinced me that detector holes are unreliable and a useless expense, and that the

hammer test, conducted by an experienced inspector, is the safer method to follow.

I have reached this conclusion for the reason that fully 60 per cent of the staybolts we remove are *partially* broken, and are broken in such a way that the detector hole would be useless. As many of these bolts break gradually, the holes fill with sediment quickly and prevent detection. The size and position of these fractures vary. Some bolts break on the top side, some on the bottom, some front and back, and others on both top and bottom, leaving the center solid, as shown in Fig. 1—the average area broken being about one-half. This is a serious matter, and would indicate that when *clearly* broken bolts only, are removed, the firebox is unsafe. Out of eighty-four bolts removed from one firebox in a year at this point only twenty-five were *clearly* broken.

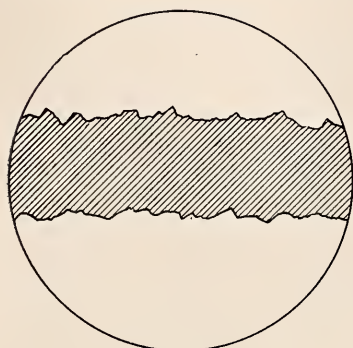


FIG. 1.

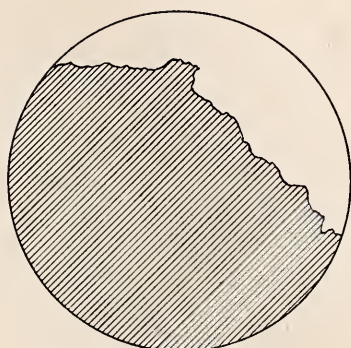


FIG. 2.

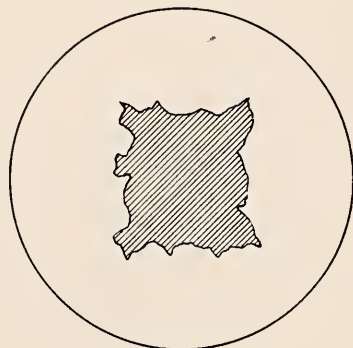


FIG. 3.

## STAYBOLT FRACTURES.

In only a few parts of the firebox do the bolts break quickly after the fracture begins. Those in the curve of the side sheets and in the outside vertical rows of the back head give the most trouble. An expert will soon become familiar with the different kinds of fireboxes, and have no difficulty in locating fractured or broken bolts, and, when he learns the direction of the strains, he can show when a bolt is partially broken, just how much it is broken, and the side that is fractured. This last point is of value when they are being cut out.

I will take one firebox, with which we are familiar, for an illustration. Beginning with the first staybolt from the boiler head in the bottom row of the side sheet:—this one, if fractured, will show the defect on the bottom. Passing up this row until the bend is reached, the fractures, if any, will be next to the boiler head. Taking the first row in the bend the defect will work around to the top at about the fourth bolt, and so on to the center of the sheet, where we may find several broken bolts.

The second row in the bend will fracture on the bottom and the third row on the top. If there are diagonal rows between these, they will fracture on the top and bottom, leaving the center solid, as shown in Fig. 1. Continuing on the back row to the top, the corner bolt, if defective, will be broken on the back and top, as shown in Fig. 2. Passing along this row to the center, the fractures will show on the top. The same results will be shown by beginning at the throat sheet. In the boiler head we find that the outside vertical rows break first. If not renewed soon, they break toward the center—the top row first, if the boiler and frame braces are high on the boiler head. Very few partially broken bolts are found in the boiler head, as they break quickly after the defect begins. In the throat sheet the action is different on account of the heavy flue sheet. In this we find the bolts broken all around, leaving a small portion in the center solid, as in Fig. 3. There is little doubt that in a large percentage of the broken bolts the center is the last to break.

Staybolts can be tested better, by one man sounding on the inside of the firebox with a light hammer. Different parts of the firebox give different sounds. Staybolts under frame fastenings, if the bolt is touching, give a peculiar sound and often deceive inspectors.

Broken bolts are detected by the sound. Those partially broken are found by the vibration of the sheet taken off by the fingers. If there are any such bolts in the firebox they can be found as I have stated. An examination of the bolts removed will confirm this.

It requires a great deal of practice to become an expert at this work of staybolt inspection, and no doubt some can acquire the faculty quicker than others. The matter is, however, so important that every opportunity should be taken to train men for the work.

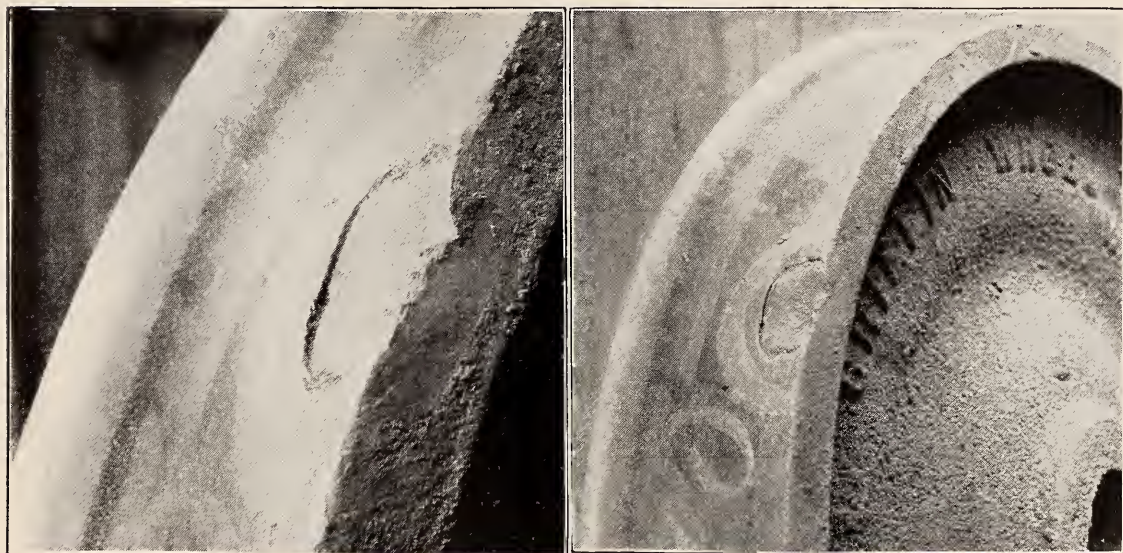
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## A CURIOUS WHEEL DEFECT.

Some time ago a case came up before the Car Foremen's Association of Chicago, involving the responsibility for a curious defect in the tread of a cast iron wheel. This defect is quite clearly shown in the two photographic views which we present; the question was as to how this defect should be classed—as “shelled out,” or “flaked,” or by some other term. There was nothing to show that the car had been off the track or roughly handled in any way. The car was inspected at 47th street, Chicago, and no defect found on the wheel when there, but when

it got down in the yards the wheel showed the mysterious defect, which was clean and bright and evidently recently caused. Mr. Bundy, of Swift & Co., the receiver, felt that the delivering road should card for the wheel, and accordingly made claim for a card, which was refused. Mr. Bundy had felt that he could not get back on the owner and ask him to replace the wheel, because there was nothing in the M. C. B. rules to justify him in so doing. He thought, when he first looked at the wheel, that it had evidently been struck on the edge of the rim and split off, but found that there was really nothing to show that it had been struck on the rim.

Mr. Deen, in explaining his position, said: "I made an examination of this wheel a day or two afterward and found it as Mr. Bundy has stated, except that I found what I took to be a little flaw at that



A CURIOUS WHEEL DEFECT

raise toward the flange of the wheel. But that was very small. There was nothing on the wheel that showed that it had been struck by anything; there were no signs on the wheel of its having been wrecked or derailed at any point. Therefore, I took the stand that Mr. Bundy was not entitled to card, and he didn't get it."

In the discussion which followed, Mr. Shannon expressed the view that this was an owner's defect—a defect that the wheel maker ought to stand—and that the owner ought to replace the wheel.

Mr. Showers considered that it was an "owner's defect" originally. He had no doubt that the wheel was bruised, perhaps when it was first

cast—bruised inwardly, allowing the metal at the outer edge to hold, and that after the wheel wore a very small amount on top, it caused it to give way and break from underneath. He therefore thought that the owners of the car would be justified in calling upon the maker of the wheel to replace it.

Mr. Miller did not quite agree with Mr. Showers in this matter. He could not see that in that way the wheel could be thus affected, and show such a fracture. According to his judgment, the wheel was struck by something that caused it to chip out after being put in service. The fracture being perfectly bright, he would judge that the casting was perfectly sound, and that, therefore, the wheel maker ought to stand the loss.

Mr. Grieb stated that he had had interest enough in this case to prompt him to get a section of the wheel to Milwaukee for inspection. The St. Paul road, he said, was quite a large wheel maker, and was specially interested in anything that is peculiar, and he had classed the defect in the wheel as something out of the ordinary. After inspection at Milwaukee, it was the unanimous opinion there that the wheel had suffered some blow or mishap while it was still warm; that the defect was brought into existence before the wheel had left the foundry. He had obtained the opinion of his foundry man, who is an expert on wheel making and on defects in wheels, and who is in a good position to note the peculiarities of wheels in railway service, as he sees them from the day they are made until they are returned home for scrap. This foundry man thought that, by some mishap or another, that wheel suffered a blow before the metal had thoroughly settled, just sufficiently to separate the integral parts of the wheel, but not sufficient to cause them to part until there had been sufficient wear on the tread to allow that piece to drop out. The St. Paul road had had in its own wheels a defect somewhat similar to this one; it was, however, located more centrally in the tread. It had been considered a case of "owners responsible." Mr. Grieb thought that it would be necessary to invent some special name to properly describe the peculiar defect under discussion. Ordinarily it would be classed under the name of "shelled out" for the want of a better name. On his road it would be called "flaked." This latter was, of course, a local term, and not in the book of rules.

Mr. Grieb moved that the defect be considered one for which the owner is responsible, and his motion was carried.

# THE REHABILITATION OF THE PISTON VALVE.

BY ROBERT F. HOFFMAN, M. E.

Atchison, Topeka & Santa Fe Railway.

## III.

In the further consideration of piston valves as applied to locomotives, those features which have come most directly under observation of the writer are herein set forth. The evolution of a plug valve, traced through its various stages, is not devoid of interest. Neither is it discreditable, to the valve and its creators, to direct attention to some of the indecisive steps of its infancy, now that it has grown to be a giant consideration among gigantic propositions in locomotive engineering.

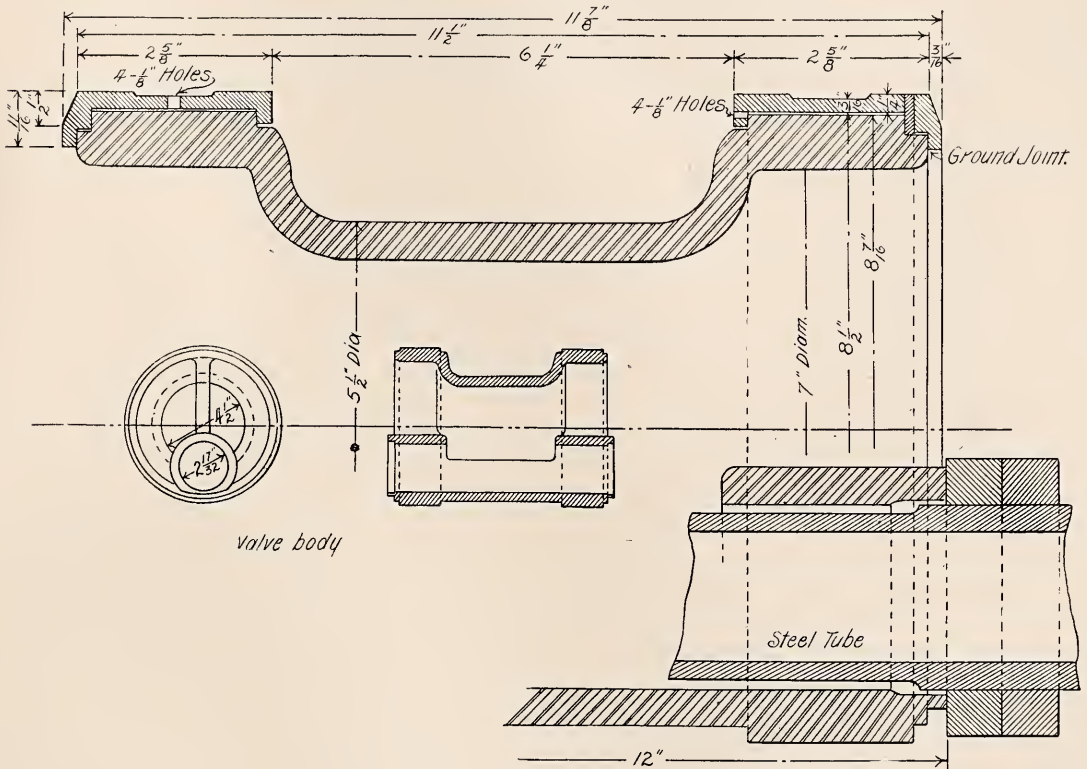
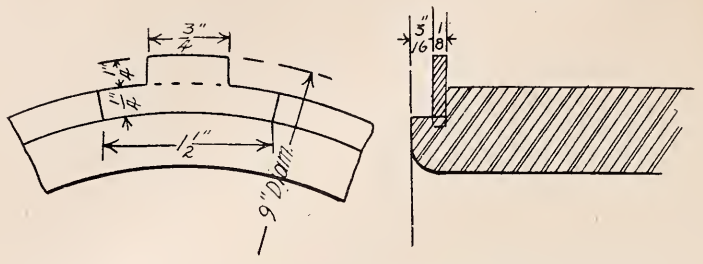


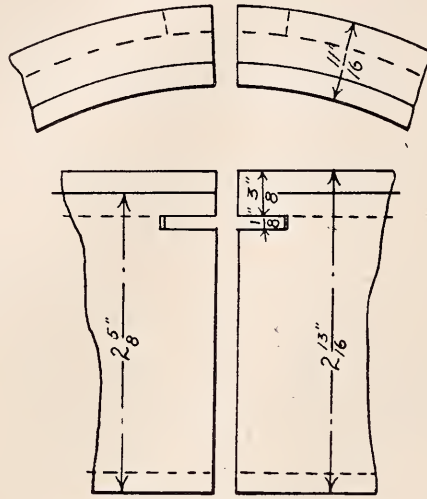
FIG. 1.

It is desirable, first, to invite attention to the design illustrated in Figs. 1 and 1-A. Closely associated with the ideas there depicted is the construction indicated in Fig. 2. These valves were sketched while consideration of the use of piston valves for tandem compound freight engines was an engrossing theme. It is readable from Figs. 1 and 1-A that the spring ring arrangement contemplated the employment of one large sawn ring, of soft steel, upon each head of the valve. A ground joint, a slit-guard and four pin-hole passages for steam, through the depressed portion of the ring face into the exhaust hood, constitute the salient features.

The sketch assumed this form after some efforts in pursuit of the balance idea. The value of the combination in reduction of friction was quite evidently less than would warrant the sacrifice of steam involved. This sketch and its companion sketch, Fig. 2, the latter showing solid rings and follower plates, served their purpose without passing beyond the drafting room. Skirmishers, they might be characterized today,



Method of Reducing leak at joint.



Top View of joint.

FIG. 1-A.

when all the air is surcharged with the breathings of men's battles.

First in the order of material development came the valve design illustrated in Fig. 3: a hollow cast steel body having two forged steel spring rings per head; rings  $\frac{1}{8}$ -inch face and  $\frac{5}{16}$ -inch deep, sawn and snapped into the solid head in the usual manner and in the proper proportion of excess normal diameter. The result was very rapid ring wear and a final mishap. The ends of a ring and the edge of a port bridge one day connived against the common peace and dignity of the piston

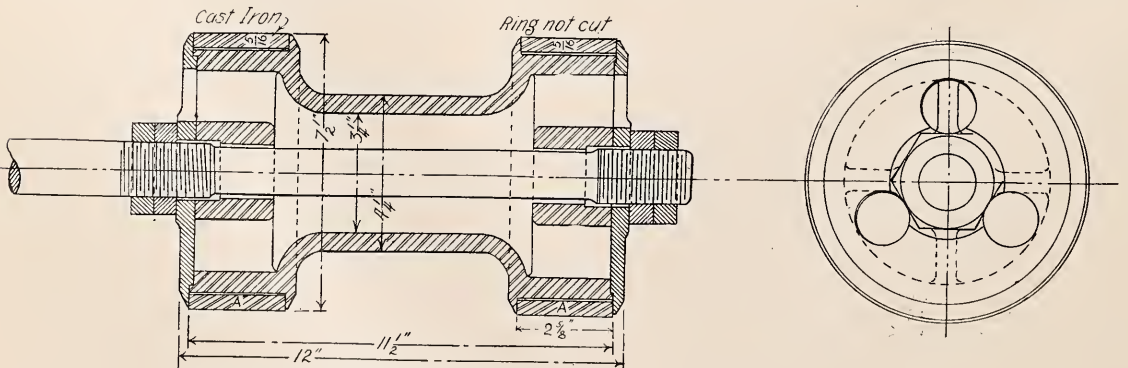


FIG. 2.

valve. They got together and became involved to the extent of "plugging" one cylinder while a run for the hill was being made. The result is not a matter of general interest, but the small rings were removed. A simple cast iron "plug sleeve" was fitted to the cast steel valve body, upon each head, the valve body being turned down to a diameter suitable for the purpose. From the valve thus made, grew the simple plug valve

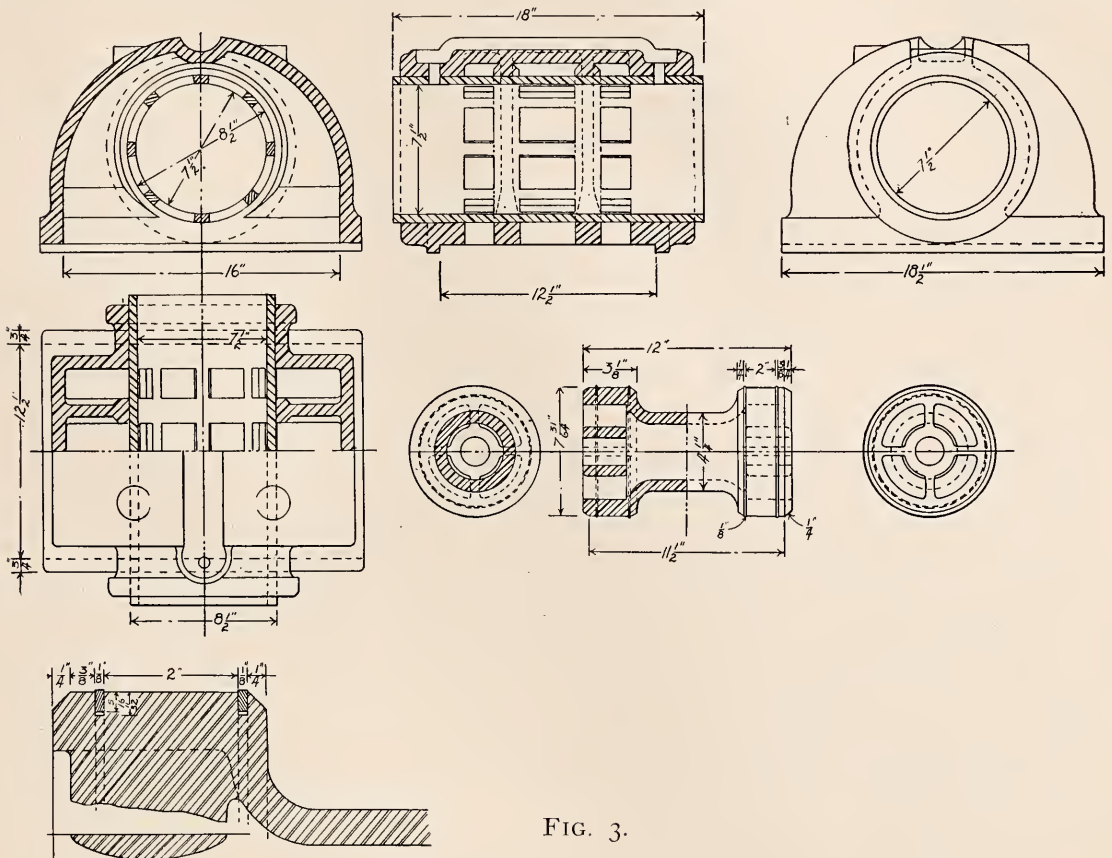


FIG. 3.

shown in Fig. 4. This form of valve, with dimensions variously adapted, is now used upon compound passenger and freight engines of this railway.

In Fig. 5 there appears a valve that was used in a 17x24-inch passenger engine. Rings are there shown  $\frac{1}{2}$ -inch wide. Rings as great as  $2\frac{1}{4}$  inches upon the face were tried in this engine. So, also, were forged rings as narrow as  $\frac{1}{8}$ -inch upon the face. With the  $2\frac{1}{4}$ -inch rings the reverse lever was at times unmanageable; with the  $\frac{1}{2}$ -inch rings the lever was also rightfully considered as coming within the "strong arm" class. With the application of the forged rings with  $\frac{1}{8}$ -inch face came easement of the valve friction load, but the relief was obtained at the price of too great ring deterioration. A running record of 8,000 engine miles showed the spring rings to have worn away  $\frac{1}{8}$  inch in diameter.

In the simple engine that was made the subject of these observations

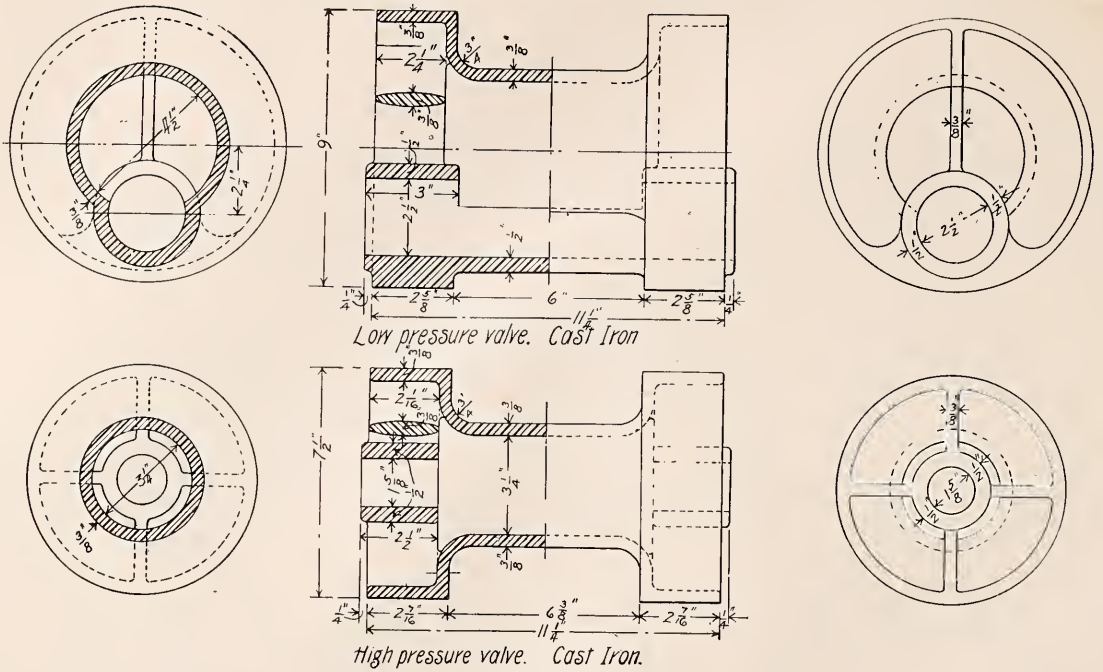


FIG. 4.

there are now being used valves similar to those pictured in Fig. 4, but suited to the requirements of a simple engine. The valves were fitted as described earlier in this series—about two thousandths (.002) of an inch to accommodate sudden contraction of the cages. Upon examinations made quite recently, it was found that the tool marks are yet largely present upon the valve body. The valves were restored to their cages without further attention. The period of service which they have withstood is now the greater part of one year, in an average fair water country.

Some indicator diagrams from various valve factors herein mentioned may serve your convenience in a succeeding issue.

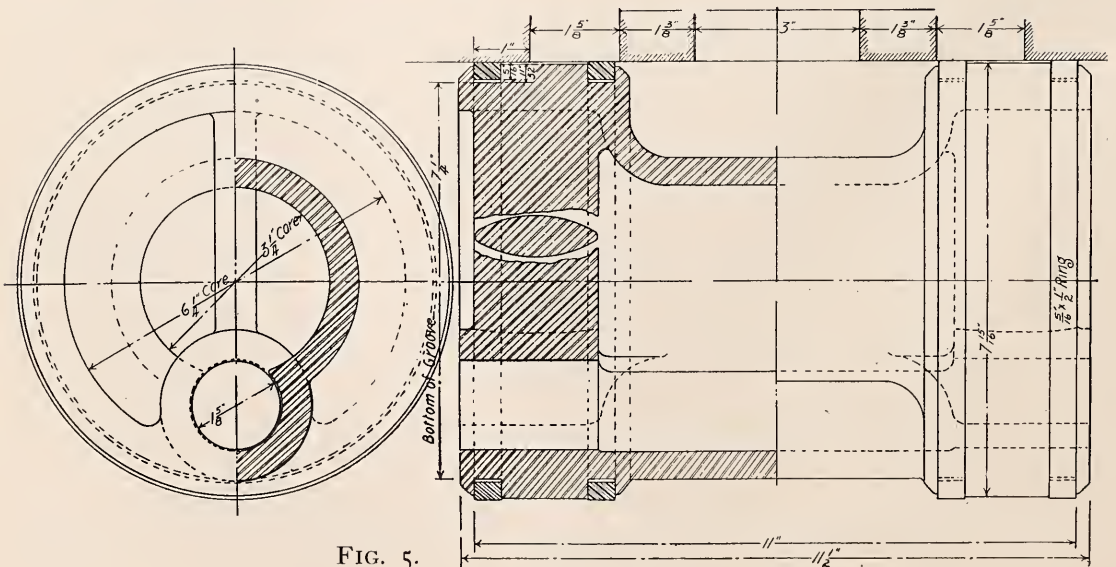


FIG. 5.

# CHARLES H. HASWELL.

## THE OLDEST ENGINEER IN ACTIVE PRACTICE.

There is today no more interesting figure in the engineering world, says *Cassier's Magazine*, than Charles H. Haswell, who, though past his ninetieth year, is still engaged in active work, and is now the oldest member of the profession in harness.

To by far the larger number of people he will probably always remain best known as the author of the almost universally familiar engineers' pocket-book bearing his name, though, after all, this represents only an incident in his unusually busy career. He was born of English parents in the city of New York, descending from a family of staunch Royalists, who, after the defeat of Charles II. at Worcester, migrated to Barbadoes, W. I. After a classical education, at the age of about nineteen he entered the employ of James P. Allaire, of New York, the proprietor of what was then the largest steam engine building shop in the United States. There he laid the foundation for much of his practical engineering knowledge, and in 1836 entered the United States navy as chief engineer, being commissioned engineer-in-chief in 1843.

During his service in the navy, in 1837, he designed and constructed the first steam launch, the *Sweetheart*, which, on her maiden trip on the East River, at New York, was saluted by steamboats and assemblages of people on the piers. He also designed the machinery for ten war vessels. After retiring from the navy, in 1851, he built several merchant steamers and designed and built various other important engineering structures as well, his work collectively giving him a national reputation. In 1853 Emperor Nicholas presented him with a diamond ring for some professional service. Mr. Haswell was the first, in 1847, to apply zinc in a steam boiler and subsequently in the hold of a steamship to arrest the corrosive action of the salt water. This use of zinc was nearly thirty years previous to its trial in Great Britain as a new invention.

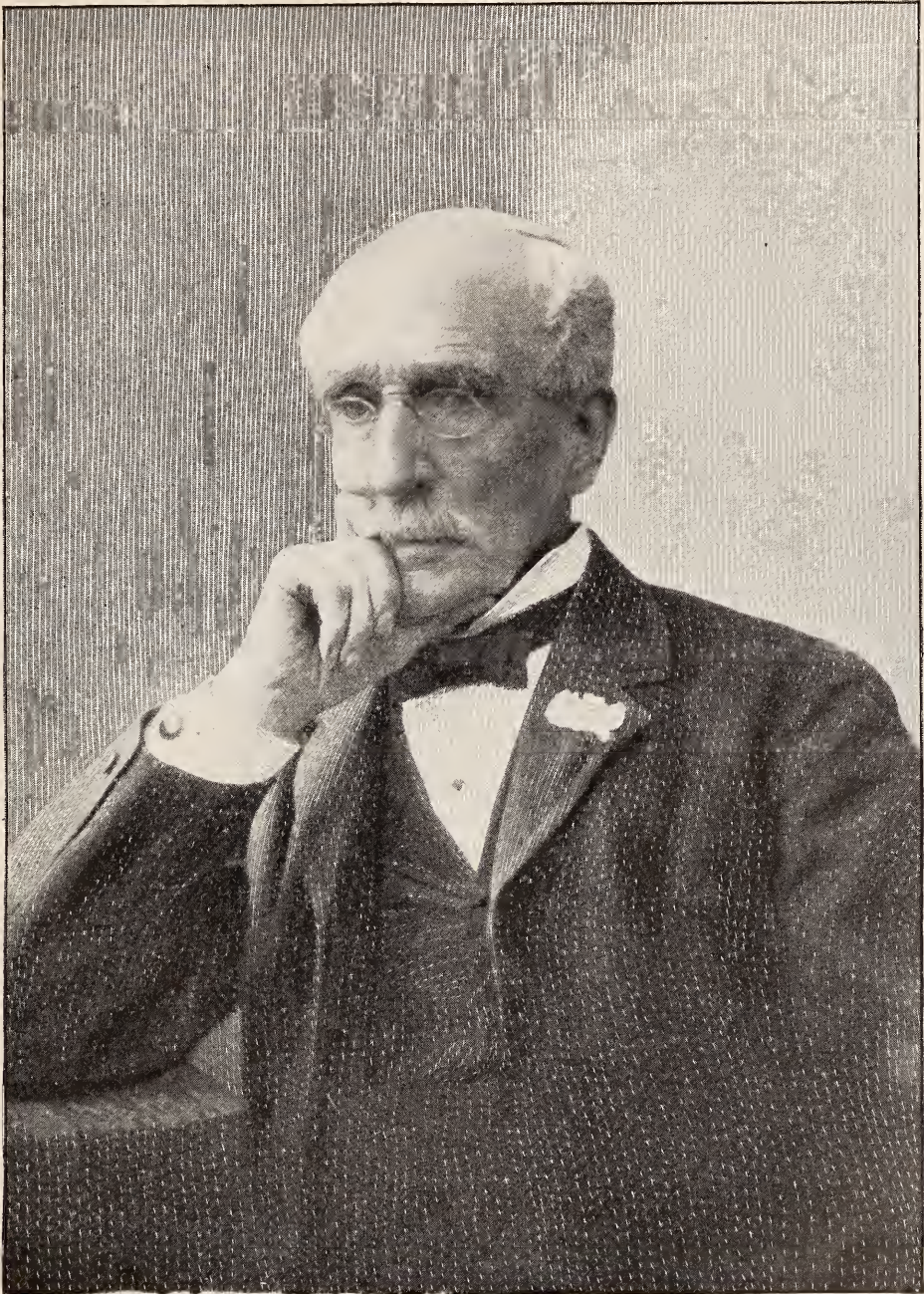
Upon the organization of the engineer corps of the navy by Congress, the grade of engineer-in-chief was established, and a man from civil life appointed to it. Soon after this the *Missouri* was ordered home to Washington, to test a novel design, a horizontal smoke pipe, and because Mr. Haswell, the chief engineer, would not agree that the scheme was practicable and that two pipes of  $3\frac{1}{2}$  feet in diameter were equal in capacity to one of 7 feet, he was held to be disrespectful to his superior officer, and suspended from duty. Upon the trial of the pipes,

it was manifested that Mr. Haswell was correct, and he was told that as soon as the old pipe was restored the vessel would proceed to the Mediterranean, and that if he would apologize for his "insubordination" he would be restored to duty; to which he replied: "I prefer to submit to injustice from others than do it to myself. I decline an apology, as I owe none."

He was then detached, and very soon after appointed to design and superintend the machinery for four revenue cutters, and shortly afterward that of a steam sloop at Pittsburg, Pa. In 1843 he was ordered to Washington to discharge the duties devolving upon the engineer-in-chief, who was officially ignored, and in 1845 he was promoted to that position, which he held until 1851, when President Fillmore appointed a civilian to supersede him, but restoring him his rank as senior chief engineer. In 1848 Mr. Haswell was a member of the board that designed four steam frigates, one of which was the well known *Powhatan*.

In 1850 he was ordered to the Mediterranean, but, as his health seemed to preclude such service, he was condemned by a board of surgeons, but notwithstanding this, an acting chief clerk of the navy department, from personal animosity, refused to acknowledge the decision of the board. Mr. Haswell proceeded to the Mediterranean, but soon after returned home, having been declared unfit for active service from ill health.

A professional feat of exceptional character was the design by Mr. Haswell, in 1847-48, of the entire engine and boiler equipment of the United States steam frigate *Powhatan*. Owing to a lack of professional and clerical aid, and the urgent requirements of the service and the contractors, Mr. Haswell was compelled to proceed with the design and details of both engines and boilers without a general design, and he personally designed every detail and made the working drawings with his own hands in the intervals between attention to necessary duties of his office as engineer-in-chief of the navy. And with this it should be stated that the design of the engines was novel in some parts, and wholly novel in the fact that the engines were set in wrought iron frames,—the first construction of its kind. This feat is unprecedented in designing work of such magnitude, and is historically so recorded, and, considered with the remarkable success of the *Powhatan's* engines, furnishes a valuable index to the rare professional accomplishments of Mr. Haswell.



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CHAS. H. HASWELL,

THE OLDEST ENGINEER IN ACTIVE PRACTICE.

Prior to 1839 the construction of all steam boilers was restricted to the ordinary merchantable plates of metal of uniform dimensions; but when the boilers of the United States steam frigates *Missouri* and *Mississippi* were designed, Mr. Haswell laid them down full-size on the mould loft floor of the navy yard at Brooklyn, and defined the dimensions of each of the required plates to suit their location in the boiler;

and in accordance with this, they were rolled and trimmed. This was the first trial of such a proceeding and one that is now of universal practice.

In 1893 Mr. Haswell retired from the position of surveyor of steamers for the marine underwriters of New York, Boston, and Philadelphia, which position he had held since 1851. He designed and located the buildings on Hoffman Island, in New York harbor, the crib bulkhead at Hart's Island, the foundations of several of the large buildings of New York City, and supervised also the testing of the capacity of the water works at New Bedford and Chicago. He is now consulting engineer for the Board of Public Improvements of New York, and in addition thereto is directing and superintending the extensive constructions and improvements at Riker's Island, near New York.

Mr. Haswell, as already mentioned, is also the author of an engineers' and mechanics' pocket-book, now in its sixty-fourth edition, and of a text-book on mensuration and also on book-keeping, besides a volume entitled "Reminiscences of an Octogenarian, of New York City, 1816 to 1860."

In 1897 he attended the convention of the Institution of Naval Architects of Great Britain, at which were professional representatives of every civilized nation, and at this he was declared to be the oldest living engineer in the world.

At the last annual meeting of the Institution, a paper by Mr. Haswell on "Reminiscences of early marine steam engine construction and navigation in the United States," was read by the secretary, and the president, the Right Hon. the Earl of Hopetoun, G. C. M. G., said in reference to it: "Gentlemen, may I remind you that Mr. Haswell, the author of this paper, is, I fancy, about the oldest practicing engineer in the world? He was chief engineer of the United States navy at the time Her Majesty came to the throne, and that was not yesterday. I may also remind you that he was present at the International Congress held about a year ago, and was about the youngest of us,—he was here, there, and everywhere. I hardly supposed there would be any discussion on this paper, which is a record of facts; and I, therefore, propose that the secretary be authorized to send our best thanks to our veteran friend for his kindness in sending this paper over."

# THE PROPER CARE OF PACKING IN JOURNAL BOXES.

ITS IMPORTANT RELATION TO SUCCESSFUL LUBRICATION.\*

BY H. C. M'CARTY.

An attempt to curtail the proper care of journal boxes at once affects the service and its successful and thoroughly safe operation, the effects of which extend from the president down through the entire management until it reaches the men assigned the duty of the care of packing and oiling the journal boxes. It would, therefore, be a reasonable claim that this branch of the work on railroads is one of the most important, if not the most important, as a car can be run that has not been thoroughly cleaned or repainted or varnished, but it cannot be run with a hot journal, which may be due in a great measure to the neglect in this branch of the work.

Too much importance cannot be attached to this branch of railway work, in having systematic methods and intelligent and reliable men to perform this service. To accomplish these ends it would appear as a wise and up-to-date policy to make a specialty of following up all the details of this work, as well as the care in the selection of intelligent men, as in all branches of the mechanical sphere the most successful are those that make a specialty of some one of the several branches.

In this connection, it would seem proper to refer to the volume of the work in the care of packing in journal boxes. When we refer to recent statistics which show that the number of cars in the United States at the present time has reached 1,300,000, making 10,400,000 journal boxes to maintain, a general idea of the magnitude of this work can possibly be realized, and in view of this the officers of the railways who can give more than passing attention to this branch

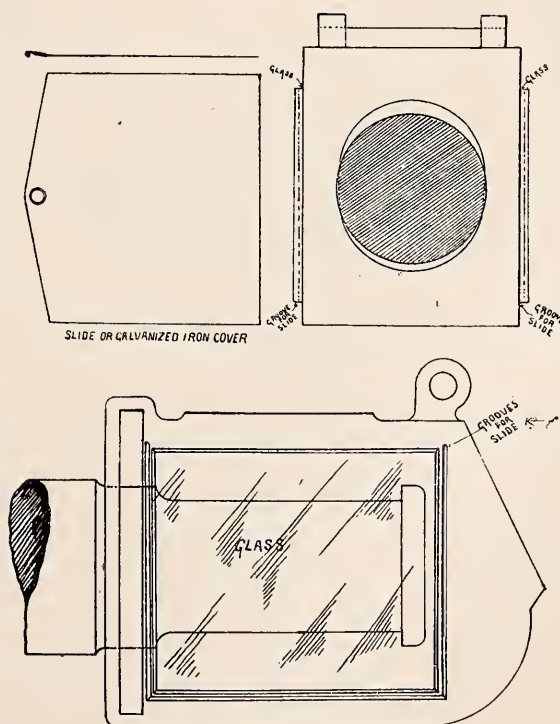


FIG. 1.

Galvanized iron box for demonstrating effect of various methods of loosening up packing.

\*From a paper presented before the Central Railway Club at its January meeting.

of the service by fully providing the best known facilities for the work, and rendering such assistance to the men responsible in this department, will, I am sure, find it greatly to the interests of the railway with which they are connected.

As a better means of interesting the men directly engaged in the care of packing and oiling cars, especially at terminals and yards where opportunity is given to give special attention to the packing prior to oiling, I desire to call attention to a model journal box which I have here (see Fig. 1), the special object of which is to educate the men up to the most efficient means of thoroughly maintaining the packing in boxes, which is of greater importance than the mere adding of oil to the box without regard to the condition of the packing. The principle of the box is such as to enable the men to make a practical demonstration of the exact effect of their method of stirring up the packing in a box, and if their methods are in any respect deficient, they may also observe the effects of a proper

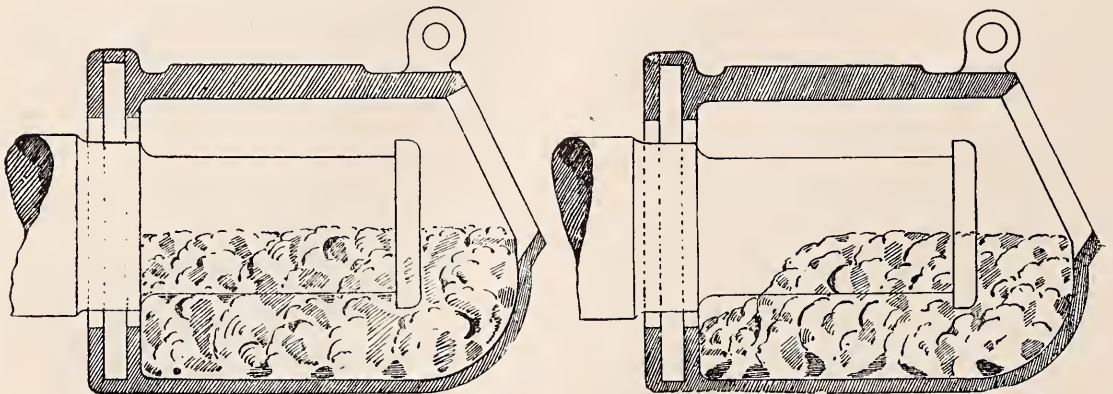


FIG. 2.

FIG. 3.

Showing proper height of packing.

Showing bad condition of packing at back end.

treatment of the packing, especially on the sides and rear of box, which portions are quite commonly neglected, and by thus practically demonstrating the bad and good effects with suitable packing tools, the interest of the average man may be awakened and the effects of his work greatly improved. Efforts in this or some direction of this kind, are a necessity if we may hope to improve and secure more satisfactory service, as I fear that on many roads the details of this work have not been given sufficient serious and personal attention.

Fig. 2 illustrates the height of packing in a box that has been found to produce the most satisfactory results. It will be seen that this illustrates the top line of packing to correspond about with the center line of the journal, thus leaving the packing entirely clear of the lower edges of the brass, which is also a desirable condition, and it also shows the pack-

ing in the front end of the box to be slightly below the opening in the box, the object being to prevent waste of oil out the front of the box; and, further, any additional packing in excess of this in the front of the box will be practically of no value.

Fig. 3 illustrates the shape packing will assume in the rear of the box when not properly maintained at terminals where opportunity is given for this work. From this it will be seen that the packing is not in contact with journal at rear end of same; this is caused, in some cases, by not packing the back end of box firmly enough, and also, more especially, owing to improper treatment of the packing on the sides and rear portions of box at terminals prior to oiling, in combination, also, in some cases with a lack of packing tools well adapted for accomplishing effective results in the least possible time. This condition of packing is further shown in the model box, the object of which, as previously stated, is to demonstrate beyond question the effects of proper and improper treatment of the packing, and serve as a better means of interesting and educating the men engaged in this work. It will be observed that by the use of glass sides in the model box the entire journal is exposed to view and also clearly shows the condition of the packing the entire length of the journal and at the back of the box. A more important feature, however, is that it clearly shows to the man to be instructed in this work the exact effect of his method of stirring up the packing prior to oiling. If the practice he has followed does not restore the packing on the sides and rear of box to proper relation with the journal, this will be clearly and positively demonstrated to him, as well, also, as the effect of such slight change that may be necessary in his methods to produce desirable results, and effect the most elastic condition of the packing, so that the oil in the box may be freely conveyed to the journal. As this is a practical demonstration, I think it will be conceded that it will serve as a superior means of interesting the men in their work, as compared to verbal or written instructions concerning the same. If this is the case, it is quite logical that the men will become more expert in the performance of this work and better results can be reasonably looked for.

The necessity for treating the packing in this, or a similar manner, we think will be quite apparent to anyone who will make the most casual observations of the solid non-elastic condition the packing assumes, through a failure to give it proper attention at the back end of the box, as previously described; and when in this condition, it not only fails to convey oil to the journal, but actually becomes in time hardened and glazed, the effect of which is to wipe or scrape off any oil that may reach

the journal from the forward part of the box. The lubrication, therefore, is so retarded as to, in a short time, result in the heating of the journal. At the same time that this condition exists in the back of the box, the appearance of the packing near the front of the box may be very good, and a man that gave attention to the packing just prior to journal heating would be under the impression that the treatment he gave it was all that possibly could be done. We, therefore, consider that the treatment of the packing as demonstrated by the model box, and also described, is of much greater importance than the mere adding of oil to the box.

Fig. 4 illustrates a journal box having an excessive quantity of packing, which is not only a wasteful practice, resulting in a loss of oil out of the ends of the box, but is also detrimental to good results, as by this method of so completely filling up the box with packing, a condition is caused that frequently results in threads or small particles of packing becoming caught between brass and journal. This occurs by violent shocks produced in switching and application of brakes, when the relation between brass and journal is sufficiently disturbed to permit

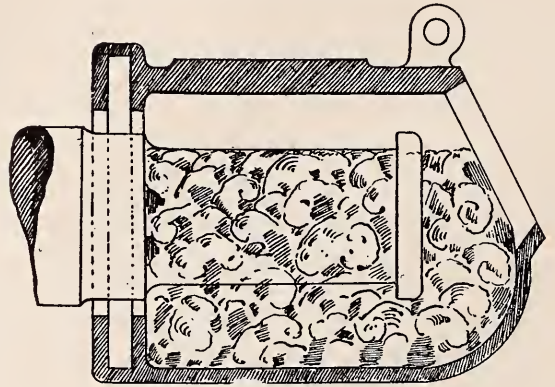


FIG. 4.

Showing excessive quantity of packing.

small particles of waste being caught under the edge of brass and journal. This is particularly true when the packing is pressed up close around the brass, as in Fig. 4. This is not an infrequent cause of very serious cases of hot driving boxes on engines. The effect is that the oil is wiped off the journal and the surface thus becomes dry, resulting in heating in a comparatively few minutes. It is therefore apparent that in stirring up packing, the top portion should be entirely below the edge of the brass. In stirring up packing as described, it should be understood clearly that all that is required is a slight loosening up of the top surface of the packing on each side of the journal, keeping the back of the box well closed up by maintaining packing at the proper height. The top layer of packing will thus be kept in a light, elastic condition next to the journal, which is most desirable in order that the oil may be freely conveyed to the journal from the more solid portions of packing underneath. A general disturbance of the packing should be avoided, as no good results can be secured by this method.

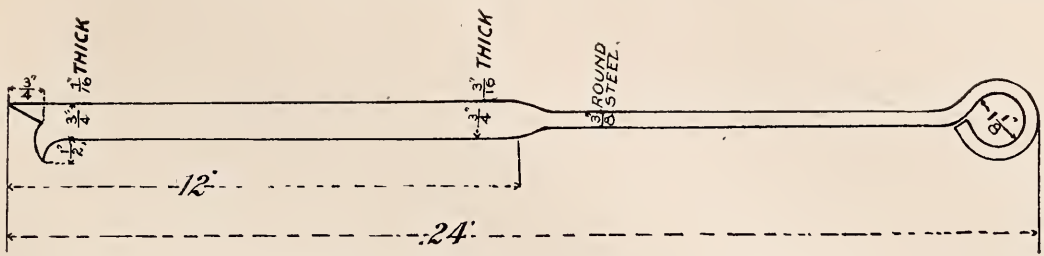


FIG. 5—Tool for loosening up packing in journal boxes.

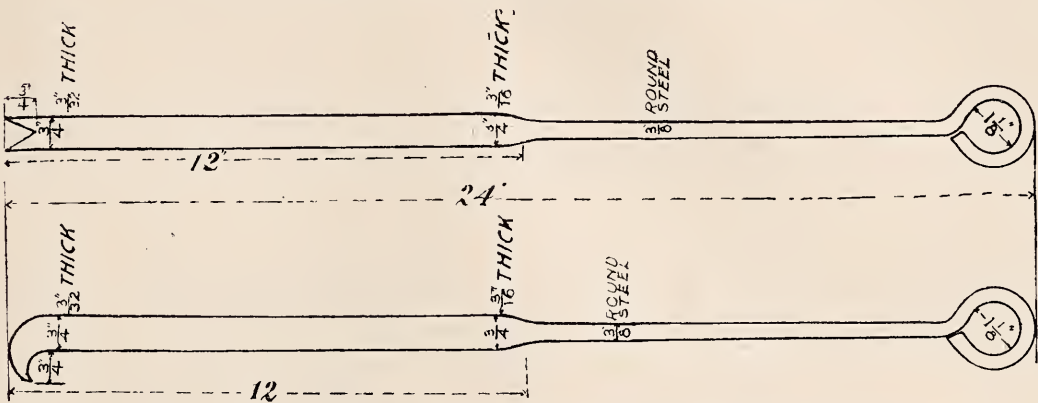


FIG. 6—Tool for packing journal boxes in shops and shop yards.

As suitable tools for this work are as essential as competent and skillful men, I show a packing tool (see Fig. 5) made of steel, that has been found well adapted for the work of slightly stirring up packing in journal boxes at terminals and yards where time is given for this work. This will apply to both passenger and freight cars. By reason of the custom of some men with other forms of packing tools they may not at first appreciate the value this form of a tool will be to them, but I think by some consideration and trial it will be found very efficient. Its efficiency depends in a great measure in following out the practice of stirring up packing as described. For illustration: It will not be desirable for the practice of placing it down under the entire bulk of the packing at the sides of the box, as some men follow. This practice I think quite questionable, for the reason that when this is done the entire bulk of packing on the side of the box is raised bodily from the bottom of the box, and I should like to have you consider carefully, if this is the case, how long it will likely remain up in that condition after the car is in motion, when the journal box is subjected to innumerable blows from frogs and switches. Is it not quite logical reasoning that it will all settle back in a short time in a non-elastic condition? This tool can be known as the combination packing tool, as it combines the features of the commonly known packing iron and hook. It is therefore only nec-

essary for the men to carry the one tool in performing this work in yards, the hook side of the tool being necessary to remove particles of dry packing when found, or, in many cases, surplus packing.

In Fig. 6 there is shown a set of packing tools intended for use in shops or shop yards, where the entire re-packing of boxes is done, and we therefore consider this operation entirely distinct from that of stirring up packing by inspectors at terminals, and consequently a slightly different form of tool for the work will be found desirable, as is the case with the great variety of tools required by skilled mechanics in their various occupations. As the practice of some is to have a hook about eight inches from the handle end of the packing tool to facilitate the opening and

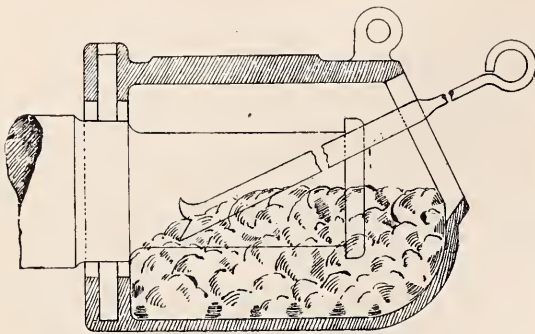


FIG. 7.

Showing position of packing tool when used to loosen up packing in each side of journal.

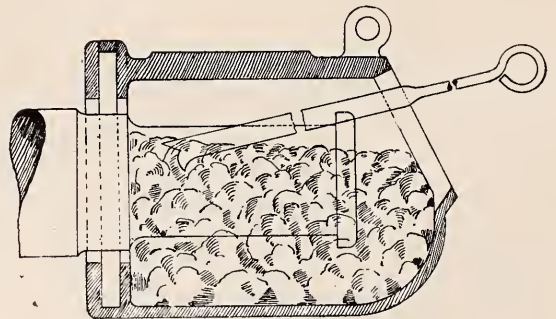


FIG. 8.

Showing position of packing tool when used to remove surplus packing.

closing of box lids, it should, of course, be understood that when this feature is a desirable one, it should be added to the tool. The "V" shaped end of these tools affords a ready and effective means to lightly loosen up the top layer of packing, which is the end most desired, so that this portion of the packing may be in the most elastic condition possible. Figs. 7 and 8 show the position of packing tool when used as described.

In this connection I desire to refer to the quantity of waste and oil in a journal box when packed in the usual manner. Each box contains from  $1\frac{1}{4}$  to  $2\frac{1}{4}$  pounds of waste and from  $4\frac{1}{2}$  to 10 pints of oil, depending upon the size of box, varying from  $3\frac{3}{4}$  x 7 inches up to the  $5\frac{1}{2}$  x 10-inch box. It will thus be seen and appreciated, I believe, that to properly utilize the oil that is in the box, the packing next to the journal should be maintained in as elastic condition as possible. It should be further understood that the oil as it passes between the surfaces of the brass and journal is not actually consumed, but is deposited

to a degree again on the opposite side of journal from which it ascended for use again an indefinite number of times.

In numerous tests made by various responsible railways, a very unusual high mileage has been made from the one re-packing of the box or boxes, without the addition of any oil during the test. In some of these tests the mileage has been from six to twenty thousand miles. During the test the packing was examined daily and maintained in an elastic condition, as previously described, no oil, however, having been added during the test. Reference to these tests and results is only for the purpose of illustrating the possible mileage in the oil contained in a journal box when subjected to a special test as referred to, and is not for the purpose of conveying the idea that such results are obtainable under the average conditions and treatment on the best regulated roads, but, instead, to indicate under reasonable conditions, which are readily obtainable through careful and systematic methods, results far superior to what we may now be obtaining under the average practices.

I desire, in conclusion, to emphasize the fact that the most important part of the work of lubrication is the skillful and proper maintenance of the packing in the box, so that the most elastic condition may be secured and maintained.

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## BENDING TEST OF AN M. C. B. ARCH BAR TRUCK.\*

BY PROF. C. V. KERR.

Some months since, some tests were made at Armour Institute of Technology, on an M. C. B. arch bar truck, which are thought to be of enough interest to bring before the Club.

The load was applied at the center by short lengths of I beams, so placed as to distribute the load in the ordinary way. The car axle was represented by a short piece of shaft, supported at each end, and in turn supporting the end of the truck with the brass in the usual position.

Three series of loads were applied to the truck with the purpose of ascertaining its behavior, both under load and upon release. The loads were applied by means of a 200,000-pound Riehle testing machine,

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\*Paper presented at the March meeting of the Western Railway Club.

which was in good order and accurately balanced. The measurements of deflection under load, were made to 0.01 inches by scales at each side of the truck.

The first series began at 4,900 pounds, the initial load being made somewhat high in order to remove the set due to taking up the slack in bolts and fittings. A gradual increase in load to 45,000 pounds resulted in curve (1) Fig. 1; on release an amount of set represented by *ab* was found.

The second series of loads resulted in curve (2) Fig. 1, the highest

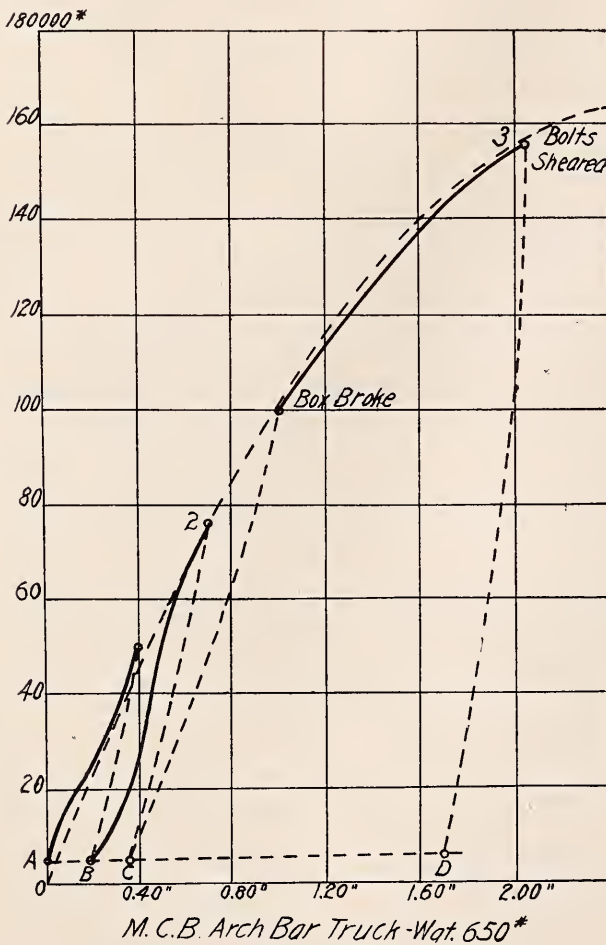


FIG. 1—ARCH BAR TRUCK TEST.

load being 75,000 pounds, with a set *ac*. Then, without noting deflections, the load was increased to 99,500 pounds, at which the journal box broke. A further increase of load, to 155,800 pounds, gave curve (3) Fig. 1; and the tests terminated with the shearing of the bolts, as shown in Fig. 2. The boxes crumbled in the manner indicated. On account of the method adopted of supporting the ends of the truck, the boxes were cut so as to be materially weakened, and, consequently, failed sooner than they otherwise would.

With a truck loaded in this manner, the upper bar is in compression and the tendency is to straighten out. The middle bar is in tension, and tends to double up; the lower bar is also in tension with a like tendency. The result of the opposite forces in the upper and middle bars of the truck is the shearing force, which finally causes the failure of the bolts.

The relative movement of the bars is clearly shown by Fig. 2. The attention of those who are intrusted with the design or loading of such

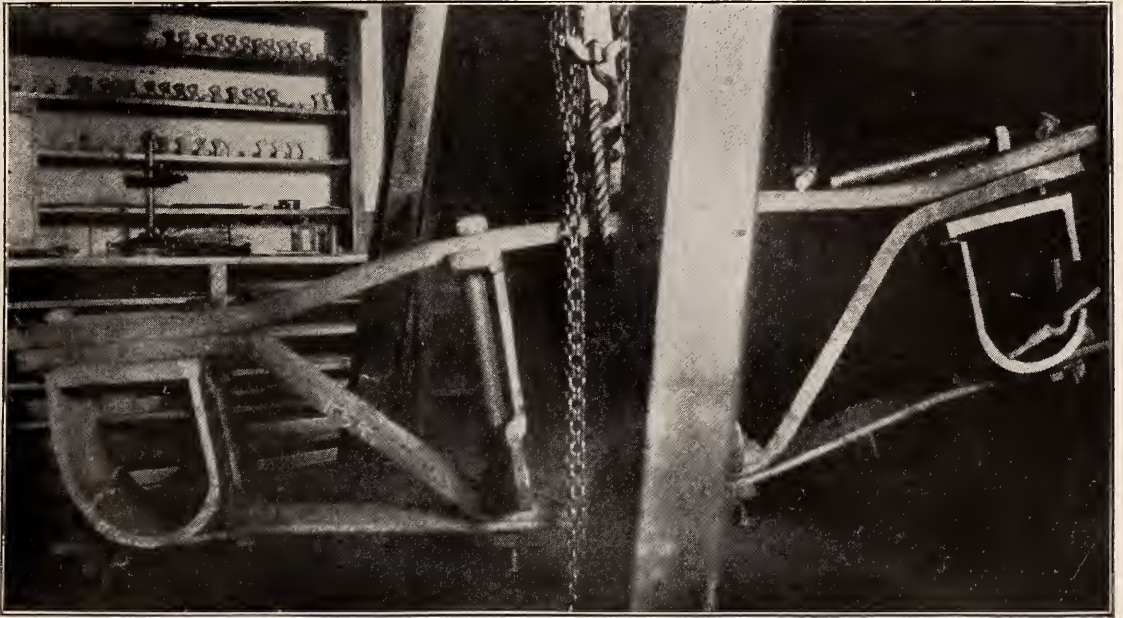


FIG. 2—ARCH BAR TRUCK TEST.

trucks is especially called to this shearing stress, as all of the tests of built up beams made at the Institute have resulted in ultimate failure of the beam by shearing of bolt or rivet connections. It seems to be a point to which designers give little or no attention.

The construction indicated by Fig 3 is found on tender trucks, and occasionally on freight car trucks. It is a much stronger design, since



FIG. 3.

FIG. 4.

ARCH BAR TRUCK TEST.

the lug on the end of the middle or tension bar gives direct support to the upper bar. It will cost more to make the bar in this way, but the middle bar has far more tensile strength than is called for, and possibly enough material could be saved to offset the extra cost. And if made thinner than the upper bar, the construction in Fig. 4 could readily be adopted. For thin bars it would probably be the better of the two.

## THE CAR FOREMEN'S ASSOCIATION OF CHICAGO.

### MARCH MEETING.

The regular meeting of the Car Foremen's Association of Chicago, was held in the Monadnock Building, Chicago, March 8, 1900.

President Morris called the meeting to order at 8:15 p. m. Among those present were:

Bates, John	Emerick, W. H.	Kremer, Wm.	Schultz, A.
Bates, Louis	Gardner, L. S.	Keebler, C. F.	Spohnholtz, J.
Bates, G. M.	Gruhlke, Edw.	Morris, T. R.	Sharp, W. E.
Bates, B.	Guthenberg, B.	Mattes, J.	Saum, C. L.
Blohm, Theo.	Groobey, Geo.	Marsh, Hugh	Saum, G. N.
Buker, J.	Hunt, T. B.	McAlpine, A. R.	Stripp, R. G.
Barton, J. E.	Hansen, A. P.	McEwen, J. H.	Smith, R. D.
Bundy, C. L.	Helwig, H.	Miller, Wm.	Schultz, F. C.
Bourell, J. W.	Harvey, H. H.	Norman, F.	Thiverge, J. C.
Bossert, Chas.	Hall, W. B.	Nordquist, Chas.	Wensley, W. H.
Cardwell, J. R.	Johannes, A.	Olsen, L.	Wentsel, Geo.
Callahan, J. P.	Jones, R. R.	Rieckhoff, Chas.	Wolfe, Chas.
Constant, E. J.	Krump, M.	Reinhard, F. B.	Wilson, J. F.
Deen, Chas.	Kline, Aaron	Richardson, Wm.	Weschler, Henry
Depue, Jas.	Kline, J. C.	Robinson, Jay G.	Williams, Thos.
Etten, L.	Kroff, F. C.	Shaw, M.	

Secretary Kline reported the following new members: Chas. Collier and J. H. Ball, C., I. & L. Railway; J. C. Miller, F. W. Cox, F. L. Alcott, Chas. Hughes and R. H. Darlington, of the C., M. & St. P. Railway; C. A. Schroyer, C. & N. W. Railway; J. E. Barton, P., C., C. & St. L. Railway; J. B. Julian, C. T. T. Railway; Frank Norman, Louis Bates and Henry Wodrich, C., B. & Q. Railway; Geo. C. Murray, Sterlingworth Railway Supply Co.; W. E. Coffin, National Malleable Castings Co.; Thos. Madill, Sherwin-Williams Co.; F. E. Miller, Gutta Percha and Rubber Manufacturing Co.; W. J. Walsh, Galena Oil Co.

Secretary Kline reported the receipt from Mr. Dennerle, secretary of the Car Foremen's Association at Cleveland, a report of the meeting which they held February 5. He had also received a notice of the formation of a Car Foremen's Association at St. Louis, which was organized with fifteen charter members. He had received a letter from the secretary of the Interstate Commerce Commission, stating that he thinks the Car Foremen's Association can do a great deal toward maintaining the safety appliances on freight cars in proper condition, and assist the commission greatly in this respect.

President Morris: I regret to say that Mr. Grieb, chairman of the Committee on Revision of the M. C. B. Rules, is sick, and not able to leave his home, and he wrote me requesting that the discussion of his committee's report be laid over until the April meeting and if there are no objections this will be done. We will pass to question No. 2—

### SHOULD OWNERS BE CHARGED FOR TURNING DOWN A TAPERED JOURNAL?

Mr. Parish was to open the discussion, but is absent. He, however, wrote the Secretary a letter, embodying some of his ideas. Will the Secretary please read.

Mr. Parish (read by Secretary): Section 16 of Rule No. 3, which refers to defects of axles which justify renewal, covers only the following defects: Axles broken, seamy journals, collars broken or worn out. In addition to these defects, should not tapered journals be

added to the section? The fact that taper journals are the cause of a great many hot boxes, and consequent cut journals, has brought up the question whether it would be best to make the owner responsible for cut journals when it is proven that the journal was tapering. This is a concealed defect, and as such should be chargeable to the owner. A new brass applied to a taper journal will not have a good bearing, and is very liable to heat before it is properly seated. This is particularly true of brasses which are lined with a hard bearing metal. It would follow that the amount of the taper would have to be defined in order to avoid misunderstanding. In order to bring this point up for discussion, I would recommend that if a journal be worn, tapering 1-16 of an inch or over, the owner be charged with turning up axle, or renewal of the axle if it should be below limit when turned. This would, no doubt, bring up the question that roads would charge for all cut journals. This should not be an argument against this change in the rules, as we would be taking the position that our neighbors are dishonest.

President Morris: You are all probably familiar, more or less, with taper journals, and the bad effects of allowing them to run. The question as to whether a taper journal should be turned down and charged to the owner, is one that is attracting a good deal of attention lately, and I think that every one here in the room has some views on the subject that we would like to hear.

Mr. Miller: It seems to me that when the operating road finds it necessary to renew an axle as a measure of safety, on account of tapering journal, the owner ought to be—in fact, generally is—willing to pay for the expense. At least, we always did when we were charged for turning down taper journals. Those cases are very few. Now, in all cases where it is necessary to remove the axle on account of tapering journal, the party doing the repairs should be required to state on the bill what the axle was removed for and the amount; that is, to what extent the journal was tapering, and in no case should an axle be removed on account of taper journal as long as it is running cool; and the M. C. B. book of rules ought to give instructions as to the amount of taper allowable before the axle can be considered unsafe for further service in that condition.

Mr. Hunt: I do not know as we have turned down many tapered journals; if we have, they have not come to my notice. Still, I believe there are conditions where a tapered journal is chargeable to the owner. For instance, you may take a pair of wheels out of a car for defects other than the axle, and should you find this axle to have a taper journal and you deemed it necessary to true it up, you ought to have the privilege of doing it, I think, and charging it to the owner, because you will all admit that the journals ought to be true. Of course, there are other conditions in which a taper journal might be found that possibly should not be charged to the owner. For instance, when a pair of wheels are removed on account of a cut journal, you might find this journal tapering. It may have become tapering on account of being hot. Now there might be a question whether that would be chargeable to the owner. We hardly think it would; in fact, I do not think it has heretofore been charged to the owner, especially if the journal was found cut, and in many cases of hot journals the journal is found cut; but if you had a case where the journal was not cut at all, and the box hot, and you found the journal tapering, it seems to me that trueing up that journal should be charged to the owner. But it is something that requires a good deal of judgment to be used, and it ought not to be understood that with every hot box we get hold of, where the journal is tapering, we should charge the trueing of the journal to the owner. I hardly think that would be right, where the journal is cut.

Mr. Deen: I have had only one case of that kind, and I am satisfied that the cause of the journal running hot was a taper journal. We put in three different brasses in getting the car, under load, ten miles, and had a good deal of trouble with it. After we got it unloaded, we found the journal smooth as could be, but about 1-16 inch taper, but it went home all right, causing no further trouble.

Mr. Smith: This question is something I have been up against a good many years, and I would like to know whether I understand it correctly. When you speak of tapered journal we would infer that the journal is smaller at the outer end than the inner end. As I understand this question, it means the reverse. It means a journal worn smaller at the inside end. Is that correct?

President Morris: I do not believe there is anything in the question to show that distinction. It may be tapered at the front or back end, usually at the back.

Mr. Deen: The case that I referred to was smaller in the center—1-16 inch smaller there than at either end.

Mr. Smith: I have had considerable experience with journals, and unless the journal has been misused by running hot, I have yet to see one smaller at the outer end, or smaller in the center. My experience has shown them to be smaller at the inside end of journal. This is due, I think, principally, to the dust entering from the dust guard end of journal box more than from the outer end, and, perhaps, from its getting less lubrication at the inner end. But it seems to me that the conditions producing this result are owner's defects, from the fact that there are other causes for the journal wearing smaller on the inside. There is greater pressure on the inside end of the journal, and this is the result of the truck being out of square and the box not bearing evenly on the journal. That has been my experience, but I must say that I have not seen very much of that in freight service. There has, however, been a good bit of it in passenger service. But I will have to take issue with Mr. Parish, if I understand his communication correctly, in that he says that this occurs more with hard bearings than with soft bearings. I think that the reverse is the case,—that a lead lined or a filled bearing will wear a journal much more rapidly than a hard bearing, because it is in the nature of things for it to do so.

Mr. Sharp: I have noticed a few journals that were worn taper at the back end. I am of the opinion, and always have been, that a journal worn tapered toward the front end, or toward the center, was caused by some unfair usage, by a broken brass or running hot at some time and not being discovered until the wheels were removed for some other defects. I think Mr. Smith has given a very clear explanation as to what causes the reduction of the journal at the back, and it is, in my mind, an owner's defect, and I think they should stand the expense of truing up the journal.

Mr. Jones: I have seen only one or two cases. We had one case in passenger service where the car continued to run hot, the wheels were removed and we found that the journal was smaller next to the fillet than in front. When wheels are removed in such cases I think they are owner's defects and they should be charged for turning up the axle.

President Morris: Don't you find most of that in passenger service?

Mr. Jones: Yes, sir; none in freight.

President Morris: Can you account, Mr. Smith, for there being more of this trouble in passenger service than in freight, if such is the case?

Mr. Smith: My experience with tapered journals is that they have always worn on the inside end, and I have never noticed a case in freight service. I think a majority of our passenger journals are worn in this manner. I believe it is because the passenger cars make more and faster mileage than the freight cars. I believe that the form of the truck on the freight cars is less liable to swing out than are the pedestals on the passenger truck. It is this springing out of the pedestals at the bottom on passenger trucks that tips the box over and wears the brass uneven.

Mr. Kroff: I would say that what I have seen would be mostly on pedestal trucks, because they have a tendency to spread at the bottom, while the rigid truck on freight cars does not do so. I have seen very few taper journals lately. These mostly seem to be hollow in the center.

Mr. Marsh: It seems to me that the ground has been pretty well covered. We have

had lots of good experience which would show why journals should become tapering. It seems to me there are some cases where it is an owner's defect, but I believe we have got to be guided by the conditions in each particular case as to who is responsible.

Mr. Bates: I have not had any experience with tapered journals, but if they are caused as has been stated here, I believe they should be properly chargeable to the owners.

President Morris: Do you have any cases of hot boxes caused by taper journals?

Mr. Bates: No, sir. I have noticed a good many hollow journals, journals that were smallest in the center, but I have not seen any taper journals.

Mr. Cardwell: I think taper journals are an owner's responsibility, but I must disagree with Mr. Parish in his idea that there should be a Master Car Builders' ruling making cut journals, which are often taper, chargeable to owners, for the reason that the same causes which cut the journals may subsequently taper them; and, furthermore, it would lay the foundation for a whole lot of argument, and when a railway company removed the axle with a cut journal for which they might justly be held responsible, they would have a chance to shift the responsibility and claim that the journal was tapered.

Mr. Callahan: I have not had very much experience with tapered journals, but think as to responsibility that it is altogether owing to how the journal was tapered. If the taper is caused by a hot journal, I do not think the owner should be charged for it; if it was from the truck being out of square, or anything of the kind, it should be charged to the owner.

President Morris: Do you find many on freight cars, or are they on passenger cars only?

Mr. Callahan: Principally on passenger cars, and if you take it up you will find it is on account of truck being loose or out of square.

President Morris: I will ask Mr. Bates, as a member of the committee on recommended changes in the rules, whether this was considered?

Mr. Bates: It was talked of, and we concluded it would be a good subject for a topical discussion at the noonday meeting of the Master Car Builders' Association; and we did not feel that we ought to recommend that it be incorporated in the rules.

President Morris: Is it the wish of the Association that we be put on record in any way with regard to this question? If not, we will pass to the next question, No. 3: "Is the present M. C. B. coupler more destructive on the draft gear of cars than the old link and pin drawbar? If so, what steps are being taken to prevent damage?" Mr. Kehm, of the Illinois Central, was to open this discussion, but I see he is not here.

## THE M. C. B. COUPLER AND DRAFT RIGGING FAILURES.

Mr. Marsh: I believe that in taking this up we are getting up against something which will bring forth all kinds of remarks from all kinds of people. I believe the draft rigging on the cars receives more injury from the M. C. B. coupler than it does from the old link and pin drawbar, not because of any defects in the coupler, and not because it has not been applied properly,—but simply because the engineers are becoming more reckless. When the engineer knows the switchman is standing off in the background, he is less careful than he was when he knew the switchman was in between the cars.

Mr. Jones: I am of the same opinion as Mr. Marsh. The engineers have no mercy on the cars now in switching, whereas before they had to look out for the switchmen to see that they made the coupling. Now it is "go ahead" and "back up," and no attention paid to the switchmen at all. They pull her wide open and let her go. And the draft rigging suffers.

Mr. Deen: I do not quite agree with Mr. Marsh that the engineers cause the trouble. I think it is the switchmen. It used to be, with the old link and pin drawbar, that they had to go in between the cars and make the coupling. Now when they set the knuckle they

give the "high ball" and the engineer is supposed to obey them and he gives them a kick, consequently they come together with knuckles open and strike in such a way that one, or the other is bound to be broken. I do not believe the engineers are to blame.

Mr. Sharp: I do not know just what Mr. Kehm meant to bring out. It seems to me that the link and pin drawbar is a thing of the past. If it is a fact that the draft timbers suffer from the effect of the M. C. B. coupler, then the only good remedy I know of is to get a malleable iron draft timber. I think the suggestion that the switchmen and the engineers are careless, perhaps is a good one, but we will agree that it would be impossible to limit the switchmen or these engineers in the way they handle the cars. There are so many cars to handle and they have got to handle them rapidly in order to get the work done. The M. C. B. coupler, no doubt, stands more severe shocks than the link and pin drawbar would. We know that to be so, from the very fact that we do not find so many of them broken as we did the link and pin drawbar. You seldom see a car going through a switching yard today with the drawbar broken, where it used to be a common thing to see several cars in one train chained up. I do not know what steps could be taken to remedy the evil other than to strengthen the draft rigging, and I believe that railway companies are working to that end.

Mr. Hunt: From my observation I feel like taking issue with some of the gentlemen. I do not believe that the draft rigging suffers as much as it did before. I believe it is protected more by the M. C. B. coupler. There were formerly all styles of the common drawbar, wrought iron, cast, malleable—almost anything and in all shapes and sizes—and many of them did not have stops or brackets, so that the most of the blow came on the draft rigging. Now it is a fact that nearly all, if not all, of the M. C. B. couplers have stops, so that when there is a hard shock the stop comes against the end sill and the end sill takes a good deal of the blow. The M. C. B. couplers are all made with a good face, we may say good buffing face; it is large, and if everything is in order they stand quite a shock without doing much damage, and I do not believe, from the observations I have made, that we are putting in nearly the number of draft timbers that we did before. I do not believe we are putting in more than one-third as many as we did before we had the M. C. B. coupler. So far as protection to the draft rigging is concerned, I believe the M. C. B. coupler is superior to the old link and pin drawbar.

Mr. Buker: I think that the M. C. B. coupler is an improvement over the old link and pin drawbar, and do not think it is as hard on the draft rigging as the old link and pin was. I think a great deal of the hard shock comes from the long trains and double headers, which cause a severe strain on the draft rigging in a good many cases, but I do not think there is any way of remedying it except to put an iron draft rigging in, but we are not fortunate enough to have them in our cars.

Mr. Kremer: I think I know it to be a fact that we do not break half as many draft riggings today as we did ten or fifteen years ago, when we had the old link and pin drawbar. The M. C. B. coupler is a safeguard for the draft rigging. Ten or fifteen years ago we had all kinds of drawbars without brackets; all kinds and lengths. Today every coupler has got a bracket and it strikes against the end sill and saves the draft rigging. As far as my experience extends, I know that we do not put in one draft rigging today where we put in fifteen or twenty ten years ago.

President Morris: Does that refer to your own cars?

Mr. Kremer: Everybody's cars. We handle all kinds of cars every day and the draft rigging stands it all right. All they can do nowadays is to knock the ends out of the cars, and that is what they are doing.

Mr. Harvey: My experience has been somewhat limited, but from what I can see I do not think we replace nearly the number of draft timbers that we used to. Of course we put in heavier draft timbers. A great many of our cars have buffers which serve to stand a great deal of the shock.

Mr. Hunt: I think there is a great deal in the remark that Mr. Sharp made when he mentioned malleable iron draft rigging. We may say any kind of a good rigging would do, but I believe there are a great many couplers being placed in a weak draft rigging; in fact, they are being placed in the same draft rigging that was used with the link-and-pin couplers, and some of the riggings have been very weak in years past.

Mr. Cardwell: I know of several instances where companies have equipped their cars with automatic couplers, discarding the old drawbars and using the same draft rigging, and in so doing it was necessary to spread the draft timbers to a greater distance apart; and they did that by re-boring them and putting the bolts nearer to the center lug, leaving the old bolt holes in the draft timbers as they were, and getting the bolts in the new position, thus affording only a very small hold on the draft timbers. These draft timbers so treated would not have stood the strain with the old cast iron drawbar, or drawbar that was removed, and as the draft timbers gave out they laid it to the M. C. B. coupler. It certainly is a fact that cars receive a greater shock in switching, that are equipped with the M. C. B. couplers, than they used to when equipped with drawbars, and the couplers are also heavier. I do not think the weight, though, cuts any figure; but if you have a proper draft rigging, and the coupler is properly applied, I think the draft rigging will last as long or longer than it did with the old link-and-pin drawbar.

Mr. Bates: In talking this matter over with Mr. Kehm, who suggested the subject, he thought, of course, that the switchmen became more careless, and would give the "high-ball" signal, as one of the members mentioned, and the cars would strike a good deal harder than they would if they had to go in between the cars, and I believe that is so. I remember some years ago, when there were only a very few cars equipped with M. C. B. couplers, that it was a common thing when they got a car equipped with a coupler, for the switchmen to say, "It is a Janney; give them the high-ball." Now, on our road we have buffers, and I believe the buffer is a very good thing. I think that a coupler is too expensive an article to use as a buffer as well as a puller. I think it is intended to do pulling and not buffing, and for that reason I think that buffers on cars save the draft rigging a great deal.

Mr. Groobey: I move that it is the sense of the Car Foremen's Association that the present M. C. B. coupler has proved to be less destructive on the draft rigging than the old link-and-pin drawbar.

Mr. Smith: Some of the lines used buffers with the old link-and-pin drawbar, and they were termed "man-killers," but with the introduction of the M. C. B. coupler they were taken off. Our line, however, has seen fit to adopt them with the M. C. B. coupler. They can no longer be termed "man-killers." The men do not have to go in between the cars now to make the coupling. I believe that there is more of an impact required to make the coupling with the M. C. B. coupler than there was with the link-and-pin drawbar, and that the buffers are very necessary on cars equipped with the M. C. B. couplers, because they are not only a protection to the M. C. B. couplers but also to the draft rigging.

Mr. Wentsel: I think that it is not the fault of the coupler that the draft rigging is broken; they hit them harder nowadays than they used to. In fact, sometimes they have to hit them very hard to make the coupling, and sometimes the cars have to come together two or three times before they make the coupling; still, I do not think they are more destructive on the draft rigging than the link-and-pin drawbar.

Mr. Hunt: So far as the breaking of draft rigging is concerned, either with the coupler or common drawbar, I believe there are many draft riggings broken when the fault lies solely with the owner. There are many draft riggings on cars today that originally were not very good, and that have since become very bad while in use, and they are not being kept up in many instances. But, in many cases after they are broken, the party breaking them has to stand the damage. I do not believe that is right. I believe that, with the M. C. B. coupler, there can be a draft rigging put on a car, and should be put on, that would stand the

racket. In the first place, it should stand a good deal because hard blows are given it. I have thought for a long time that the owner of a car should be responsible for the coupler and the draft rigging in a car, providing it was not broken in derailment or wreck. That would force people, and it would be right too, to put upon their cars something that would stand, something good, something equal to the requirements, and it would knock out draft riggings that were poor, and it would also compel the owners of cars to keep up the draft rigging, as it is very important that the draft rigging should be kept up.

Mr. Sharp: I have in mind a line of cars that I used to have considerable to do with, that were equipped with what was called a "cage iron" draft rigging. I guess most of the members know what I mean by that. But I have seen those draft timbers carried from the mill to be put on a car, and broken before they were tightened up. They were sawed down to an inch at the follower strap. When the Interstate Commerce Commission required that so many cars be equipped with couplers each year, those cars were equipped with couplers with a stem through the 14-inch follower, and the followers had 3-inch bearing face in that cage iron draft timber. You will readily see why an M. C. B. coupler would be less liable to break than the draft timbers.

Mr. Miller: Seeing the necessity for some device, which would take up the shocks and blows which the couplers are subjected to, we started some years ago to equip our cars with a draft rigging having double springs in it, and by doing so I find that we have reduced the cost of maintenance of draft rigging as much as 80 per cent. In fact, we have cars that have been in service for three years, and over, that have not had the cost of repairs amount to over 12 cents for the draft rigging, where the common draft rigging would have cost \$1.00 for repairs. I think that with the more powerful engines we have in use, and the way the cars are handled by the switchmen, who have to do three times as much work as when we used the link-and-pin drawbars, that we have to have something to take up these blows to which the cars are subjected, and we have found out that it pays to put in a good draft rigging, which save delays and expense all around.

Mr. Groobey's motion was here put, and unanimously carried.

### BROKEN KINGBOLTS AND ROUGH SWITCHING.

President Morris: The next question is No. 4: "Discussion on broken kingbolts of cars. Is the cause due to defective construction or due to rough switching?"

Mr. Reinhard: I have had a good deal of trouble with broken kingbolts, and I have wondered whether it was due to inferior construction, defective center plates, or rough switching or handling of the cars by the trainmen. It may be possible that some members may think that because of the great number, it is not exactly faulty construction of cars, but a great many freight cars I have seen were knocked off the center at both ends. Now, we have been pretty hard on the trainmen tonight, but I think that is a thing that has been thoroughly proven—that cars receive unusually rough handling.

President Morris: Do you think it rough handling altogether?

Mr. Reinhard: I think it is. I do not see how it can be otherwise. Anybody that has paid any attention to the matter can see how the cars are being handled, and a great many are being knocked off the center and center pins broken. I do not know what could cause it, if it was not rough switching.

President Morris: Have you noticed that the construction of the car has been improved or strengthened in such a way as to provide for this—to relieve strain on kingbolts in any way?

Mr. Reinhard: I do not know that I have. It seems to me that a good many center plates in use today are the same as they were using several years ago. In looking up the reports of cars knocked off center and center pins broken, I find there are a good many light cars.

Mr. Bates: I think that most broken kingbolts are due more to the fact that the center plates are not properly constructed. I find that they break in cars that have the old style center plate—something like a dish—and when the car receives a blow it is very easy to slide off, while on the other cars that have the modern deeper center plates they do not break. I take it from that, that breakages are not due to rough switching but due to improper construction.

Mr. Kroff: Most kingbolts that I find broken are in the swing motion trucks. One-half of them are tipped so badly that you do not know which way it is going when the car is struck. Now, it is the lateral motion in that truck that breaks the kingbolt. I think it is faulty construction, and is chargeable to the owner.

President Morris: Do you find it is greater in the rigid truck or swing motion truck, Mr. Reinhard?

Mr. Reinhard: In both. Now, we put in 163 kingbolts last month, and I found a foreign car, belonging to a company in Chicago, that had both ends knocked off the center, and the center pin was not broken fresh but seemed to have been broken for some time. Now, it seems to me that even with the modern center plates we have today, or, take the modern or old style, just as you like, a car would have to be hit very hard to raise it up and break off the kingbolt. In most cases the center pin is broken off without bending the iron in any way.

Mr. Hunt: It has been my experience on our cars that we have had very few broken center pins. There may be reasons for that, because our cars are handled just as roughly as any other cars, and are handled by other people just as roughly as by ourselves. The center plate that we had previous to the very latest, was a large cast iron center plate that could hardly get out of place. Of course there would not be many broken center pins with that, but we have since got a malleable center plate that is as good, while it is much lighter than the old center plate, that will probably answer as well, with a good deal less iron, and I must say we do not now find many broken center pins; in fact it is a defect that we hardly ever pay any attention to because there are so few of them. Many of the broken center pins I have seen have been on the swing motion trucks, with a dish center plate that will slide out of place easily. There are various reasons for broken center pins. There is some very poor iron in the country that might be the cause of some of them, and I would not for a moment lay all broken center pins to rough usage. Of course the rules now define rough usage, and there are many things now that might be called rough usage that the M. C. B. Rules say is not rough usage; and I do not believe that the M. C. B. Rules intimate that breaking the center pin is rough usage. We must not lay it all to the switchmen. There are some defects elsewhere.

President Morris: Do you find, Mr. Bates, that there are more broken center pins on swing motion trucks?

Mr. Bates: I think they are about evenly divided. I do not think the swing motion trucks have very much to do with it.

Mr. Sharp: I have noticed a great many cars with broken center pins recently. I think there is a great deal of this trouble due, however, to poor design of the center plate. Take the old style center plate known as the "ball bearing," without any boss in the center for the female plate to shoulder on. It is very easy to raise the car off the center sufficient to break the pin. I think, also, that a good deal of very poor iron is used in center pins. Take iron of that size that is very coarse, and as a usual thing it is not subjected to any severe test. A center pin is a part of the car that does not often give trouble to speak of. I would like to ask Mr. Reinhard if he does not find most of the center pins broken on cars with the old style center plate, on center plates with no boss in the center?

Mr. Reinhard: Not alone old style center plates, but a good many others. I cannot give any percentage, but I believe they are about equally divided.

Mr. Sharp: We used a malleable iron center plate with a boss in the center to give the center plate a hold, and I think I am safe in the assertion that we do not use as many center plates in a year as Mr. Reinhard does in a month.

Mr. McAlpine: I think that a great deal of the breakage is due to poor iron. For two years past we have replaced all broken kingbolts with a mild steel center pin and have had much better success.

Mr. Smith: Some years ago I went into this matter pretty thoroughly. We did not think that the form of the truck, whether swing motion or rigid, had anything to do with the breaking of the kingbolts, but that this was rather due to the saucer shape of the center plates. These center plates are of a form that will raise the body up off of the truck, and, in order to make it work freely, it is lubricated. As Mr. Reinhard says, there is a raise in the center of, probably, one inch by perhaps three inches in diameter on the bottom plate. There is a corresponding opening in the upper plate, but it is so much larger that it gives the top center a chance to slide down the incline on one side and up on the other before it strikes this iron projection, and in that way it gets a start and shears the kingbolt off just as if it was done with a pair of shears. I believe the remedy for it is to make the center plate with square shoulders.

Mr. Saum: I think these breakages are a good deal due to the cold weather. I have noticed, lately, that we have a good many cars out in the yard that have broken kingbolts. I have not noticed it before.

Mr. Callahan: I have found a great many broken kingbolts. I think I found 90 per cent of them in small center plates and in swing motion trucks, and think those causes, together with poor iron, account for the pins breaking.

Mr. Bundy: I believe the cause of the most of the broken center pins is due to the construction of the center plate. I know of one particular line of cars which has center plates shaped like a saucer, and we invariably find more broken center pins in those cars than in any other line of cars.

Mr. Deen: I think this trouble is due to rough usage to a certain extent. I see them switching cars and striking so hard that the center plate is raised, and if they do not break the center pin I do not know what would. I have six or eight cars every day to put on the center, and put in new center pins.

Mr. Jones: We applied 150 center pins last month, and our castings have a ring about  $3\frac{1}{2}$  inches in diameter and a raise for the upper plate, and in many cases the pins are broken off just as if they were sawed off—no bend to them. There may be some breakages due to poor iron, but most of them are caused by rough switching. You can stand in the yard and watch men switching cars and probably see a dozen off the center. They strike the cars hard enough to jump them off and break the center pin.

President Morris: What kind of cars?

Mr. Jones: Rigid and swing motion trucks. I cannot notice any difference. We cannot keep center pins enough on hand.

Mr. Deen: I do not think poor iron would cause the car to raise off the center.

Mr. Hunt: I would like to say for Mr. Jones' information that if these center pins were not bent, but were simply broken off without any bending whatever, it would indicate, to my mind, poor iron. Of course you can get good iron and have it fail in such a way that there will be no bend: but if all those center pins were straight and simply broken off without a bend, it would indicate poor iron, in my mind, under the conditions in which they broke.

Mr. Jones: It must have been poor iron, then, for every one of those center pins broke off straight; there was not a particle of bend in any of them.

Mr. Reinhard: It would indicate very poor iron. Now, it would necessarily seem to me that soft steel would break off as square as wrought iron, or even poor iron. Take, for

instance, an arch bar. We have arch bars broken made of steel, and they break just as clean and smooth as ever. I think when they let those cars down against one another, they raise up and break the center pins off.

Mr. Kroff: I do not see how you can consider center pins broken in fair usage. I would like to ask if, with those 90 per cent that were found broken, they found 90 per cent of the drawbars broken also, because if we can divide the line on center pins and not break any drawbars we will find what the M. C. B. Rules call unfair usage.

Mr. Cardwell: We handle a great many more cars than we did ten years ago. At that time the handling of equipment was lighter than it is at the present day. It did not have to be handled so expeditiously and the cars, as has been demonstrated, were let together with a smaller shock, and the old ball and socket center plate would suffice; but today, the way the cars are handled, switched and coupled it is evident that the center pin has to stand more, in a ball and socket center plate, than the center plate with vertical sides to the depression in the bottom center plate, with the top center plate fitting it properly, and I think with the center plates made in this way, this trouble will be dispensed with to a very great extent in both swing motion truck bolsters and rigid.

Mr. Marsh: I presume that everyone here is a railroad man, and has been around where they are switching cars, and he has noticed when they come together hard, as they often do, the cars invariably rebound from the trucks and clear of the center plates, from different causes, principally from the camber of the car, and that the cars standing on the track will stop the car body and its load, while it remains for the center pin to withstand the momentum of the trucks, and that would naturally be a greater strain, comparatively, upon the center pin, which is only  $1\frac{3}{4}$  or 2 inches in diameter, than the balance of the car would be on the coupler, and would cause the center pin to be broken squarely off. Now, if that was a new center pin and it snapped off squarely with a bright face, it would indicate poor iron; but if it was an old center pin, and the car had been on the road a long time, of course, the old center pin would have become crystallized and be easily broken. I believe the old style dish shaped center plate is one of the worst things put in a car, and they will shear center pins as fast as you can put them in.

Mr. Sharp: I would like to offer a motion that the chair request the members present to make a thorough investigation of this matter during the coming month and report to the Association at the next regular meeting the results of their investigation; to recommend what is the thing necessary, to report on iron in the pins that they found broken, and to come here with such information as will satisfy each and every one of us that it is from one cause. Now Mr. Jones says that with the center pins that were broken in his cars, in many cases the body was lifted off from the truck from  $1\frac{1}{2}$  to 2 inches, and that the center pin was broken square off. That is conclusive evidence, in my mind, that it is poor iron.

Mr. Groobey: I would like to suggest that the members take notes of the defects under special headings, something systematic—say, swing motion trucks, rigid trucks, quality of iron, diameter of center pins, etc. If these reports were made out by all along these lines I think they would have more value.

Mr. Sharp's motion was here put and carried.

Meeting adjourned.

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The next meeting of the Association will be held April 12, 1900, in Room 1741, Monadnock Building. The following program has been arranged:

1. Discussion of the proposed revision of the M. C. B. Rules as presented by the Committee.
2. Is a delivering line responsible for lamps or tools missing from the interior of passenger equipment, in interchange, regardless of whether the car could be inspected on the inside or not?

## 3. Case in dispute:

A issues defect card for damage done to B's car as follows:

11 pcs. siding  $\frac{7}{8} \times 4\frac{1}{2}$  in. x  $8\frac{1}{2}$  ft. long.

14 " "  $\frac{7}{8} \times 5\frac{1}{4}$  in. x 8 ft. long.

71 " "  $\frac{7}{8} \times 3\frac{1}{4}$  in. x 8 ft. long.

When B gets the car home he makes repairs, and bills against A, charging him for:

11 pcs. siding 1 x 5 in. x  $8\frac{1}{2}$  ft. long.

14 " " 1 x 6 in. x 8 ft. long.

71 " " 1 x 4 in. x 8 ft. long.

A refuses to pay the bill, and asks that it be rendered in accordance with the sizes of siding as shown on the defect card. B claims that the bill is correct, and that he has charged for the siding in the rough, as is the usual custom among the railroad companies, and refers to section 10 of rule 5.

Is the bill as rendered by B correct?

*Topical Discussions.*

1. In replacing a missing brake wheel on a foreign car (owner's defect), where brake staffs and attachments are intact, can bill be rendered for labor and material, or for labor only?
2. Causes for loss of brake shoes.

NOTE.—Members of this Association failing to receive the Railway Master Mechanic will please notify the Secretary, Aaron Kline, 702 Maplewood Ave., Chicago.

## AUTOMATIC AIR AND STEAM COUPLER.

Our illustrations show a device that automatically couples and uncouples the air brake, air signal and steam heating pipes on passenger cars, as well as the air brake pipes only, on freight cars. This device has been in successful operation on a number of passenger trains and also on freight cars for several years.

The construction, manner of attaching to the cars and operation of this device may be described as follows:

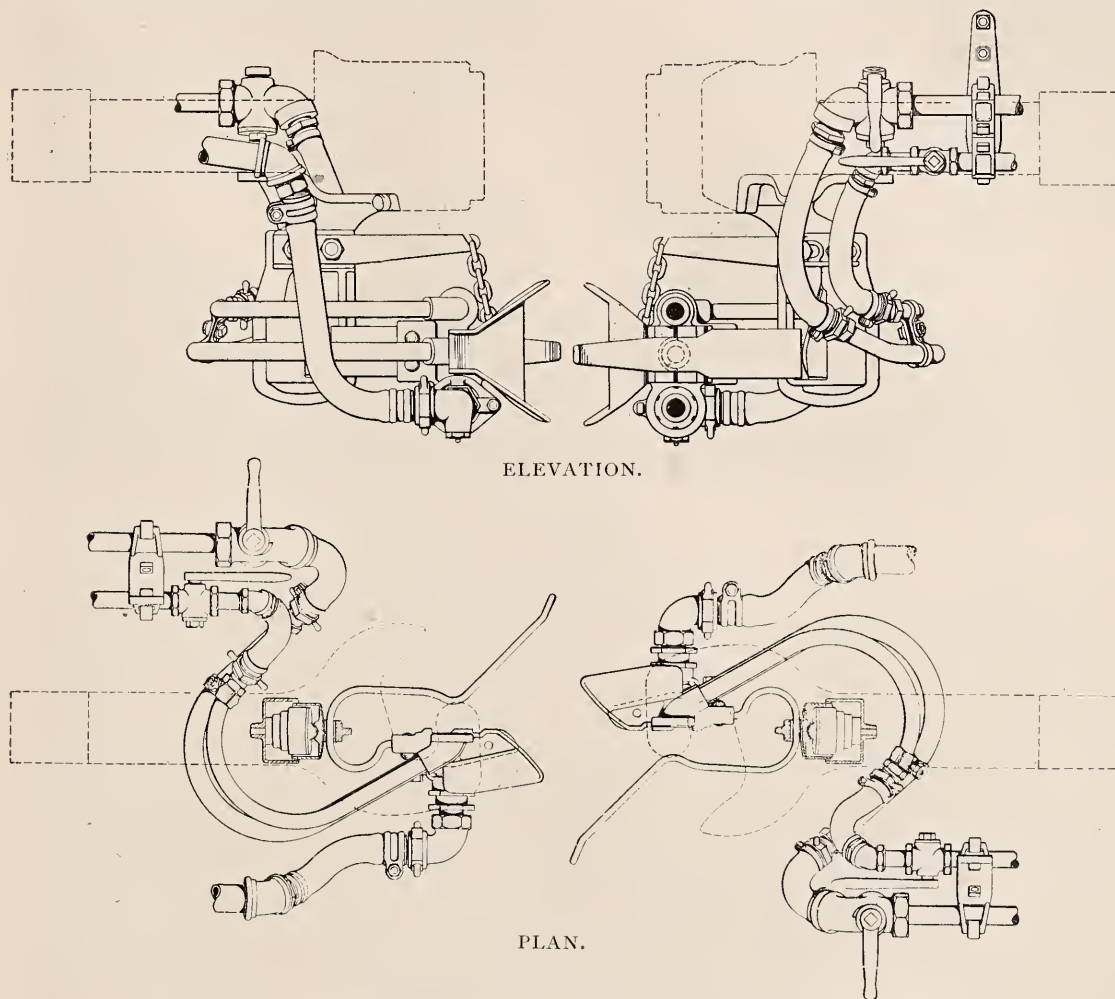
The apparatus is interchangeable, there being no rights and lefts. The coupling head consists of a casting with openings on its face to receive the registering gaskets, and a coupling spring riveted thereto, as shown on the plan views (Fig. 1). On the elevation views (Fig. 2) is shown a cast steel bracket riveted to the under side of the drawbar, to which a slotted hanger, in which the coupling spring rests, and a chain arm to support the coupling head, are bolted.

The gaskets are so placed in the head that neither is touched by the opposite one until the coupling is made. This protection is effected by a tongue and groove, on which tongue the face rides until the gaskets are in position to register, when the tongue drops into the groove.

The outer end of the coupling head, having "V" and wedge shape guides, is directed both vertically and horizontally by the outwardly bent spring on the opposing members. This coupling spring performs the

double function of guide and clamp to hold the head firmly together when coupled.

As will be seen on the elevation views, the heads are tapped to receive the air pipes to which connection is made to the train pipes by a short hose. The steam attachment is so arranged that it can be readily removed or attached without affecting the air connections. An auto-



FIGS. 1 AND 2—AUTOMATIC AIR AND STEAM COUPLER.

matic drip at the lowest point of the steam attachment provides for all condensation.

As will be seen on the plan views, the slotted hanger is provided with a spring buffer which positively insures the air coupling under all conditions where the car couplers will operate, and which maintains the coupling point of the air coupler in advance of the car coupling. The spring resting in this slotted hanger, the head being suspended by the chain, and the flexibility of the short hose, permit the free movements required by the variations in the heights of cars, as well as the movements on curves, and also permit the free coupling in all such cases.

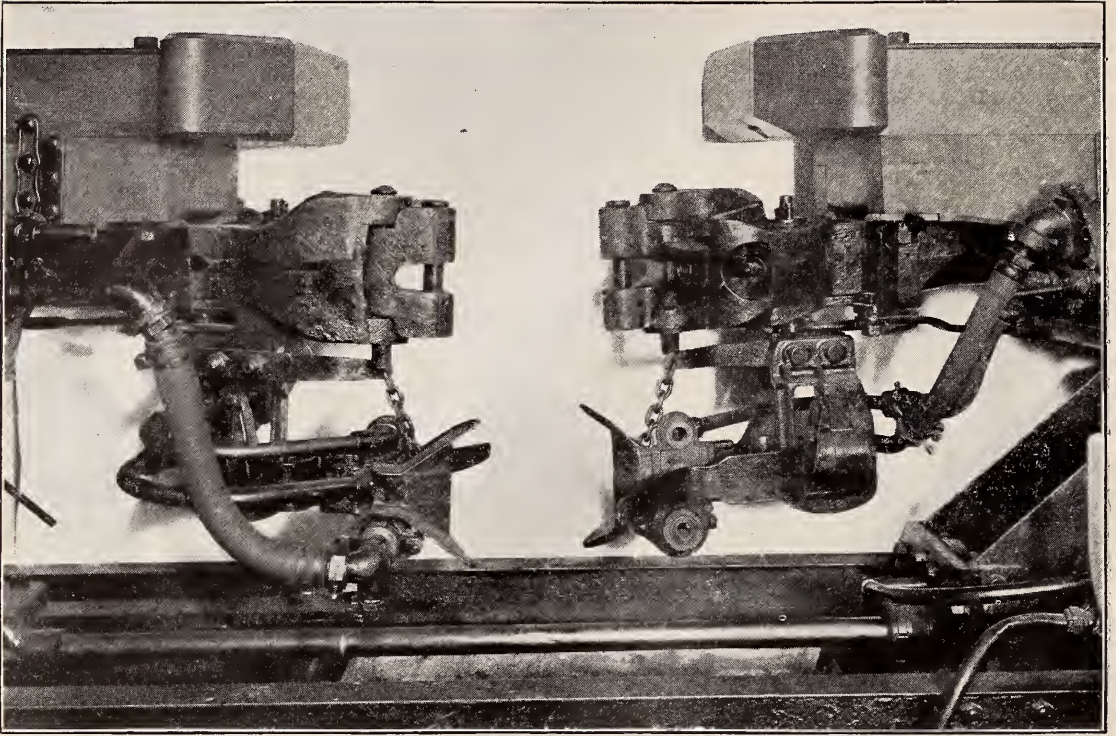


FIG. 4.

Passenger uncoupled on 20 deg. curve on level track.

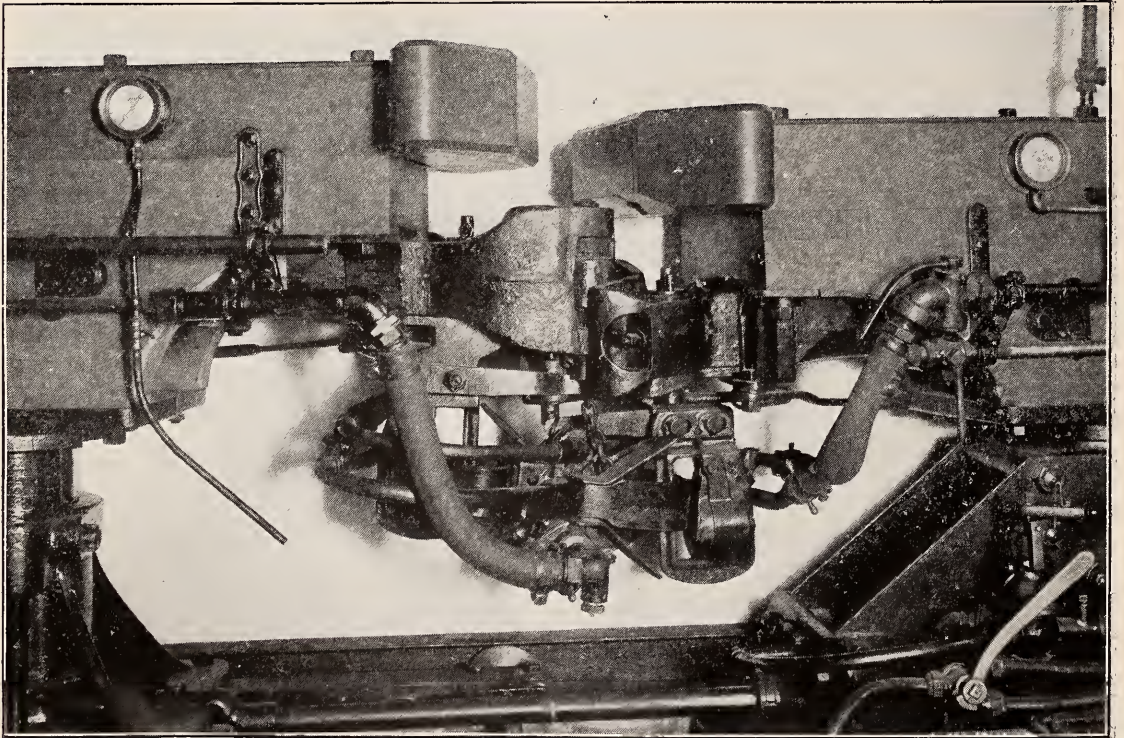


FIG. 5.

Passenger coupled on 20 deg. curve and 5 inch variation in height of cars.

AUTOMATIC AIR AND STEAM COUPLER.

An interchange is provided whereby coupling may be effected with the ordinary hand hose coupler.

The coupling and uncoupling takes place automatically and simultaneously, as well as with the same degree of certainty as does the car coupling.

In order that this very ingenious coupling arrangement might be given thorough and exhaustive shop tests a special machine (see Figs. 3 to 8) has been built. The testing machine consists of a pair of girders forming tracks upon which are mounted, within suitable housings, four car couplers with all the usual drawbar attachments. One of these housings, representing complete passenger and freight equipment, is stationary,

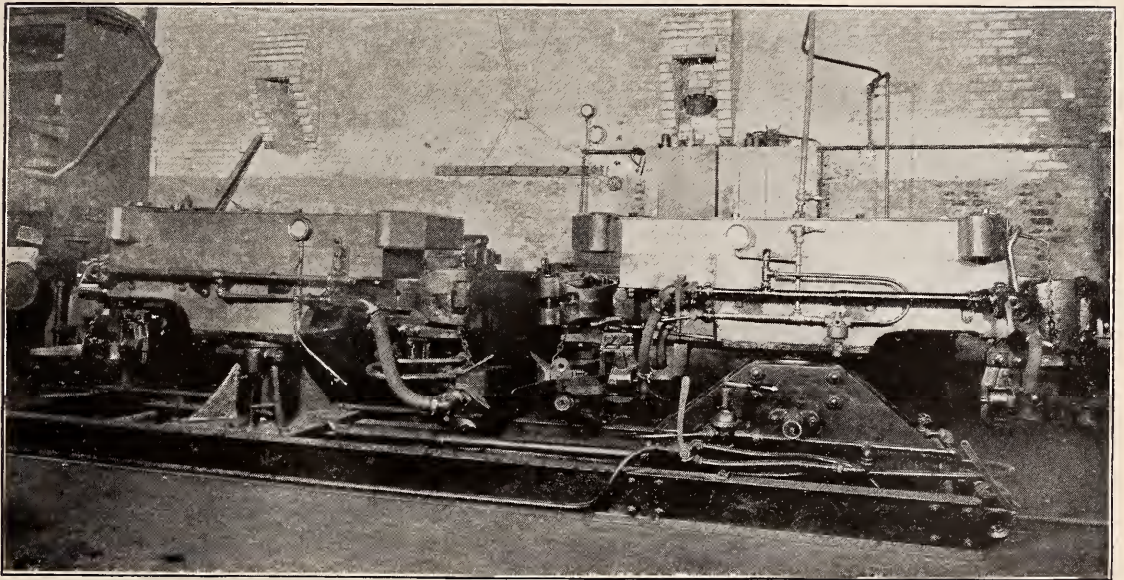


FIG. 3.

Air coupler testing machine, uncoupled.

except that it can be adjusted to all degrees of curvature and except that it can be reversed, presenting either the passenger or freight coupler to the couplers within the other housing. This other housing is likewise pivoted for adjustment to the different curves, but it is also movable along the base, for the purpose of engaging and disengaging the couplers. This movable frame has, in addition to its longitudinal and swinging movements, an arrangement for vertical adjustment for the purpose of representing the differences due to varying heights of car couplers. The movements in all directions are accomplished by air pressure, and can be as gentle or as forcible as desired. In fact, the couplers can be

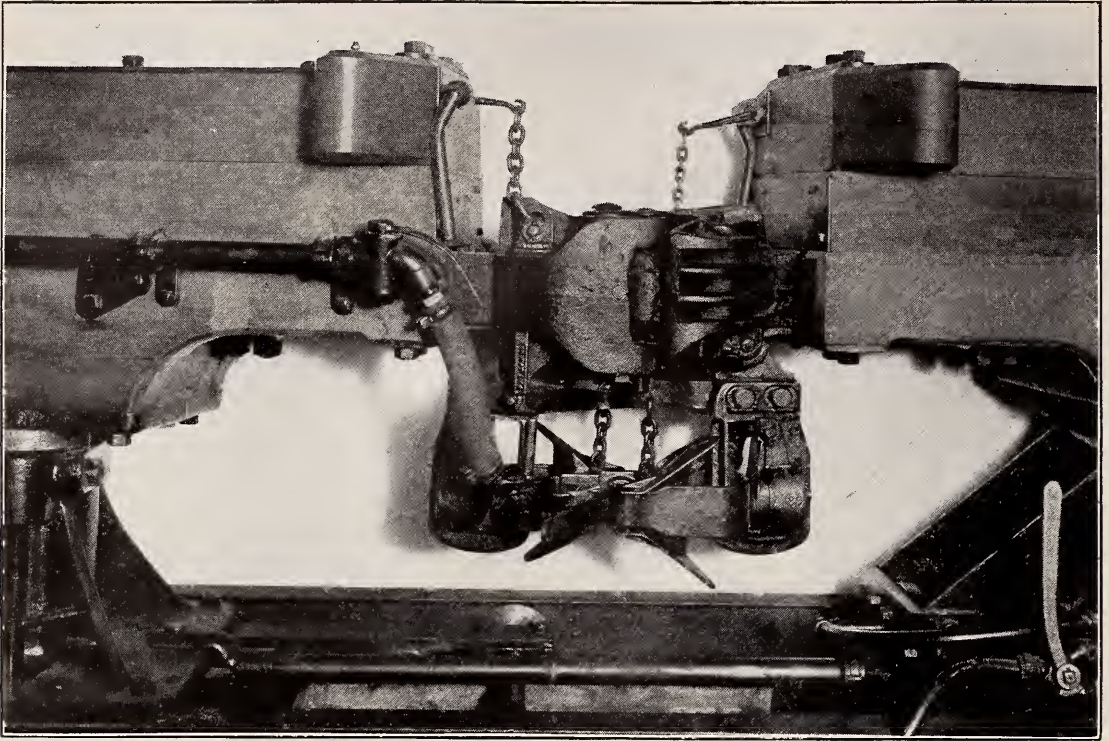


FIG. 7.

Freight coupled on curve and level track.

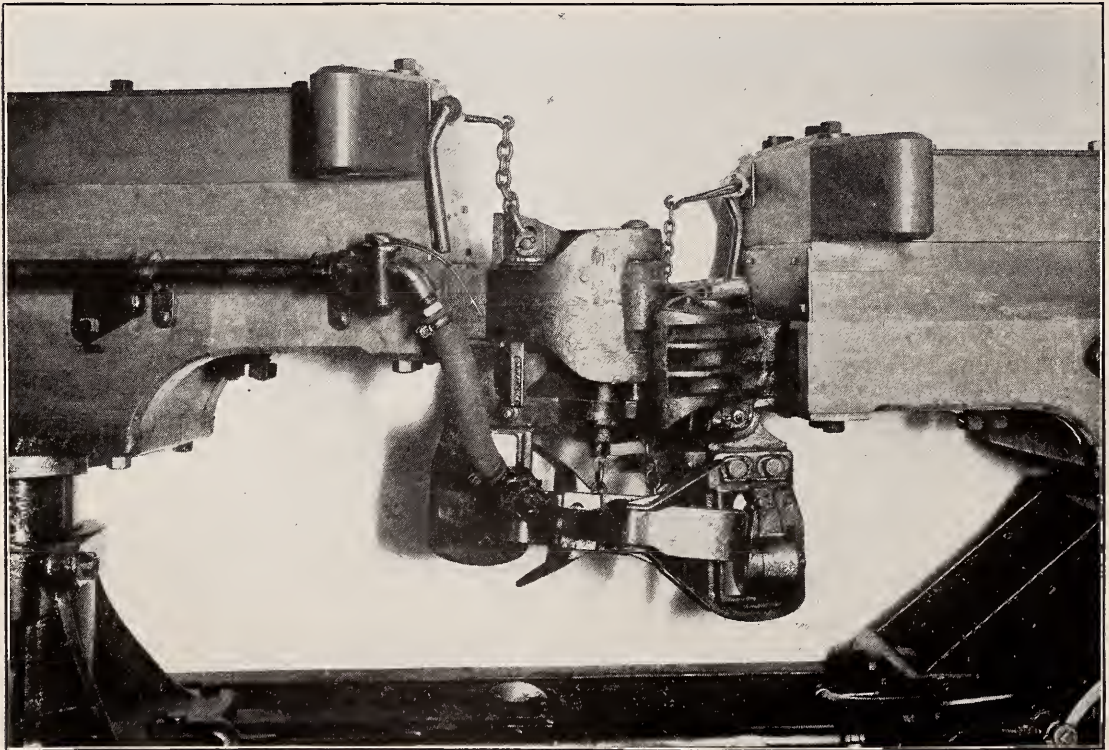


FIG. 8.

Freight on curve, and 5 inch variation in height of cars.

AUTOMATIC AIR AND STEAM COUPLER.

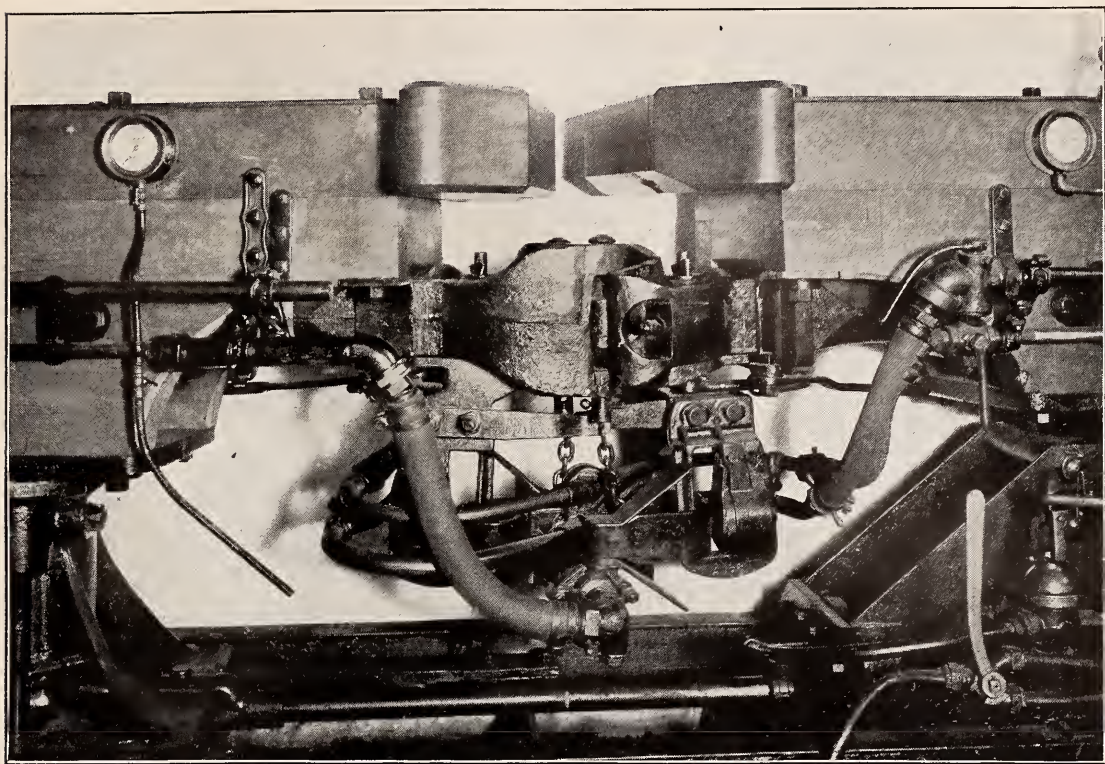


FIG. 6.

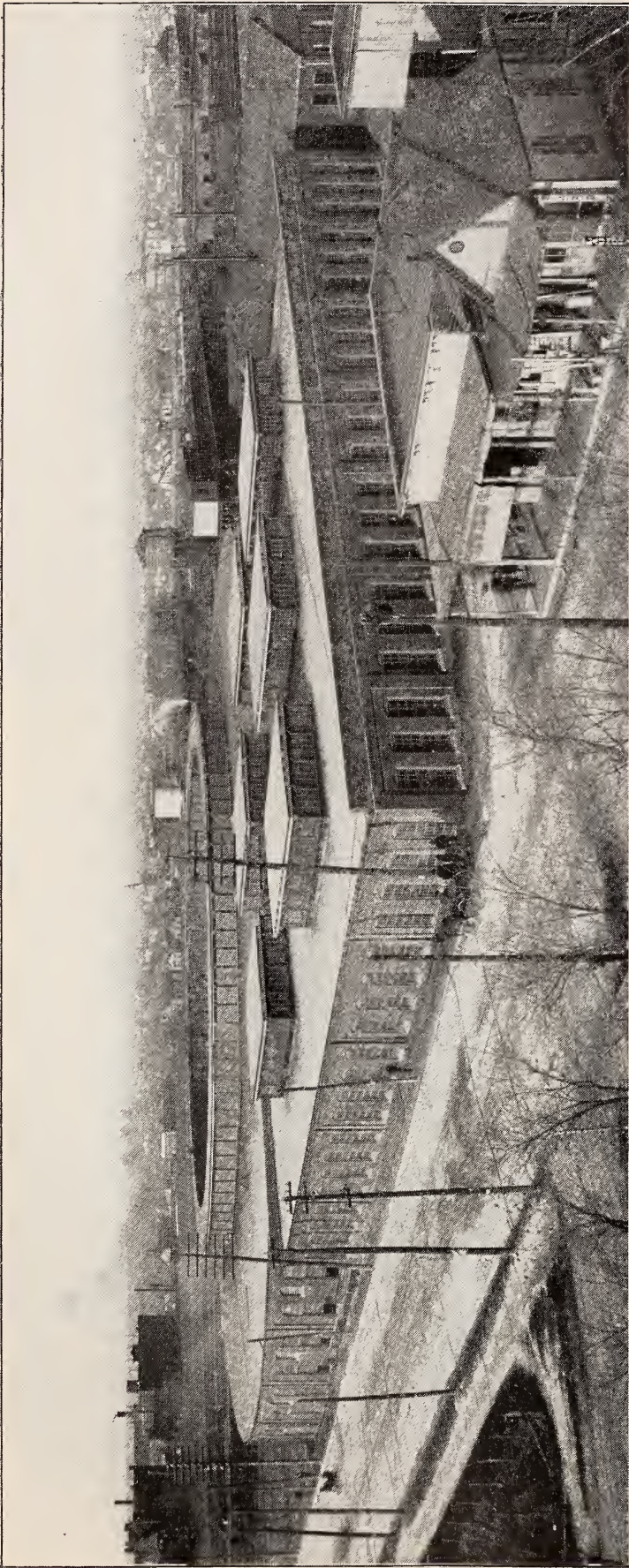
Passenger coupled on 20 deg. curve on level track.

brought together with a degree of speed that would be in excess of any force permissible even in the rough handling of cars.

It will be seen that with all the movements of which the machine is capable, all the undesirable motions or positions to which car couplers are subject can be produced, or even exaggerated, to a degree never experienced in service.

In order to determine any leakage in the automatic air couplers a complete Westinghouse air signal system is provided, on this testing machine, which is of such sensitive construction that the most trifling escape of air between the gaskets of the air couplers would be promptly detected.

The automatic air and steam coupler above described is manufactured by the Automatic Air and Steam Coupler Co., whose shops and offices are at 1933 North Second street, St. Louis, Missouri.



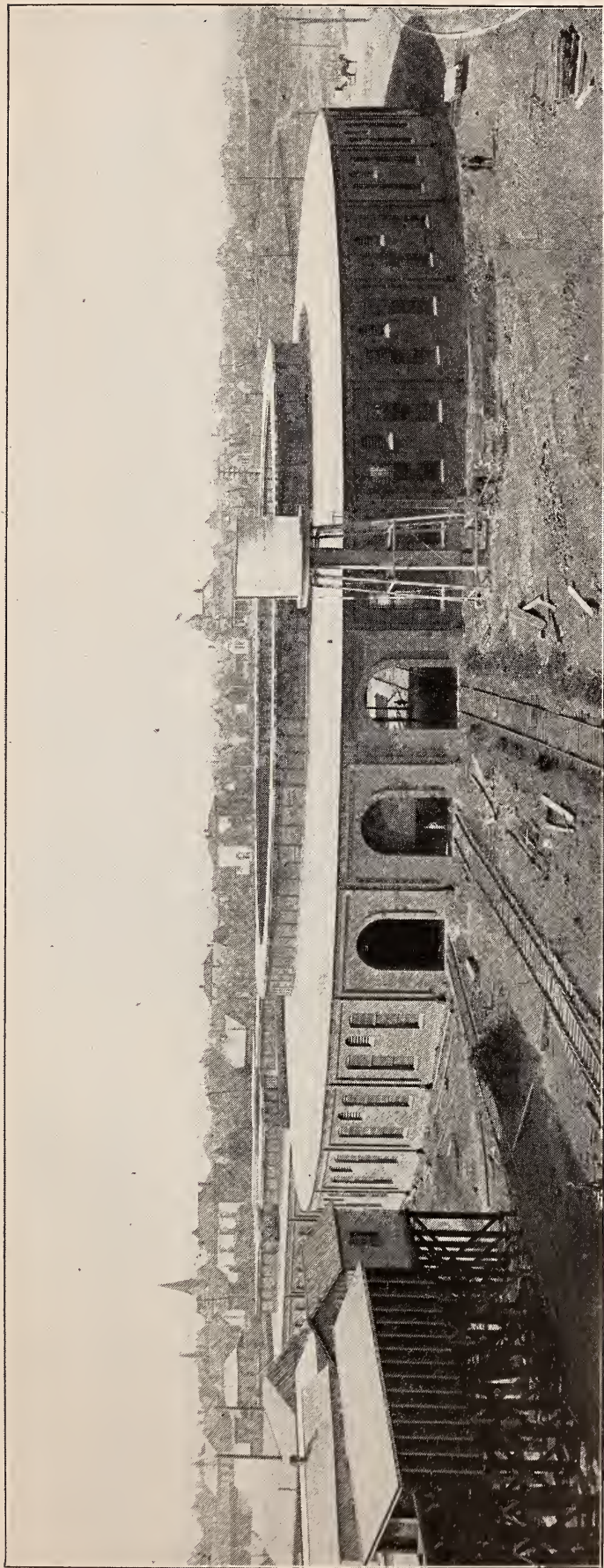
FORT WORTH SHOPS—TEXAS &amp; PACIFIC RAILWAY.

### FORT WORTH SHOPS—TEXAS & PACIFIC RAILWAY.

We think that it will be agreed that for architectural beauty lines the round house and machine shop of the Texas & Pacific at Fort Worth, Texas, illustrated herewith, outrank anything of a similar nature that is generally known. Here is certainly shown a compact, handsome design. The scheme of arrangement is quite

novel and there are reasons for believing that, for a small plant, it is almost an ideal plan.

The plant consists of a full circle round house, fitted on to which is the machine shop; a boiler house and blacksmith shop, a coaling station, sand house, etc., adjoin the composite structure. The round house has



FORT WORTH SHOPS—TEXAS &amp; PACIFIC RAILWAY.

36 stalls, and is 292 feet in diameter. It has brick walls, with wooden roof covered with asbestos. The floor of the house and the central space are paved with brick. The pits are of stone with brick bottoms. A continuous smoke ventilator is provided as shown. The door openings are covered by rolling steel shutters; there are forty-one of these shutters—thirty-six on the inside of the round house, four on the outside track leads and one

opening to the machine shop. There are three track leads to the Eastern division and one to the Rio Grande division.

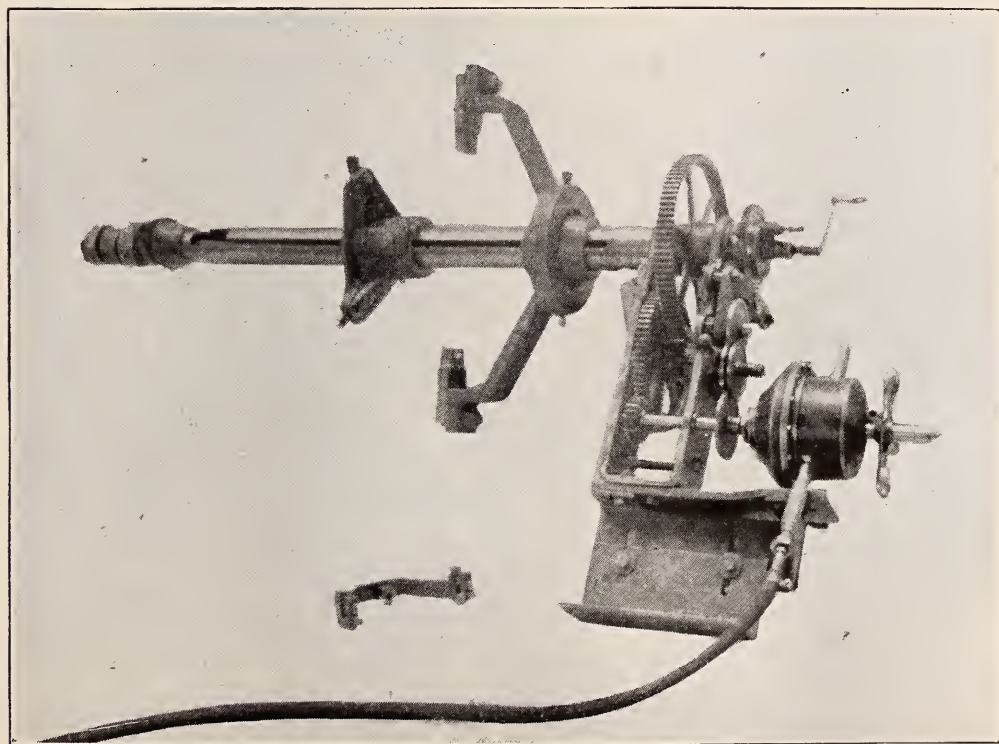
The machine shop, which is built on to the round house, and of the same materials, is 140x160 feet in dimension. It is well lighted, having fifty-eight large windows, with transoms over every window. There are two pits in this shop, each 130 feet long.



FORT WORTH SHOPS—TEXAS & PACIFIC RAILWAY.

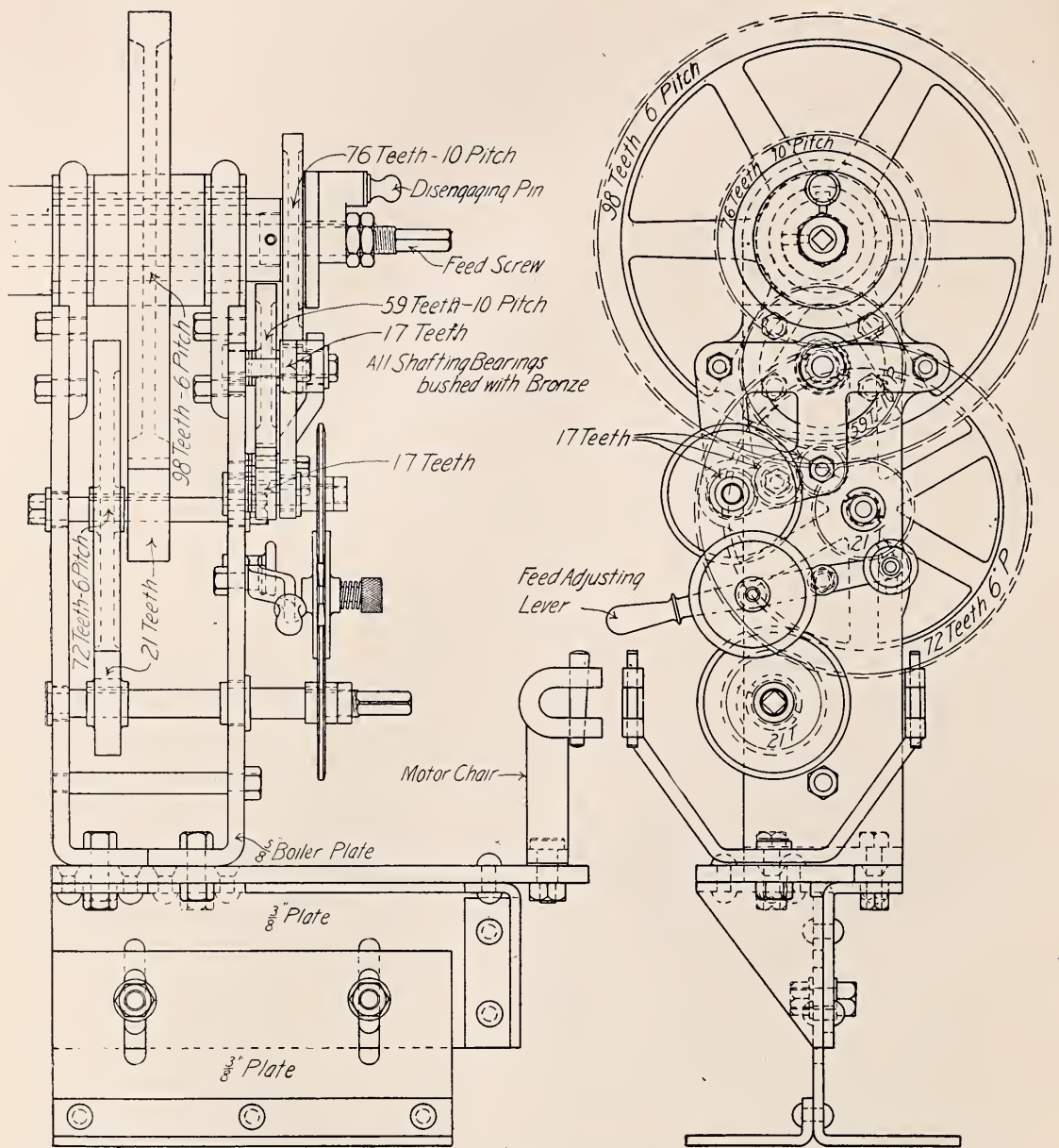
Near by the machine shop—eighteen feet away—is a building, also of brick with asbestos covered roof, devoted to the boiler room and blacksmith shop. This building is 80x40 feet. It is well ventilated and lighted.

The coal chute has twenty pockets of six tons capacity each. The sand house and bin, located next to the coal chute, is elevated so as to deliver sand from a pipe. The sand is taken from a 2½-inch pipe, operated from the engine. The sand bin holds twenty cars of sand. The cinder pit is 150 feet long. There are three water tanks, each of 48,000 gallons capacity, two serving directly and one through a stand-pipe. A fourth tank, of 30,000 gallons capacity, carries artesian water, used for drinking purposes in the buildings, and also in the passenger station and for coach supply.



### CYLINDER BORING BAR—C., B. & Q. RY.

At the West Burlington shops of the Chicago, Burlington & Quincy Railway, there is in use a portable cylinder boring bar which was there designed and built. Through the courtesy of Mr. J. F. Deems, master mechanic of the road at West Burlington, we are enabled to present a drawing and a photographic view of this interesting machine. Through the two illustrations an excellent idea of the design followed may be



CYLINDER BORING BAR—C., B. &amp; Q. RAILWAY.

obtained. In this machine the bar is stationary with reference to the feed, and the head feeds on the bar. This affords a decided advantage, for, with the old style bar feeding through the cylinder it is necessary, on many types of engines, to take off the pilot and bumper beam, in order to bore out a cylinder. This trouble is entirely obviated with this bar.

Another advantage is that the feed can be adjusted while the machine is working. Moreover, it is a continuous feed and not a pawl and ratchet arrangement. In taking a finishing cut the feed is usually  $\frac{3}{8}$ -inch for each revolution, and even for a roughing cut it is not unusual for it to be  $\frac{1}{4}$ -inch.

The efficiency of this boring bar may be indicated by stating that, in regular work, such as is done day after day, two cylinders are bored out, counter bored and finished complete in eight hours or slightly less—this time including that occupied by getting the bar into position and putting it away again. The machine, it will be noted in the photographic view, is being operated by a Boyer motor.

## A NEW BRAKE SHOE DESIGN.

A decidedly novel departure in brake shoe design is that revealed in our engravings of the "interlocking" brake shoe. The idea followed in designing this shoe was to utilize, to the last scrap, the entire material of the shoe. This is accomplished by inserting the back of a partially worn shoe into the face of a new shoe and re-applying both on the brake head for service, where they both remain until the old shoe has entirely disappeared. This new shoe—into whose face the old shoe was inserted—becomes, in its turn, a partially worn shoe, when the same process again takes place and is thus continued indefinitely. Fig. 1 shows the back and Fig. 2 the face of this shoe, and Fig. 3 shows how the shoe is completely worn out. In Fig. 4 is a reproduction of a photograph of a shoe where the old shoe

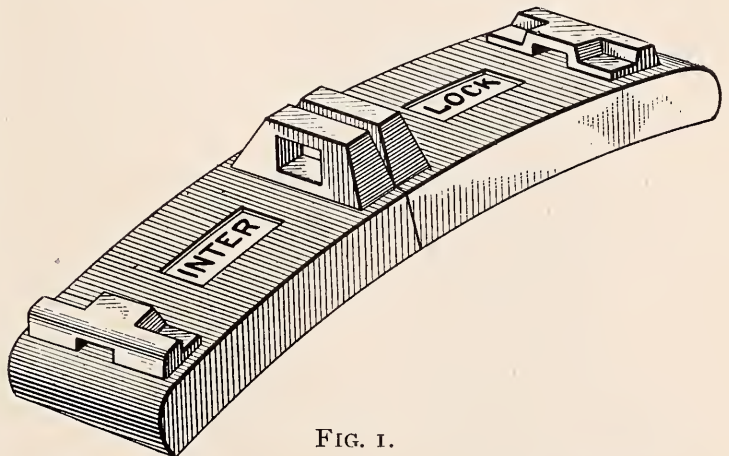


FIG. 1.

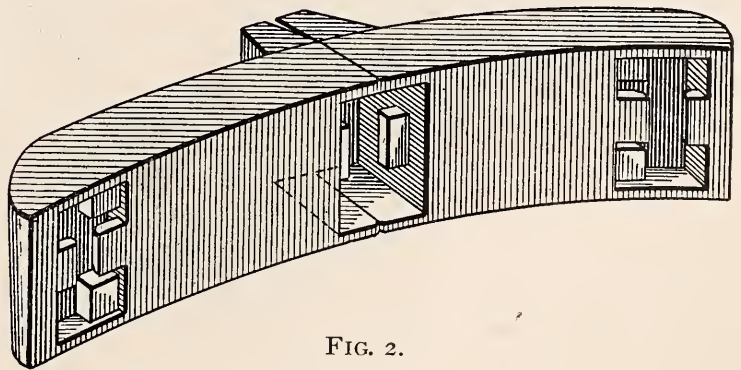


FIG. 2.

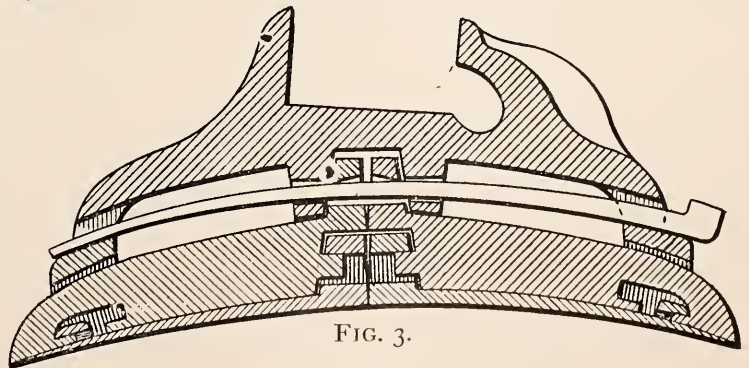


FIG. 3.

THE INTERLOCKING, DIVIDED, BRAKE SHOE.

is shown as almost worn out. The method of interlocking is clearly shown in Figs. 2 and 3; the process is simple and the old shoe is placed in the new easily and quickly.

A feature as novel as is the interlocking is the making of the shoe in two parts. This feature has particularly commended it to railway men, and concerning this point a superintendent of motive power writes: "The feature of a sectional construction is particularly valuable, as it enables

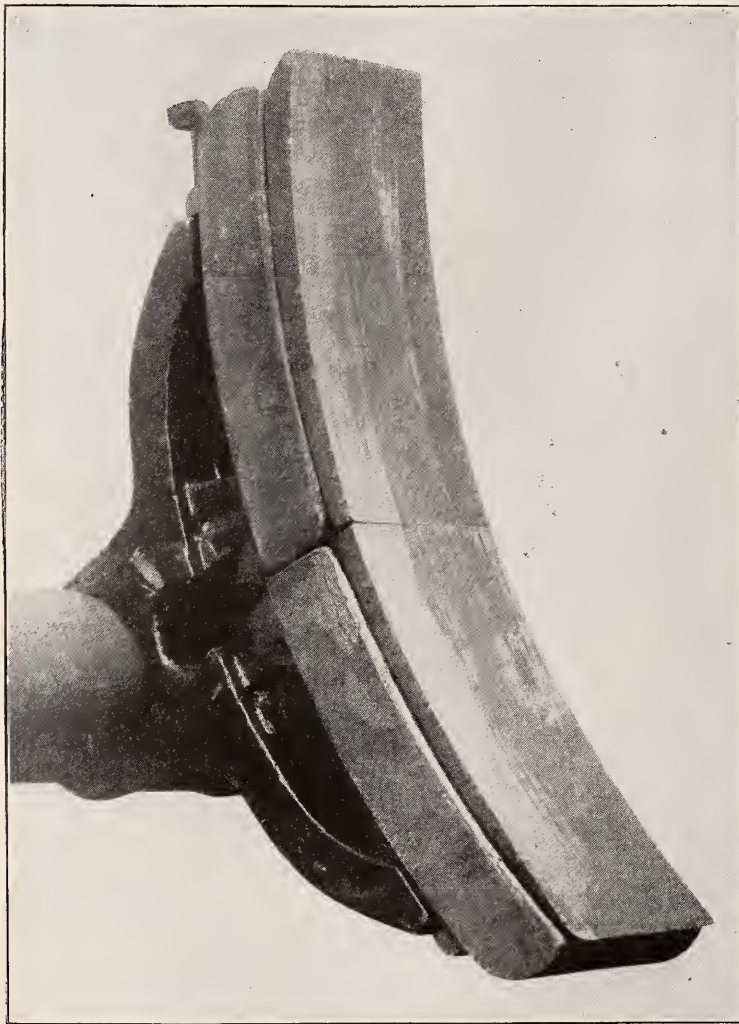


FIG. 4.

the shoe to adjust itself to the wheel and thus to give a more uniform wear, counteracting improper brake beam adjustment." This adjusting of the shoe is more thoroughly attained, owing to the fact that the inside faces of the lugs on the back (as will be noticed by referring to Figs. 1, 2 and 3) are constructed so as to admit of a certain clearance, thus allowing the shoe to hinge in the center and bend back to the brake head at each end, thus taking up the  $\frac{1}{16}$ -inch clearance allowed in M. C. B. recommended practice, and permitting the

shoe to rest solidly on each end of the brake head, thus throwing all strains from the shoe on to the head where it properly belongs.

Another feature in regard to this shoe is, that on improperly adjusted brake heads, when the shoe is worn down on its face to an angle at which the brake beam presses it against the wheel, then all strain, owing to this improper adjustment of the brake beam, is relieved from the beam; for, if the partially worn shoe is removed and an entirely new shoe placed on

its back, and then both replaced on the brake head in service, the partially worn shoe presents on its face the same angle toward the wheel as it did before, and thus relieves the brake beam of all the strain of re-wearing a new shoe down to the angle at which it presses against the wheel.

An increased factor of safety is claimed to come in here, and is explained as follows: As this shoe is made to fit the head perfectly at the holding and guide lugs, instead of the interlocking shoe standing away from the brake head at each end  $\frac{1}{16}$  of an inch, resulting in one end standing away always  $\frac{1}{8}$  of an inch when the air is applied, as is the case with the ordinary style of shoe, this construction takes all the strain or pressure from the shoe, throwing it on to the brake head and distributing the strain there where it belongs, thereby allowing the interlocking shoe, before being re-applied in the face of another shoe, to wear out very much thinner than the ordinary style of shoe; and when it is interlocked into the face of another shoe, and reinforced thereby, allowing it to wear completely out without breaking, the factor of safety is very much increased by the use of the interlocking shoe, as there is not nearly the danger of the shoe breaking or the brake head breaking as they do with the ordinary style of shoe.

The ordinary practice which is indulged in by car inspectors at the present time with the ordinary shoes, viz., of reversing the shoes when worn light at one end, causes more or less strain upon an improperly adjusted beam, and each application of a new shoe on the beam, in the ordinary practice now, involves a similar strain upon it until it is worn down to the angle at which the beam presses against the wheel. With this shoe, after the first wearing down, all this subsequent strain will be entirely removed from the beam.

It is further claimed for this shoe that as it weighs the same as the ordinary cast iron shoe, which latter scraps at an average of ten pounds, one of the interlocking shoes, as a cast iron shoe without an insert, since it wears completely out, will outlast two of the ordinary cast iron shoes; and it is still further claimed that as all other shoes with inserts scrap at from eight to ten pounds, these interlocking shoes with inserts—since they wear entirely out—will give from eight to ten pounds more wear than any other insert shoe. In addition to this saving, the roads will apparently only have to carry one-half the stock of these shoes that they carry with the ordinary shoes, and will only transport one-half of the new tonnage, and will be at no expense in handling, re-handling, loading, unloading and transporting scrap, as they will have no brake shoe scrap

piles with the use of this shoe. Moreover, as there is always material equal to a full shoe on the brake head to be worn out before removal, the roads will only have to apply interlocking brake shoes to the brake heads one-half as often as they will apply other brake shoes, which means a saving of labor in application and handling.

In addition to the above, there is still another claim made, to the effect that there would be a saving effected in interchange charges from one road to another for the application of shoes to foreign cars on their tracks, the present charges being arbitrarily based upon a difference between certain arbitrary charges allowed for a new and a scrap shoe; with the interlocking shoe, a certain fixed charge to be made for the new shoe, the road upon which this application was made in interchange would receive in friction the entire value of the charge made, and the old shoe would not have to be taken into consideration in the charge, as it would remain on the car from which it was removed and re-applied in making the interchange, and would entirely wear out. A special plain faced interlocking shoe is used on new equipment and in interchange on foreign cars, and is the shoe for first application, but there is nothing to prevent the pocket faced divided interlocking shoe from being used altogether, except that where the pocket faced shoes are used for first application, owing to the pockets being in the faces of the shoes, the roads would not get the full frictional effect of the shoe.

The foregoing are in substance the claims made for this shoe. We are assured that most roads who are using this shoe, notably the Pittsburg & Lake Erie, find that the use of the interlocking shoe saves them \$15.00 or more on every ton used, in addition to the saving indicated in other directions by the preceding notes. The Pittsburg & Lake Erie has adopted the interlocking shoe for its entire freight, passenger and tender equipments, and has used the shoe for several months. Within the past month three other roads have adopted the interlocking shoe, and in addition eighteen other roads within the last month have ordered shoes for test, some of which roads are the largest systems in the country. Mr. L. H. Turner, superintendent of motive power and equipment of the Pittsburg & Lake Erie, in writing of his experience with this shoe, says, in substance, in a recent letter: "We have given them a most careful test upon our fast runs between Pittsburg and Cleveland, and have experienced no trouble whatever in holding the interlocking brake shoe in position. We wear them out entirely in service, and are not forced to lose from 15 to 18 cents on each shoe by having to sell a large amount of high priced metal at scrap prices. As to the extent we

shall use them, will say we expect to purchase nothing else for our locomotive tenders, passenger and freight cars. As to their being economical, we believe there is nothing in the market at this time that will anywhere near approach their performance. As to their safety, I cannot see that there is any reason for concern. If we thought so, we would not have them at any price. While our road is short, our service is just as severe as upon any line in the country, and our requirements for safety and economy just as great."

The interlocking divided shoe is made (with or without inserts) by the Manufacturers' Railway Supply Co., 904 Fisher Building, Chicago.

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## PURCHASING UNDER SPECIFICATIONS.\*

BY IRA C. HUBBELL.

In a paper read before the New York Railroad Club by a well known gentleman, a precedent was established that permits your speaker to make quotations from that book so generally accepted as *the* book of books: "Wisdom is the principal thing; therefore, get wisdom; and with all thy getting, get understanding." (Prov. 4-7.) "Happy is the man that findeth wisdom, and the man that getteth understanding." (Prov. 3-13.)

Friction between individuals results always from a false estimate of our individual importance.

The organization necessary to operate a railway brings together a large number of persons, each possessing varied capacities, and the best results follow where the several talents are fitted into each other, as the wheels of the clock, each doing his best for the best result of the whole, and each realizing the usefulness of the others.

The departmental lines should never be so rigidly drawn as to occasion a decrease in the net results of the railway's operation; and it particularly devolves upon the one to whom is assigned the purchasing of the varied lines of materials required in operating and maintaining a railway, that he shall adapt himself to the entire railway and become a part of all departments, show no partiality to any, and belong wholly to no one branch of the service.

The heads of each department should consider the purchaser as a part of that particular department, and the two, with the other officials, work for the sole object of an increase in the sum to be placed to the credit of profit and loss account at the end of the year.

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\*A paper presented at the March meeting of the Western Railway Club.

“What is worth doing at all, is worth doing well,” presents to your ears words familiar to you from your childhood days.

There may be several ways of accomplishing this “well doing.” “Two heads are better than one,” is also as familiar to you as “two times two are four,” nevertheless, there are both wisdom and understanding in these two old “saws.” The more thoroughly a person absorbs and makes part of himself the real spirit and intent of their real meaning, the more useful will that person be to himself, to the world at large, and of the greater especial value in his particular vocation.

The value of materials and supplies purchased annually by the railway forms a goodly proportion of the cost of yearly operation. The first cost of any article is not the sole basis of that article’s value. Price is but one component part in the determination of values, therefore, care needs be exercised in the preparation of specifications covering that which is to be purchased, that they are not so worded as to cut out legitimate competition in your purchases. To make your requisitions of purchase call for so many boiler tubes of some particular copyrighted brand; or for so many pieces of boiler plate of some special manufacture; or for so many bars of some particular brand of staybolt iron; or for so many dozen of some particular make of track shovels, etc., etc., is not to provide your buyer with specifications, but tends only to annul the sole intent and purpose of the office of purchasing agent.

We will agree, as a general proposition, that a person who makes a specialty of manufacturing any one thing will be better posted regarding the details of that particular business, than one whose time is necessarily divided between a great variety of subjects other than materials and supplies, and of most articles used in railway operation there are several reputable concerns engaged in the production of each line of goods.

Specifications are sometimes so worded that the manufacturer is told just how he must make the article desired, and then told the particular results that he must guarantee that particular article to yield the purchasing company.

Your speaker believes in specifications, but not in hobbies.

There is nothing purchased but what, speaking generally, should be bought under specifications, but—and here’s the rub.

A school teacher of the speaker’s boyhood days, once said: “It’s those ‘buts’ to the boys, that spoils the whole thing. There’s such and such a boy—he is all right; *but*”—“Johnnie so-and-so is all right, *but*”—and it was what followed the “*but*” that spoiled the boy’s record.

But the specifications should be such as to clearly place before the

several manufacturers the result to be accomplished, and the accomplishment of which it is your intent to hold them accountable for, rather than to have the specifications so drawn that the purchase price is the principal thing affected, and that in an upward direction. It is either the misfortune or good fortune of your speaker to have had several years' experience, both as a purchaser and as a seller, and in the latter capacity he has frequently "gone up against" a phase of the "specification argument" that is quite familiar to many of the members of this body, and where the specifications were so worded that the speaker's bid could not be entertained because his articles did not have quite the proper ingredients in quite the proper proportion.

One of our members not long ago, very courteously referred to a letter your speaker had addressed him, upon the question of the specifications for air brake hose used upon the line with which the speaker is connected—and more or less discussion followed in one of the railway papers. The writer's experience from that date to this, fully justifies the position he assumed in these discussions, and he still continues to purchase air brake hose upon the broad specifications of a guaranteed service. Experience has taught the requirements of a hose capable of resisting a specified pressure, and that in average service should yield certain results; what more do you want of a reputable manufacturer than his guarantee of that result in service?

Broadly speaking, this should be the sole aim of all specifications, namely, guaranteed service. Let the several heads of departments recognize the fact that, as they are unquestionably much better fitted to have charge of the work assigned them, so is it possible that the man doing the buying may, perhaps, be a better trader than they, and the better fitted for his particular duties. Mix these two good things together and so get the full capacity of both wheels of the clock—and don't handicap your buyer with specifications that some interested person may have helped suggest; and when the purchasing agent asks for prices, the purchasing agent gets the "cold laugh, ha! ha!" and "I'm specified."

Specifications can always be so drawn that they will secure the service desired, and, at the same time, not shut out competition from any reputable manufacturer, and, therefore, secure to the road the one result that should always be sought, viz., the best value for one dollar invested, with the necessary attendant reduction in the operating expenses of the railway.

Buying is fully as much an art as is any other branch of the railway service, and the buyer should be selected with as much care as to his

fitness for the place, as is the apparent intent in engaging the services of the president.

It requires more than one man to run a railway, or there would never be but the one man on a railway but, as before stated, the several officials and subordinates must unite in the one grand aim of increasing the sum placed annually to the credit of profit and loss account, or the railway cannot continue to exist, and no branch of the railway operation offers a better field for saving than that which can be accomplished by taking the buyer into your confidence in all departments of the service, and secure his co-operation in the preparation of all specifications and, subsequently, by keeping him fully advised as to the practical results obtained from using the things bought, remembering that the lowest priced article is not necessarily the best value, neither is the highest priced article by any manner of means always the best to purchase, and strive to each keep in touch with the other, laying aside personal ideas as to which is the greatest, and keep your eyes concentrated solely upon the right hand side of profit and loss account, and do those things which will increase the profit from operation.

Whilst not entirely germane to the subject, your speaker begs to suggest that it will be conducive to the economical operation of the railway if the heads of the several departments will consult freely with the purchasing agent in the matter of ordering various articles for trial purposes, and provide for the purchasing agent making the necessary purchase order for the articles for trial, and so arrange that all reports with regard to the performance of the trial material shall be issued through the purchasing agent's office.

It is far from the speaker's desire to undertake to create the impression that the purchasing agent's office is the one central pivot around which, or upon which, the entire railway organization rotates, but from past experiences gathered from a rather active experience both as a seller and a buyer, your speaker is confident that the observance of the spirit of what has been said upon the subject of "Purchasing under specifications" will conduce to a material reduction in the operating expenses of the road.

The subject has not been exhaustively handled, and is one which a great many other persons could probably treat to much better advantage than the speaker; however, what has been said has been given out through a desire to reciprocate the helpful thoughts which the speaker has received from the other members of the Club, and because of the speaker's desire to do all that he can to extend the usefulness of this organization and, at the same time, do all that is possible toward the advancement of the service of railroading.



## AN ASTRONOMICALLY INCLINED MASTER MECHANIC.

Mr. L. Bartlett, master mechanic of the Missouri Pacific Railway, at St. Louis, Mo., is fond of astronomy, and some time ago built with his own hands the telescope shown in the illustration above—built it himself, even to the finest details. We are indebted to *Locomotive Engi-*

*neering* for this illustration, which was prepared by that paper, and also for the following matter sent to that paper by Mr. Bartlett:

“I send you by mail today a photograph of the instrument in the observatory at my residence. I have felt some little hesitancy in doing this, because I have never been a seeker of notoriety; but as a picture of this instrument might indicate to the balance of our railway friends that railway men sometimes have fads or hobbies, disconnected from their legitimate line of business, and they might also be glad to know who such gentlemen are, and in visiting different cities, should they be interested in some of these lines, they would have an opportunity of calling and witnessing some of the productions of amateurs. It was at your solicitation I had a copy of the photograph made, and send same to you. I do not think that I would have done it voluntarily. You saw the instrument and the surroundings, and possibly can better describe what you saw than I.

“Suffice to say, in a general way, that the building is square, made of wood in the cheapest possible form, covered with iron upon the outside, and the roof is run off on rollers. The track upon which the roof runs off has an inclination of about six inches in twelve feet, and the roof is pulled back in position by a rope going over a sleeve. The instrument is set upon a brick pier and the columns bolted securely thereto. The telescope tube is driven by clockwork, which is not shown in the photograph, as it was taken before the clockwork was applied. The right ascension and declination circles are made of aluminum, the graduation being made upon this metal, and as the metal does not tarnish under any circumstances, it makes a most excellent material for this service.

“The entire instrument was built by the undersigned, even to the grinding of the lenses composing the object glass, and I might say in this connection that in the figuring of object lenses for telescopes, the refinement of mechanics is developed to the highest degree. The errors of curvature amounting to anywhere from twenty to fifty or more thousandths of an inch have to be taken into consideration, and instruments for measuring these quantities are used. These figures may seem extravagant to some of our friends in the locomotive business, but I assure you they are not extravagant to the optician. The heat from the finger held for a very short time upon the surface of a piece of glass will cause a little hill to be raised by the expansion of the glass, and this hill can be readily measured. This gives some idea of the delicacy with which the curves of object lenses have to be produced. In fact,

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opticians sometimes cease work entirely for some hours upon lenses, in order that they may accommodate themselves to an equalized temperature, so that the figure can be more accurately determined."

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## COMMUNICATION.

### SCHOOLS FOR RAILWAY EMPLOYEES.

DETROIT, Jan. 29, 1900.

*To the Editor of the Railway Master Mechanic:*

I noticed, some time ago, in the December number of the RAILWAY MASTER MECHANIC an article entitled "The Ordinary Apprentice," by D. J. Durrell, in which the writer gives Mr. Charles Paine, Mr. E. T. Jeffreys, and Mr. H. G. Brooks credit for having gone to considerable expense in having fitted up school rooms and starting schools for young men and apprentices in their employ. I think it is a very nice thing to do, but I want to inform you that "there are others" who have for years past established, and are yet maintaining, such schools. For your information, I would say that Mr. H. B. Ledyard, of the Michigan Central Road, established such schools a number of years ago, and they are now in operation, and anybody that cares to know what they are doing can find some very creditable work done in these schools.

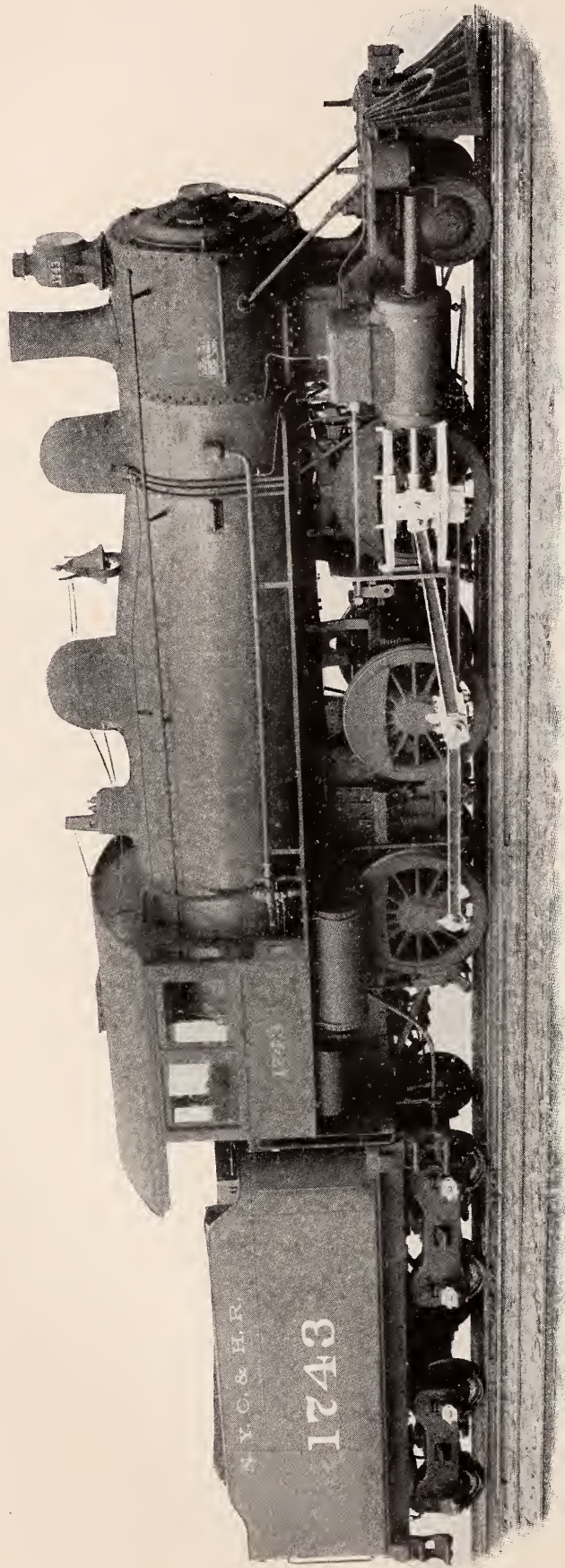
Notice was first given on the Michigan Central, Aug. 20, 1886, that a night school would soon be established, holding one evening a week, to give free instruction in mechanical drawing, mathematics, etc., to employes, the only expense being for their instruments.

Sufficient number responding to this notice to make the project seem a worthy one, the first session was held on the evening of Sept. 10, 1886, and the school has continued to hold one session per week during six months of each year.

At present, classes are held at Jackson, St. Thomas and Detroit. At St. Thomas and Detroit, instruction is given in both free hand and mechanical drawing. The free hand drawing is mostly lettering, scroll work and ornamentation that would be beneficial to painters and decorators in the car department.

The mechanical class receives instruction in drawing from copy and model, the copies being details of cars, tools, machinery, etc., that are come in contact with in their work.

At present the average attendance is, Jackson, seventeen; St. Thomas mechanical class, fifteen; St. Thomas free hand class, thirteen; Detroit free hand class, thirteen; Detroit mechanical class, thirteen;



MOGUL FREIGHT LOCOMOTIVE, NEW YORK CENTRAL & HUDSON RIVER RY.

Total weight—155,200 pounds; weight on drivers—135,500 pounds; cylinders—20x28 inches; drivers—57 inches; heating surface—2,507.2 square feet, of which 185.6 square feet is firebox and 2,321.6

square feet tube surface; grate area—30.3 square feet; fuel—bituminous coal;

working steam pressure—190 pounds; boiler 67 5-16 inches; tank

capacity—water 5,000 gallons; coal 10 tons.

making a total of seventy-one young men receiving instruction one evening per week.

The interest taken by the majority of the pupils is all that could be desired. Most of the pupils are young men who have had no previous training at drafting, and the experience gained has not only aided them to do their work more intelligently, but, in a great number of cases, to better their positions and become foremen in their departments.

Yours truly,

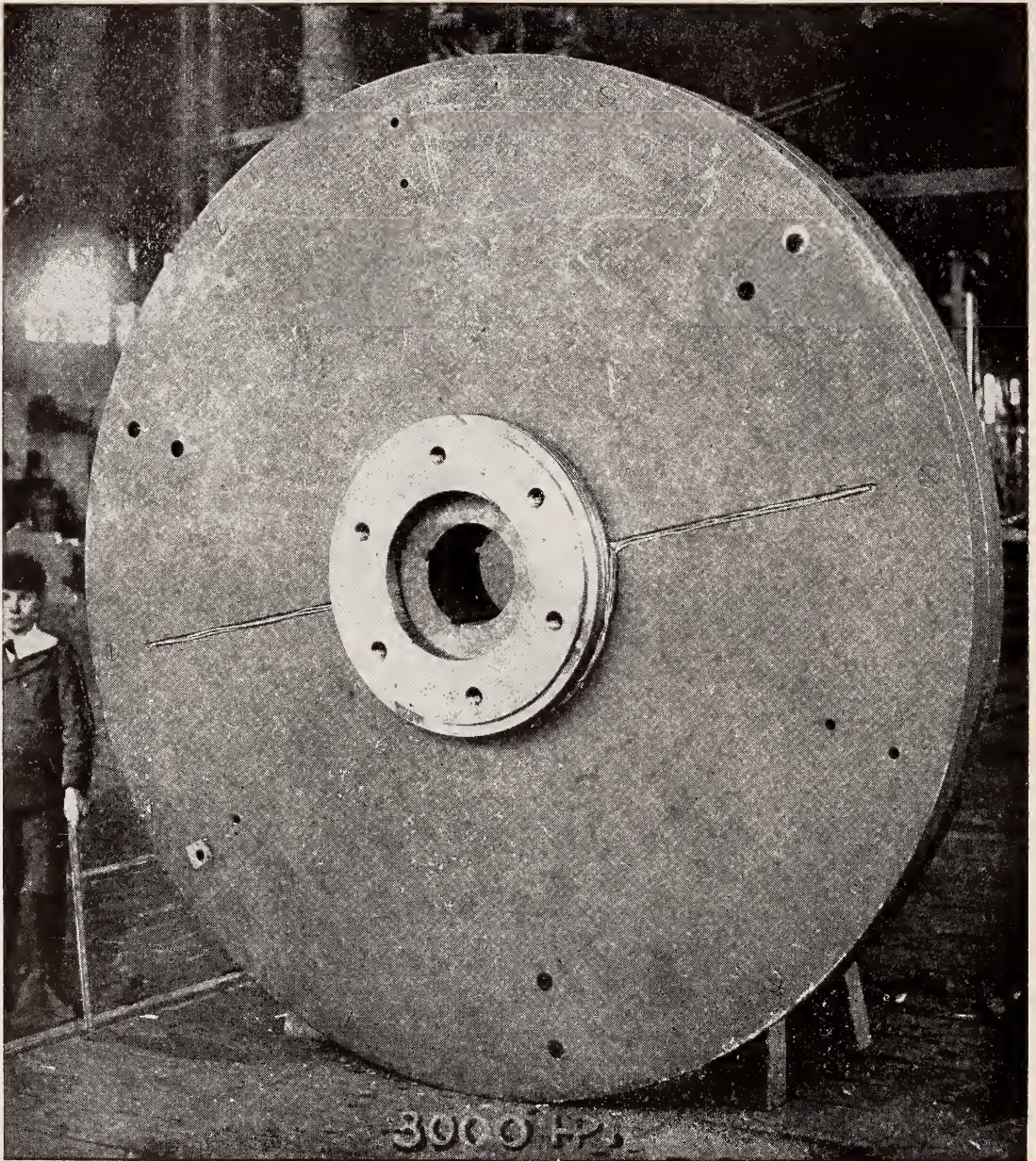
ROBT. MILLER.

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## MOGUL FREIGHT LOCOMOTIVE—NEW YORK CENTRAL.

Some new mogul freight locomotives have just been built for the New York Central & Hudson River R. R. by the Schenectady Locomotive Works. On the opposite page we give a perspective of one of these engines. They were built to the designs and specifications of the mechanical department of the New York Central, and were worked out under the direct supervision of Mr. A. M. Waitt, superintendent of motive power and rolling stock of that road. The engines have 20x28-inch cylinders. They weigh 155,200 pounds, of which 135,500 pounds are on the drivers. They have 57-inch drivers; extended wagon top boilers 67 5-16 inches in diameter, and designed to carry 190 pounds; a firebox 108 1-16x40 3/8 inches; grate area of 30.3 square feet; heating surface of — tubes 2,321.6 square feet; firebox 185.6 square feet — total, 2,507.2 square feet.

These engines have U. S. metallic piston rod and valve stem packing, Richardson balanced valves, cast steel driver centers, Monitor injectors, Fox pressed steel floating bolster tender trucks, Westinghouse-American combined brakes, Westinghouse pump, Consolidated muffled safety valves, Nathan triple sight feed lubricator, French springs, Franklin boiler lagging, Leach sander, Gould couplers, National Hollow brake beams, United States round headlight, Utica steam gauge, and water scoop on tender.



## THE ARNOLD MAGNETIC CLUTCH.

In the design of the modern electric power plant it is frequently found desirable to arrange the generators in such a way that they may be readily connected or disconnected to the prime movers, according to the exigencies of the service. This requirement of successful power station design was early realized by Mr. Bion J. Arnold, of Chicago, a pioneer in this field of engineering, who recognized at the same time the limitations of the ordinary friction clutch for this purpose. Accordingly, some years ago, Mr. Arnold worked out a device which would meet modern requirements, and the result has been the development of the Arnold magnetic clutch, a number of which have already been built.

These clutches are, in reality, friction clutches, yet the friction between the contact surfaces is not due to mechanical pressure, but to magnetic traction. The working parts of the clutch are composed of metal having a high permeability, so arranged as to become magnetized upon the passage of direct current through the coils with which they are provided. The two parts of the clutch can be attracted together in this way with a pressure far in excess of that obtained in mechanical clutches, and it is only a question of making the clutches large enough to enable them to transmit power in any desired amount. The energizing circuit is controlled by means of a switch placed at a convenient point, which is quite a decided advantage over the ordinary friction clutch.

These magnetic clutches possess the advantages of neat appearance and compact design. Even in the larger sizes the amount of space occupied upon the shaft is not much more than twice the diameter of the shaft, and by using a flange forged solid on the end of the shaft, they can be made to occupy even less space when used as cut-off couplings. Owing to their having no projecting surface or parts to catch the air when in operation, the windage resistance is negligible. The greatest advantage, however, of this form of clutch over others, is the fact that it is self-contained—the “action and reaction” being within the clutch itself, and consequently there is no resulting end thrust upon the shaft bearings and no additional friction load due to the operation of the clutch.

Our illustration shows the largest magnetic clutch in the world. It is 100 inches in diameter, and is capable of transmitting 3,000 horse-power at 150 revolutions per minute. This clutch is one of three now in use, connecting the engines and generators in the central station of the Imperial Electric Light, Heat and Power Company at St. Louis.

The current is carried to the clutch coils through contact rings upon the side of the clutch, and carbon brushes held by insulated brush holders. The electric connections are simple and easily accessible for inspection.

The unique feature of this clutch is the small amount of current needed. It requires no more than would be used by four 16-candle power incandescent lamps, and the loss in the clutch due to the continuous use of the electric current, while the clutch is in operation, amounts to only one-hundredth of 1 per cent of the power transmitting capacity.

Although these clutches were developed for use in connection with the “Arnold system” of power station construction, their application is in no way limited to the demands of this system, and they have been adapted and adopted for other purposes. A number have been made to

connect large synchronous motors to their load in such a way that they can be quickly disconnected in case of accident, and they have also been built for use upon line shafting. Indeed, there would seem to be no limit to their use wherever it is desired to transmit power from one shaft to another.

### THE CLIMAX ARMOUR HOSE COUPLING.

An armour for rubber hose is, as is well known on the road and in the shops, a thing much needed. But when it is supplied the problem arises as to how to fasten it at the hose ends. The Climax armour and coupling seems to meet both needs. This armour, the form of which is shown in Fig. 1 of our engravings, is made of flat steel ribbon about  $\frac{1}{8}$ -inch wide and about as thick as an ordinary piece of tin. It is so closely woven that it is practically impossible for anything to damage the hose by cutting it, and it also makes it impossible for the hose to kink, and yet the plan of weaving it around the hose is such that the flexibility of the latter is not impaired.

It will stand, it is claimed, anywhere from one to five thousand pounds pressure with a very light weight hose. At a recent test in the east a 2-ply garden hose, which will ordinarily stand only a few pounds pressure, withstood 1,800 pounds pressure to the square inch with this armour applied.

This armour has been on the market for a long while, but a great objection to it has been that there was no way to fasten it at the end of the hose lengths. Heretofore it has been wound with wire and soldered, but this was damaging to the hose, and when under high pressure it would either cut the hose or break the armour, or tear it out. The new method of holding this armour is clearly shown in detail in Fig. 2 of our engravings, Fig. 3 revealing the neat exterior design. Referring to Fig. 2, it will be seen that an inside sleeve fits closely around the hose. This sleeve has in it a recess near the end into which the rubber hose is expanded. A brass ferrule is slipped inside the hose and then expanded so as to force the substance of the hose back into the recess, thus giving an effective grip upon it. After this inside sleeve is placed on the hose, the end of the armour extending around the outside of the sleeve, an outside tapered collar is slipped over all, and the nut at the top screwed in tightly. This, of course, draws the tapered pieces together, firmly gripping the armour. Increase of pressure or any pulling out strain simply makes tighter the grip with which the armour is held. It should be noted that the lower edge of the collar is flared out and rounding, so that there can be no real sharp bend of the hose at the point of connection.

It is claimed that 100 feet of hose and armour, with two couplings, fitted up so as to stand 2,000 pounds pressure, can be furnished for just about one-half the price of a first-class high grade hose. According to this claim the first cost thus becomes even less than that of hose that the majority of compressed air and steam machinery users are buying.

A leading advantage of using armour covered hose, aside from the strengthening, etc., is that the hose cannot be cut or damaged when drawn over rough places or against sharp

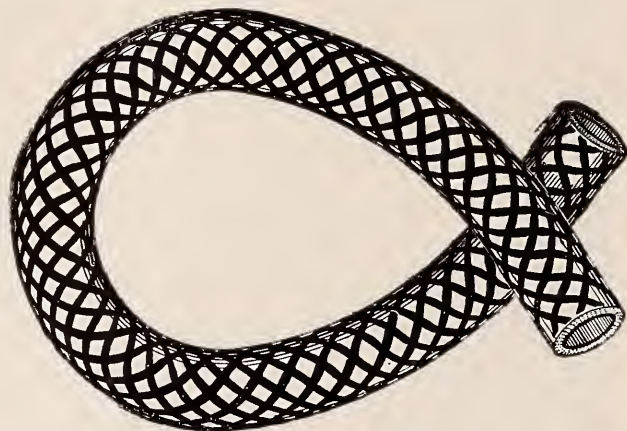


FIG. 1—THE ARMOUR.

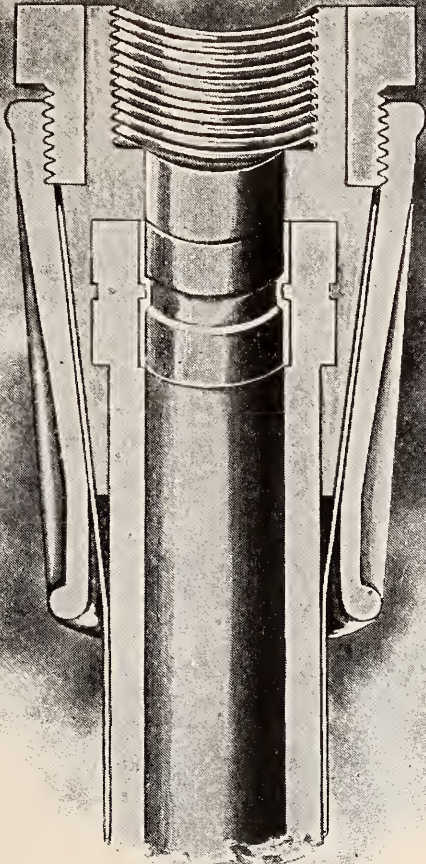


FIG. 2.

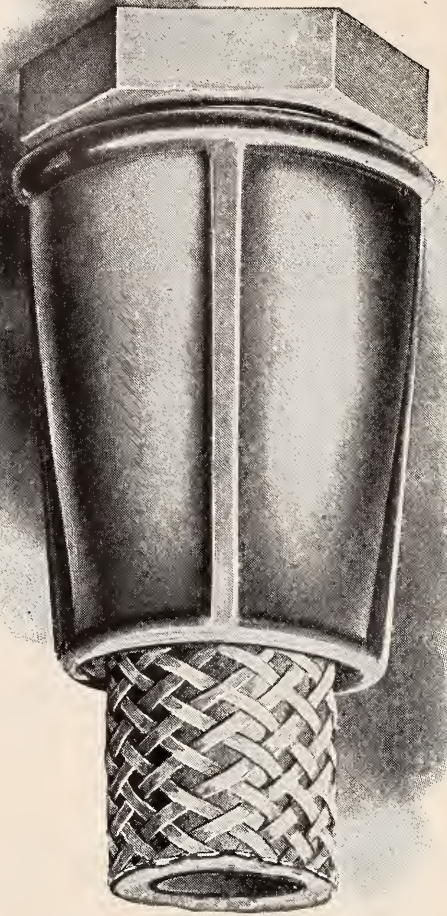


FIG. 3.

THE CLIMAX ARMOUR HOSE COUPLING.

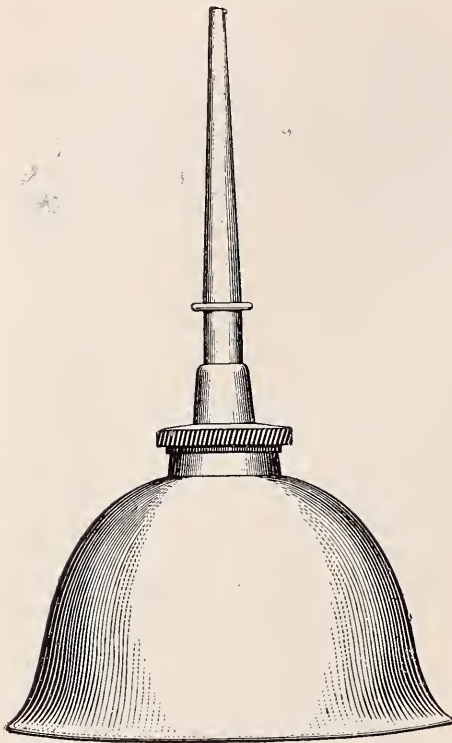
points, for the armour is closely woven. Some of the railways using this are the Pennsylvania Railway Co., Chesapeake & Ohio, Chicago & Northwestern, Denver & Rio Grande, Chicago Great Western, Great Northern, Southern, and the Lake Shore. This armour and coupling are offered by F. G. Street, 535 Temple Court Building, Chicago.

A NEW OILER.

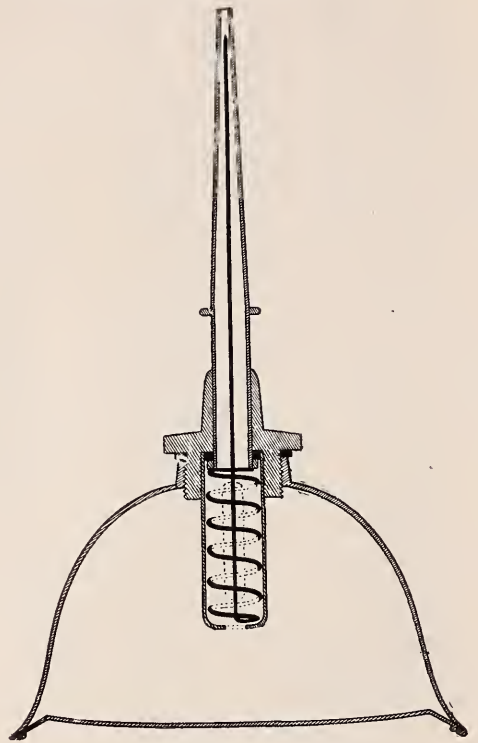
The Gem Manufacturing Co., of Pittsburg, Pa., presents a new device in the Gem oiler. The can, in itself, is a departure from methods now obtaining, yet it still preserves the fundamental principle of the old.

In this oiler the bottom is constructed from high carbon spring steel. The body is made from the best grade of basic low phosphorus steel, pressed and drop-forged into shape, and flared and spun firmly against the bottom proper. This process secures 50 per cent greater strength to the can and permits 95 per cent of the product to leave the machines proof against leakage. To further strengthen the cans and insure against any leakage whatever, the oilers are all brazed upon the inside. The spout is made of the same material as

the body and is shaped to prevent excessive oil flow. The brass work, so far as finish and quality is concerned, speaks for itself. This is, in fact, true of the entire can.



PERSPECTIVE.



SECTIONAL VIEW.

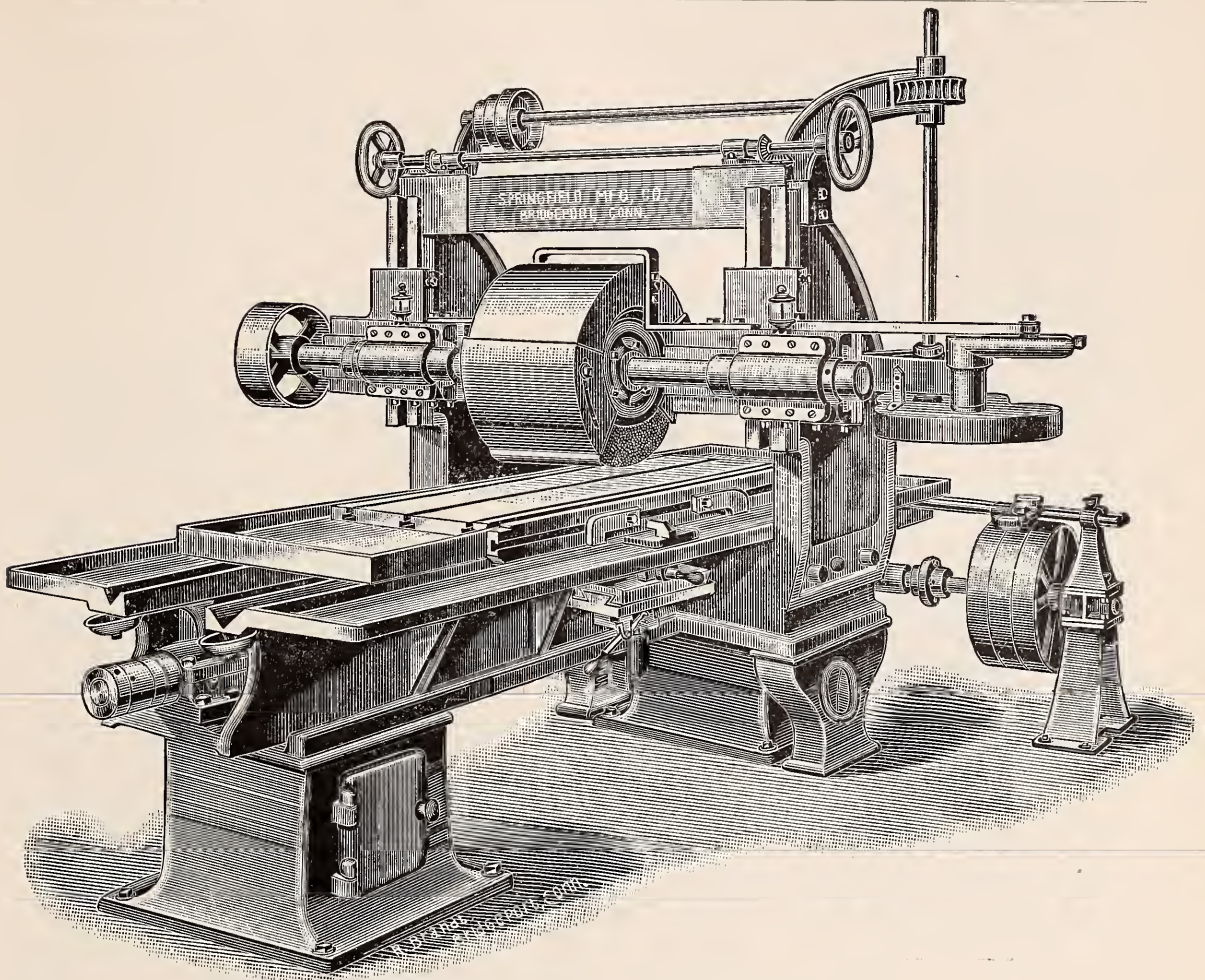
THE GEM OILER.

The construction of the spring steel bottom merits attention, and is well shown in the sectional view. The bevel shown arrests the spring and is claimed to thus relieve the junction of the body with the bottom, of any strain whatever. The shape of the body shows good strength lines. The cage is strongly built of brass and allows a free oil flow, while proving a sturdy base for the spring plunger action.

The dirt ejecting device, which is the especial feature of this oiler, is made of piano wire and will, it is claimed, last almost a lifetime. The mechanism is free and simple, and every part is readily replaced, and interchangeable, so that should any part or parts of the can be injured the entire oiler is not lost, as is the case with many of the older ones. To eject dirt or other clogging substance from the spout, a firm but easy pressure downward upon the copper ring assures the automatic action of the plunger. The spout ejector answers another purpose, for, it is claimed, if the can is dropped directly upon its point the spring acts as a recoil, taking up the force of impact.

### AN AUTOMATIC OSCILLATING SURFACER.

This machine is designed for rapidly, accurately and economically finishing large surfaces, or a large number of small surfaces of uniform thickness. The bed and platen are so arranged that water is used, conducted to a receptacle and forced back over the wheel by the use of a pump. Care has been taken to protect the ways and bearings from emery grit. The machine is constructed under two different plans. Where exceptionally fine work is required the platen is driven with a screw in connection with a worm and worm gear, and, by this construction, vibration is overcome and a very even motion is transmitted, producing a fine, even face. Where a fine finish is required, but not necessarily an exact thickness, the platen is driven with rack and gear, making it somewhat cheaper to construct. The oscil-



AUTOMATIC OSCILLATING SURFACER.

lating feature not only assists in producing the work economically, but in retaining an even face on the emery wheel. By this motion the emery wheel has a cross cut on the metal similar to the operation of a file. The oscillation is obtained by the boxes and spindle, carrying the emery wheel, sliding on specially constructed ways connected by a connecting rod to a cam wheel. Each machine is equipped with an automatic idler, which automatically keeps the belt in proper tension regardless of the thickness of work being ground. These machines are manufactured in three different widths, viz: To grind fifteen inches, twenty-four inches and thirty inches, and in several different lengths to grind from four feet to twelve feet long. It has been demonstrated by many of the largest manufacturers in this and foreign countries, that this machine will produce work more economically than any other process at the present time; and it is particularly adapted for work where locomotives are constructed. This machine is made by the Springfield Mfg. Co. of Bridgeport, Conn.

## PERSONAL MENTION.

Mr. J. O. Pattee has been appointed superintendent locomotive and car department of the Missouri Pacific and St. Louis, Iron Mountain & Southern system, vice Mr. Frank Rearden, resigned to engage in other business. Mr. Pattee left the position of superintendent of motive power of the Great Northern system January 1, 1900, and in our notice of his career in our February issue we stated that he would rest for a year at least. This statement was made upon his authority, but it is evident that he could not resist the temptation to again put on the harness.

Mr. Joseph Townsend, whose retirement from the position of master car builder of the Chicago & Alton Railway we announced some time ago, has long been a picturesque



MR. JOSEPH TOWNSEND.

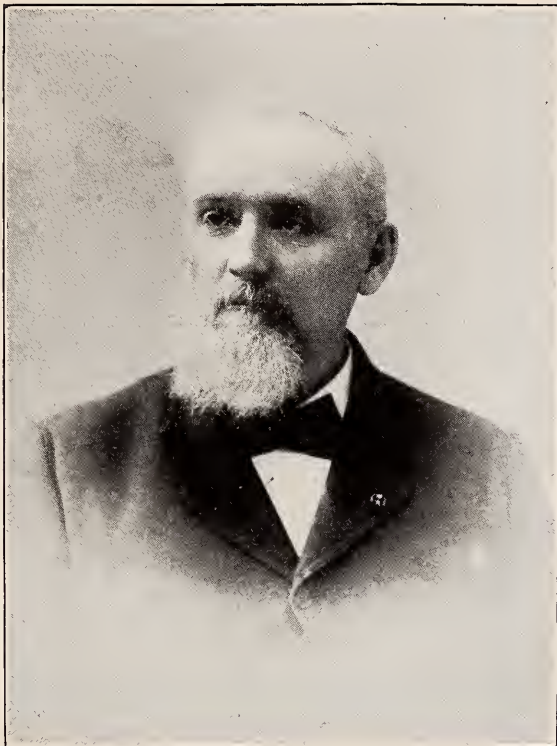
and lovable character in the railway world. Mr. Townsend had been in service with the Chicago & Alton Railway as master car builder at Bloomington, Ill., for twenty years, and when he retired, on the first of this year, he did so with the purpose of spending the rest of his days in quiet retirement. Mr. Townsend, at the age of eighteen, was serving an apprenticeship at the carpenter's trade in Utica, N. Y. He first took up railway work, after this experience, at Oneida, N. Y., entering the repair department in the car shops of the Syracuse & Utica Railroad, which is now part of the New York Central. He later came west, going to Adrian, Mich., and working in the Lake Shore & Michigan Southern shops at that point. The Lake Shore Company later sent him to Chicago, where for two years he had charge of the car works at that end of the road. He then went to the Racine & Mississippi Railroad, now part of the Chicago & Northwestern, as general foreman at Racine, Wis. He remained here in charge of the building of cars for this new road until the breaking out

of the civil war, when he resigned. He endeavored to enlist at the first call for troops, but was rejected because of an injured ankle. He was then for two years at St. Charles, Mo., with the Northern Missouri Railroad; afterward becoming general foreman of the car building department of the Iron Mountain road under John Hewitt. The Chicago & Great Eastern Railroad then offered him the position of master car builder, and he went to Richmond, Ind., to fill that post. He went west again, in about 1865, as master car builder of the Kansas & Pacific Railroad at Wyandotte, Kan., where he remained for many years. He was later with the Missouri, Kansas & Texas, with Mr. R. S. Stevens, and went with Mr. Stevens to the Hannibal & St. Joe, remaining there as long as Mr. Stevens did. He was then appointed master car builder of the Central branch of the Union Pacific, holding that position for a short time, when in March, 1880, came the call which permanently located him for the rest of his business life, the Chicago & Alton Railway offering him the position of master car builder. Here for twenty years he had charge of all new car work and the repairing. Mr. Townsend has for many years been one of the most popular attendants at the Master Car Builders' conventions. And there, and at the Western Railway Club meetings, (he was one of the earliest workers in and supporters of that club), and everywhere and at all times he has been affectionately and reverently spoken to and of as "Uncle Joe." He has a son, James A., who is foreman

of locomotive and car repairs of the Chicago & Alton at Kansas City, Mo. "Uncle Joe" some time ago recovered from a severe illness of three months' duration, and will be at home to his old railway friends at 606 West Jefferson street, Bloomington, Ill., where he, with his good wife at his side, will round out the allotted term, which his hosts of friends hope may be long and happy to him.

Mr. Robert Miller, whose retirement from the position of superintendent of motive power and equipment of the Michigan Central Railway we noted in our last issue, has for

years been prominent in railway mechanical circles. Mr. Miller is a fine type of the self-made American man. His life epitomized may be thus expressed:—a stern struggle for existence in boyhood, a youth dedicated to the public service, a gradual progress upward in his profession, and finally a recognition on a scale far beyond his early hopes. Mr. Miller was born in 1839, near Ithaca, N. Y., and in 1858 he went to work in the Chicago, Burlington & Quincy shops at Aurora, Ill. When the war broke out he was a small foreman at that point. He enlisted at once in the Eighty-ninth Illinois Volunteers, the "railroad regiment," first for the three months' service and afterward for the war. He was at Stone River, Chattanooga, Knoxville, Atlanta, Franklin and Nashville. At Chickamauga, a spent bullet struck the buckle of his belt and was turned by it to his thigh. The buckle, it may be added, is preserved by his sons with a feeling which ordinary buckles do not inspire. At the close of the war he was a first lieutenant. He still tells, with quiet irony inspired by the spectacle of Cuban



MR. ROBERT MILLER

Retiring Superintendent of Motive Power and  
Equipment, Michigan Central Railway

volunteers in palace cars, how he arrived in Chicago, rejoicing, in a box car. Mr. Miller was, after the war, soon at work for the Burlington road again, and in 1865 became foreman of the Aurora shops. Here he remained until, in 1876 Mr. H. B. Ledyard sent for him to take the place of master car builder and superintendent of the building and water works departments of the Michigan Central Railway, with headquarters at Detroit. In 1884 he was made assistant superintendent, and in 1890 general superintendent of the Michigan Central system. In railway circles, everywhere, his success was regarded with satisfaction. He was destined, however, to enjoy his well earned laurels for only a brief period, for in 1896 he was relegated (though with an increased salary) to the position of superintendent of motive power and equipment. This arrangement lasted until Jan. 25, 1900, when he was curtly asked to sever his connection with the Michigan Central on the first of the following month. No word of fault had been found with his work, and no reason was assigned for his retirement. But without inquiring into the motives inspiring

this step on the part of his company he, on Feb. 1, 1900, quietly quitted the service to which, for twenty-five years, he had devoted himself. Mr. Miller is a man of naturally fine physique, and his manner of life has been such that he now finds himself with bodily strength unimpaired and his mental faculties only ripened by his diversified experience. Though over sixty, he is younger than many men of forty.

Mr. R. F. Hoffman, whose appointment as mechanical engineer of the Atchison, Topeka & Santa Fe Railway System was noted last month, has had an admirable training lead-



MR. R. F. HOFFMAN

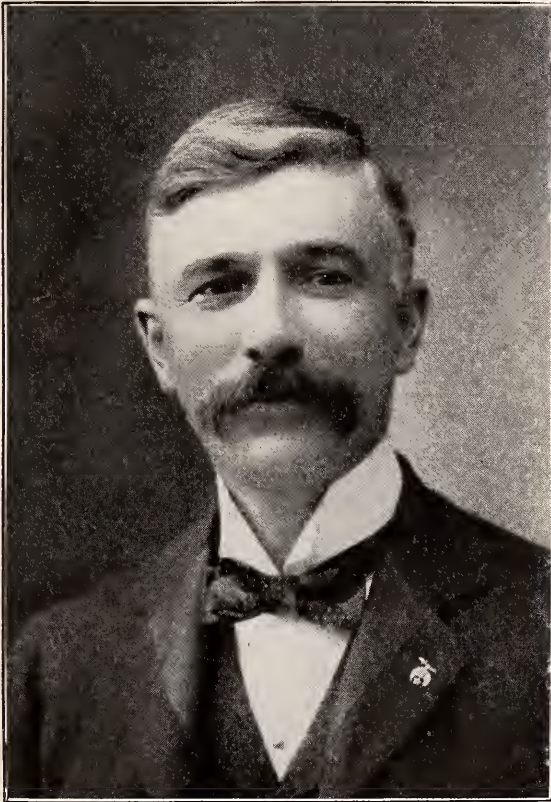
Mechanical Engineer, Atchison, Topeka & Santa Fe Railway

ing up to this important post. His business career may be briefly summarized as follows: He served one year in the rolling mills of the Montour Iron & Steel Company, in the manufacture of rails, bar iron, etc., at Danville, Pa. He then spent three years in the Houston Machine Tool Works at Montgomery, Pa. For the next two years he was with the Philadelphia and Reading Coal & Iron Company and other iron and steel makers engaged on locomotive, blast furnace and rolling mill machinery, at Danville, Pa. He next spent a season of about a year as assistant in charge of machinery with E. I. Dupont de Nemour's Powder Works near Wilkesbarre, Pa. Next followed a season of three years of locomotive building on the pits of the Lake Shore & Michigan Southern Railway at Elkhart, Ind. Then came a year in the corps of the late D. L. Barnes, consulting engineer, and in the mechanical department of the South Side Elevated Railway in Chicago. Then followed about one year in the engineer corps of the Union Loop and the Northwestern Elevated Railway Company in Chicago. After this came one year's service on the

staff of Chief Engineer J. F. Wallace, of the Illinois Central Railway, at Chicago, superintending the mechanical work of the walls and bridge anchorage on the lake front improvements. Then came a year as mechanical editor of the *Railway and Engineering Review*, at Chicago. Since June, 1898, Mr. Hoffman has been with the Atchison, Topeka & Santa Fe, on the staff of Superintendent of Motive Power John Player, where he has been engaged on locomotive road tests, the adaptation of large locomotives to a given duty, and mechanical engineering of a general character upon the system. Mr. Hoffman, at thirty-six years of age, finds himself holding a very important post, for which he became fitted, not solely by reason of his varied practical work in previous years, but also by the systematic employment of his spare time in careful and thorough self education. Both before and since his active journalistic work on the *Railway and Engineering Review* Mr. Hoffman has been an occasional contributor

to the technical press. He has published some notable articles in the *Railroad Gazette*, either over his own name or anonymously, and is now writing the interesting series of articles on the piston valve which THE RAILWAY MASTER MECHANIC is publishing.

Mr. T. B. Kirby, for many years superintendent of the Armour Car Lines, has resigned his position to accept the position of western manager of the Lappin Brake Shoe Co. Armour & Company very reluctantly accepted the resignation of Mr. Kirby because



MR. THOMAS KIRBY.

The retiring Superintendent of the Armour Car Lines.

of the valuable service he has rendered them. Their car line business was only in its infancy when he took hold of its superintendence, and the present efficient state of the equipment of their car lines is due to the untiring efforts of Mr. Kirby, who is one of the leading car builders in the country. Mr. Kirby is a comparatively young man, and is a native of Troy, N. Y., where he was born forty-five years ago. Entering the service of the Lake Shore & Michigan Southern Railway in 1873, in the car repairing department, he gradually worked his way on until he was appointed master car builder of the western division of that road, in which capacity he remained for ten years, when, in 1890, he resigned to accept the position with Armour & Company which he now relinquishes. Among railway men in general, we know of few having a greater number of warm friends, and we predict for Mr. Kirby great success in his new career. His connection with Armour & Company was such that it placed him in close touch with the officials of every road in the country, and it is a fact, we

believe, that with all the opportunity for complicated interchange questions arising from the handling of the car department of Armour & Co., no road has had occasion to resort or appeal to the Master Car Builders' Arbitration Committee for an adjustment of any matter arising with that company. It is due to his frank and open manner of doing business, that "Tom" Kirby has won the confidence of all who came in contact with him. Mr. Kirby is a nephew of Mr. John Kirby, for many years master car builder and now superintendent of car construction of the Lake Shore & Michigan Southern.

Mr. John M. Holt, general foreman of car repairs of the Southern Railway, died of paralysis of the heart at Washington, D. C., Feb. 25, 1900. He retired to his room on the night of the 25th, apparently in the best of health, and dropped dead before having time to remove his clothing. His body was found by his son the next morning. Mr. Holt began his railway career at the Burlington shops of the old North Carolina Railway, in 1865, as an apprentice in the car department, after which he was placed as car inspector at Greensboro, N. C., and when this road was absorbed by the Richmond & Danville he

was transferred to the Manchester shops of this road as foreman of car repairs. Shortly after this road was incorporated as the Southern Railway, and Mr. Holt was appointed general foreman of car repairs, with headquarters at Washington, D. C. Mr. Holt was a bright, energetic man, and an expert in his particular line of business, with a reputation for fairness which made him well liked by all who knew him. He was an active member of the Master Car Builders' Association. A widow and four children survive him.

Mr. J. F. Deems, master mechanic of the Chicago, Burlington & Quincy, at West Burlington, Iowa, has received just recognition of his services to the company by being promoted to be assistant superintendent of motive power of that road. Mr. Deems has been with the "Burlington" for something over a decade. He went to that road from the Baltimore & Ohio, where he had worked as special apprentice, machinist, etc., for some time. After working as machinist and gang foreman for the Chicago, Burlington & Quincy, at Beardstown, Ill., for about fifteen months, he was made round house foreman; and in May, 1890, he was sent to Galesburg as round house foreman. In October of that same year, he went back to Beardstown as foreman of the machine shop. On Jan. 1, 1891, he was appointed master mechanic of the same road at Ottumwa, Iowa. There he remained until March, 1897, when he was transferred to Beardstown as master mechanic; and in one month thereafter he was sent to West Burlington as master mechanic. This position he has constantly held since, until now he is given this present well merited promotion. Mr. Deems has long been recognized as one of the "coming men" of the west in railway mechanical circles, and it is now apparent that he is "arriving." His active work in the Western Railway Club, for some years past, has attracted considerable outside attention to him. His direct, logical way of attacking things in his club work, as well as in his shop work, may be ascribed in part, perhaps to his training prior to entering railway service—for he was a graduate of the Gilchrist Institute of Pennsylvania (his native state) and afterward taught school during his eighteenth and nineteenth years. Mr. Deems will continue to make his headquarters at West Burlington Iowa.

Mr. William Miller has resigned as superintendent of the car department of Nelson Morris & Co., and has been succeeded by Mr. John Watson. Mr. Miller had been with Nelson Morris & Co. for fourteen years—nine years in their machine shops and five years in charge of their car department.

Mr. L. Crosby has been appointed roundhouse foreman for the Missouri Pacific at Hoisington, Kan.

Mr. H. M. Carson, assistant engineer of motive power of the Pennsylvania Railroad at Altoona, Pa., has been appointed master mechanic, with headquarters at Pittsburg, in place of Mr. D. O. Shaver.

Mr. M. T. Fisher has been appointed master mechanic of the Great Northern at Kalispell, Mont., vice Mr. J. R. Van Cleve, resigned.

Mr. Edward Z. Hermansader has been appointed general foreman of the Lake Shore & Michigan Southern shops at Elkhart, Ind.

Mr. A. T. Flondenberg has been appointed acting chief draftsman of the Pittsburg Cincinnati, Chicago & St. Louis at Columbus, Ohio, in place of Mr. Edward Graftstrom, who, as previously noted, resigned to become mechanical engineer of the Illinois Central.

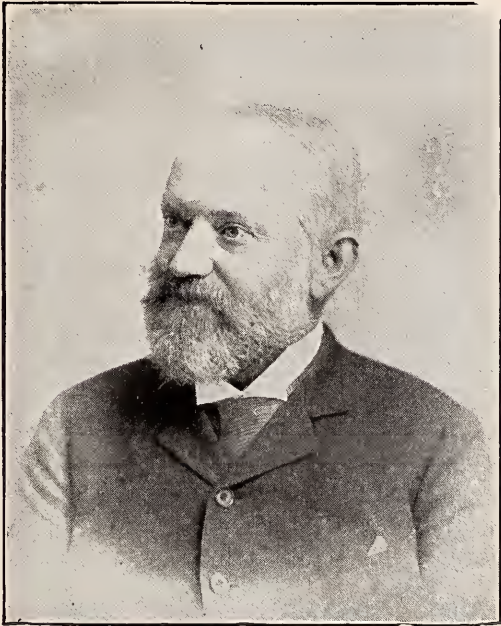
Mr. W. E. Sharp has been appointed superintendent of the Armour Car Lines with headquarters at Union Stock Yards, Chicago, effective April 1, 1900, vice T. B. Kirby, who, as elsewhere noted, resigned to become western manager for the Lappin Brake Shoe Co.

Mr. Frank Rearden has resigned as superintendent of locomotive and car department of the Missouri Pacific and St. Louis, Iron Mountain & Southern Railway System. He

will, we understand, engage in the railway supply business. Mr. Rearden has for many years ranked as a leader in southwestern railway circles. Previous to 1888 he was master mechanic of the Missouri, Kansas & Texas at Denison, Texas. For the two years following he was master mechanic of the St. Louis, Iron Mountain & Southern at Little Rock, Ark. Since 1890 he has been superintendent of the locomotive and car department of the entire Missouri Pacific system. Mr. Rearden's successor is Mr. J. O. Pattee, formerly of the Great Northern.

Mr. Addison C. Rand, president of the Rand Drill Company, of New York, died suddenly at his home, 400 West End avenue, on Friday evening, March 9. He was born in Westfield, Mass., in September, 1841, and was a member of an old New England

family, prominent since the settling of the colonies. He was one of the pioneers in rock drilling and air compressing machinery, and was identified with many of the mechanical and engineering societies. He had filled the office of treasurer of the Engineers' Club, of New York city, from its beginning, and, among other societies, was a member of the American Institute of Mining Engineers and of the American Society of Mechanical Engineers and a member of the Chamber of Commerce. He was a director of the New England Society, of the Ninth National Bank and of the Laffin and Rand Powder Company, and was a member of the Union League and Colonial Clubs. Mr. Rand's name will always be linked with the development of rock drilling and air compressing machinery. He was one of the first in this field of work, and guided its growth from the smallest



MR. ADDISON C. RAND.

and most uncertain beginnings to its present large proportions. While much work with drills had been done at the Hoosac Tunnel before his connection with the industry, it is well known that their use then was only possible because that enterprise had the State of Massachusetts behind it. The real use of rock drills in civil engineering work, and on an economic basis, began with the Rand drills at the West Point tunnel of the West Shore R. R., although the Haverstraw and Weehawken tunnels soon followed. Following this came the tunnels of the abandoned South Pennsylvania R. R., and soon after the Washington and New York aqueducts. It seems impossible that an appliance, without which no large work of this character would now be attempted, could have been of so recent origin, but such is the fact. Machine drills became an accepted fact, in mining, before they did in civil engineering work; the place of their birth, in an economic sense, being the iron mines which center about Port Henry, New York, though the iron and copper regions of Lake Superior district soon followed.

The following changes in the mechanical department of the Baltimore & Ohio were effective March 1: The position of master mechanic at Grafton was abolished. Mr. P. Hayden was appointed general foreman at Bendewood, vice J. F. Prendergast, resigned.

Mr. J. F. Prendergast was appointed general foreman at Grafton, vice P. Hayden, assigned to other duties. Mr. P. J. Harrigan was appointed general foreman at Connells-ville, Pa., vice D. Witherspoon, transferred. Mr. D. Witherspoon was appointed general foreman at Cumberland, Md.

Mr. P. Reilly, who recently resigned as superintendent of equipment of the Lake Erie & Western, died at Lima, Ohio, March 10.

Mr. G. T. Neubert, division master mechanic of the Atchison, Topeka & Santa Fe at Arkansas City, Kan., has been appointed division master mechanic at Newton, Kan., vice J. E. Gavitt.

Mr. H. Monkhouse, superintendent of machinery of the Chicago & Alton, has resigned.

Mr. Albert B. Corinth has been appointed assistant superintendent of motive power of the Atlantic Coast Line.

Mr. Edward Elden has been appointed division master mechanic of the eastern division of the Fitchburg, with headquarters at Boston, Mass., vice F. C. Smith, resigned.

Mr. T. S. Lloyd has been appointed superintendent of motive power and machinery of the Delaware, Lackawanna & Western, vice J. W. Fitzgibbon, whose resignation we noted last month. Mr. Lloyd has hitherto been master mechanic of the Chesapeake & Ohio at Richmond, Va.

Mr. B. C. Howard, for many years past general foreman of the Union Pacific shops at Grand Island, Neb., died March 14, aged sixty-seven years.

Mr. John H. Murphy, master mechanic of the New Orleans & Northeastern, Alabama & Vicksburg, and Vicksburg, Shreveport & Pacific at Monroe, La., has been appointed master mechanic of the Cincinnati, New Orleans & Texas, with headquarters at Chattanooga, Tenn., in place of Mr. V. B. Lang, who, as previously noted, resigned to become division master mechanic of the Illinois Central.

Mr. Robert Woodburn has been appointed master mechanic of the Halifax & Yarmouth, with headquarters at Yarmouth, N. S.

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## SUPPLY TRADE NOTES.

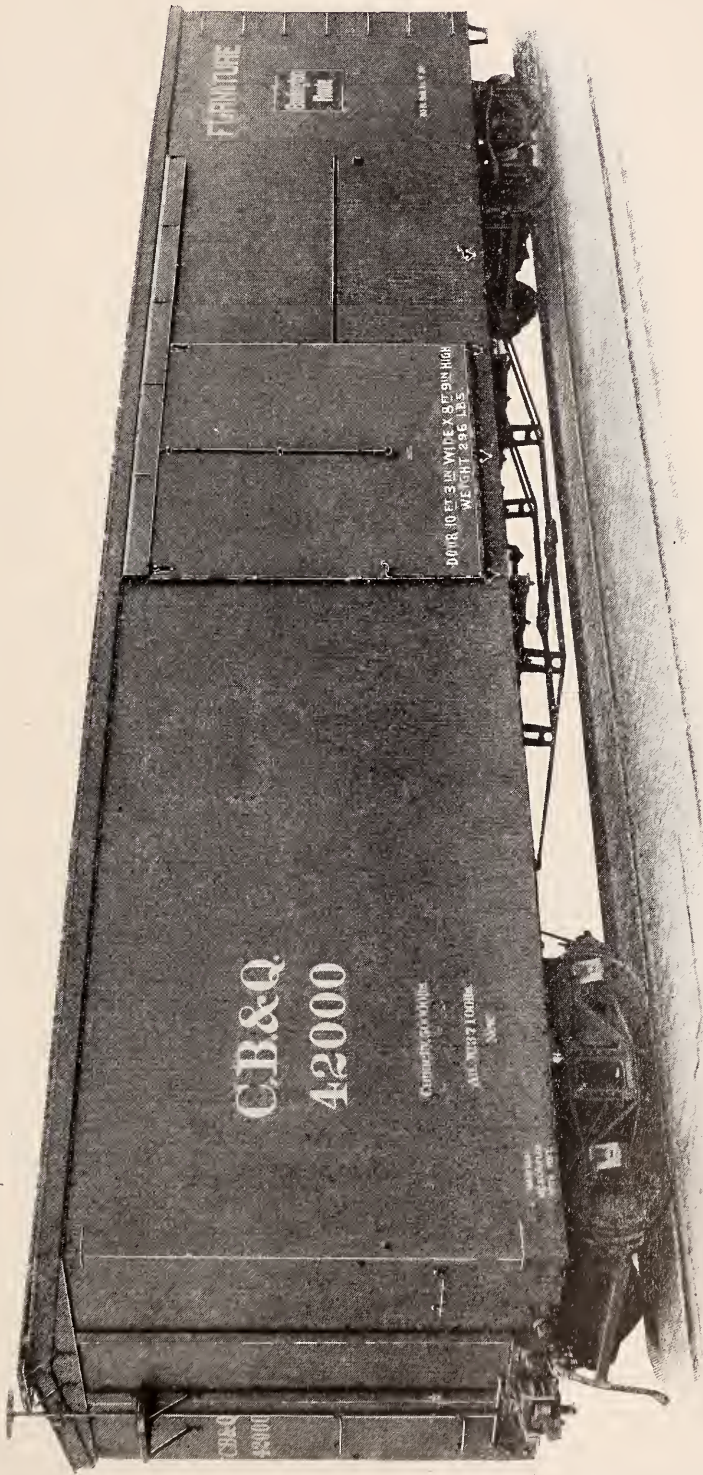
Mr. Richmond P. Scales has been appointed assistant general manager of the Consolidated Car Heating Co. with headquarters at Albany, N. Y. Mr. W. P. Cosper, hitherto general agent for the company at St. Louis, succeeds Mr. Scales at Chicago, with the title of general agent, and office at 513 Western Union Building.

Mr. Clarence H. Howard, who for many years has been with the Safety Car Heating and Lighting Co. as its secretary, has resigned to become vice president of the Schickle, Harrison & Howard Iron Co. of St. Louis, in which concern he will have direct charge of the sales department. Mr. Howard, it may not be generally known, was originally a railway man, being years ago assistant master mechanic on the Missouri Pacific. He was afterward superintendent of the Missouri Car and Foundry Company's plant at Cambridge City, and later manager of the car seat department of the Scarritt Furniture Co., and still later assistant general manager of the St. Charles Car Works.

About three years ago the standard steel platform for passenger cars, designed by H. H. Sessions, was placed upon the market by the Standard Coupler Company. It is now in use on eighty railroads, besides being the adopted standard of the Pullman Company. The president of the Standard Coupler Company, Geo. A. Post, makes the inter-

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WHEN WRITING TO ADVERTISERS, PLEASE MENTION THE RAILWAY MASTER MECHANIC.

esting statement that, during the first three months of 1900, shipments of steel platforms have been made for application to equipment of railways that, in the aggregate, operate in every state and territory of the United States, except Delaware, and as well in Canada and Mexico.

The Beaver Dam Malleable Iron Co. has opened a Chicago office at 1209 Monadnock Block which office will, for the time being, be in charge of Mr. D. P. Lamoreux, treasurer of the company. This company makes a general line of railway castings, and is enjoying a very gratifying measure of success in securing trade in this line.

Mr. Samuel B. Hynes has been elected secretary of the Safety Car Heating & Lighting Company, with office at Chicago, effective April 1, vice C. H. Howard, resigned to become vice president of the Schickle, Harrison & Howard Co.

The navy department has placed an order with the New York Air Compressor Company, 120 Liberty street, New York, for two duplex compound air compressors of large capacity for the Charlestown navy yard, Boston, Mass.

WANTED—A well established paint company desires to secure the services of a practical and experienced paint salesman. A splendid opportunity. Address William Rawston, care Railway Master Mechanic.

WANTED—Position as master car builder, or as foreman of car shops, by a practical machinist and car builder. Thoroughly experienced in all details of car work and in engine and boiler making and repairing. Best of references. Address M. C. B., care of Railway Master Mechanic.

WANTED—Position as foreman locomotive repairs, by a practical man. Have had several years' experience in this line of work. Good references furnished. Address S. E., care Railway Master Mechanic.

SITUATION WANTED.—Young mechanical draftsman, twenty-nine, machinist, inspector, and thoroughly conversant with modern locomotive work; thorough, careful and accurate; can systematize work of motive power department; is open for engagement as head draftsman with railroad or system. References as to ability and character. Address, "Draftsman," care Railway Master Mechanic.

WANTED—Position as chief clerk in motive power department of a railway. Thoroughly experienced and best of references. Address Q, care Railway Master Mechanic.

A FOREMAN BLACKSMITH desires a position in charge of railway blacksmith shop. Is thoroughly up to date in shop methods and well accustomed to handling men. Best of references can be furnished. Address A. J., care of Railway Master Mechanic.

SITUATION WANTED—By a capable general foreman of locomotive repairs. Address G. F., care of Railway Master Mechanic.

WANTED—Position as mechanical engineer or master mechanic by experienced mechanical engineer, now employed. Address P. R., care of Railway Master Mechanic.

POSITION WANTED by a thoroughly competent mechanical man who is experienced in directing work in a railway shop and in manufacturing establishments. Particularly well up in car work. Now employed, but wishes to make a change. Address the editor of the Railway Master Meehanic.

# RAILWAY MASTER MECHANIC

WALTER D. CROSMAN, EDITOR.

WILLIAM E. MAGRAW, MANAGER.

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Vol. XXIV.

CHICAGO, MAY, 1900.

No. 5.

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## Smoke Prevention on Locomotives.

The report of the committee of the Western Railway Club on smoke prevention states that more attention is given to the subject and better results are reached in Chicago than in other western cities. The report is not very definite or conclusive in its recommendations as to what lines should be followed in order to reduce the amount of smoke now produced, but we can draw our own conclusions from various positive statements scattered through the report. We will quote a few of these paragraphs and try to gather from them the truths the committee intended to convey.

“It is positively known that possibly the best example of smokeless firing is given by a road that uses no device but the brick arch. This being the case, your committee finds it difficult to make any definite recommendation as to the feasibility of mechanical contrivances.”

“The importance of careful firing is recognized by all roads, the general sentiment obtaining that a good fireman without a special device is productive of better results than any of those devices poorly managed.”

The reply of a road running engines into the Union Station at St. Louis is also significant. It states that “a number of smoke preventing devices were tried, but with no appreciable results. The best success in the abatement of smoke has been accomplished by the exercise of care on the part of the enginemen in handling and firing, and by such methods the smoke nuisance has been reduced to a minimum.”

With such information before us, it does not seem difficult to draw some definite conclusions, which should govern master mechanics in their efforts to reduce the amount of smoke made by locomotives in large cities. These could be stated as follows:

First. Steam jets and other similar devices are not to be seriously considered as successful smoke preventives.

Second. The most effectual method of preventing smoke is by the use of the brick arch and skilful firing.

Steam jets which introduce both steam and air above the fire have a temporary dampening effect, when the engine is standing, as they produce a pressure on the firebox equal to the draft, and the current of gas and smoke through the stack is stopped. In other words, smoke is prevented because combustion has almost ceased. When the engine is working, the effect of the steam jets is very slight. The steam is condensed by contact with cold air, and it enters the firebox as moisture, and its effect must be to lower the temperature of the gases and it does not support combustion. The air which is drawn in is also cool, and there is no real combination with the gases, until it is heated up to their temperature.

From any point of view, the steam and air jet cannot be considered as a promising device from which any successful smoke preventer may be evolved, and we believe it to be important that this fact be emphasized, for two reasons: First. Because valuable time has been wasted already in continued and unsuccessful experiments with steam jets; and second, because their presence on the engine and occasional use have the effect of relieving both master mechanic and enginemen of responsibility to a certain extent.

If the steam jet is given up as hopeless, then more attention and effort will be directed toward better proportions of firebox and other features in the original construction of the locomotive.

If the fireman is made to understand that smoke prevention depends almost entirely upon his skill, and that such makeshifts as steam jets are not to relieve him of such responsibility, it will certainly result in the training of better firemen than are produced under the present system of a divided responsibility.

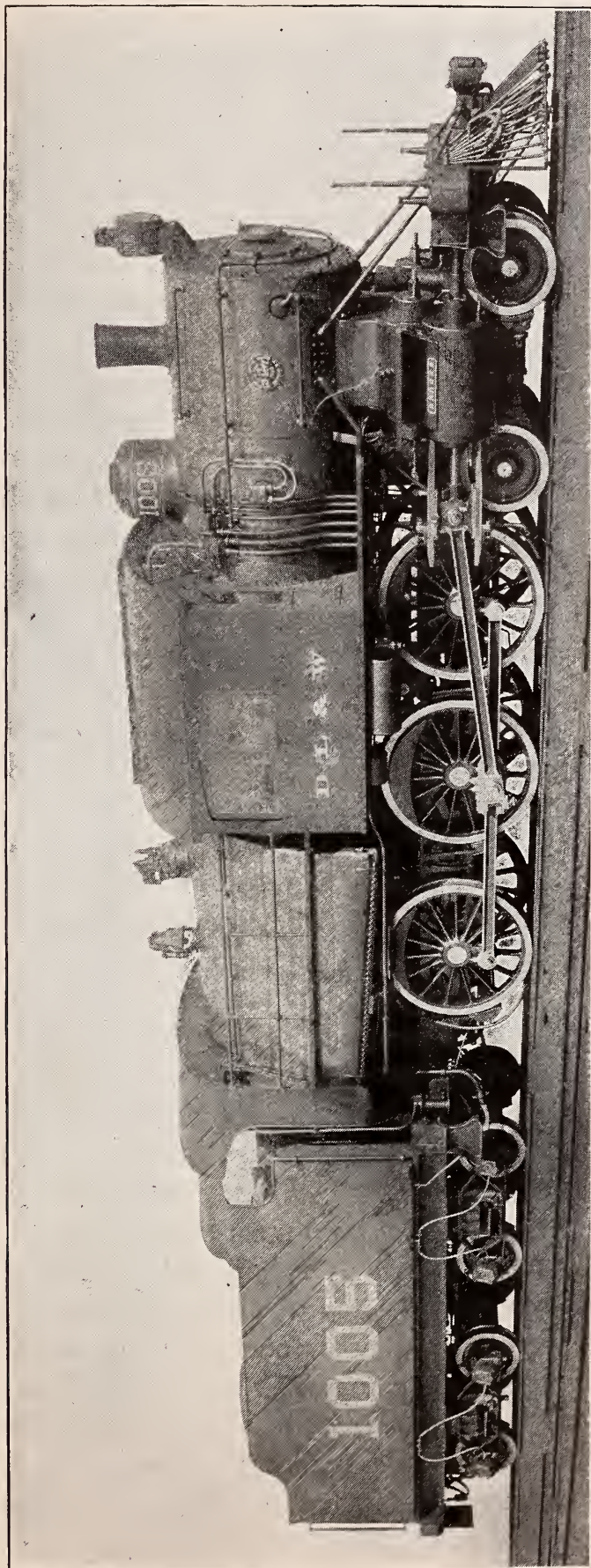
These, we believe, are the serious conclusions to be drawn from the report on smoke prevention.

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## TEN-WHEEL PASSENGER LOCOMOTIVE, DELAWARE, LACKAWANNA & WESTERN RY.

The Brooks Locomotive Works recently furnished an order of seven ten-wheel passenger locomotives to the Delaware, Lackawanna & Western Railway, and on the opposite page we illustrate one of these strikingly powerful looking machines.

These engines weigh 179,000 pounds, of which 137,000 pounds are on the drivers; have 20 x 28-inch cylinders; 69 $\frac{3}{8}$ -inch drivers;



BROOKS TEN-WHEEL PASSENGER LOCOMOTIVE FOR DELAWARE, LACKAWANNA &  
WESTERN RAILWAY.

Total weight—179,000 pounds; weight on drivers—137,000 pounds; cylinders—20x28 inches; drivers—69  $\frac{3}{8}$  inches; heating surface—2,700 square feet, of which 180 square feet is firebox and 2,520 square feet tube surface; grate area—84.2 square feet; fuel—fine anthracite coal;

working steam pressure—210 pounds; boiler 72  $\frac{1}{8}$  inches; tank capacity—water 6,000 gallons; coal 12 tons.

conical connection wagon top boilers,  $72\frac{1}{8}$  inches in diameter, and designed to carry 210 pounds of steam; a wide firebox over the wheels, 127 inches long, 97 inches wide, and 61 inches deep at front, and 50 inches deep at back; grate area of 84.2 square feet; and heating surface of 2,700 square feet, of which 180 square feet is firebox and 2,520 square feet tube surface. The engine will burn fine anthracite coal. The tanks have a capacity of 6,000 gallons of water and 12 tons of coal. The under frame of the tender is the Brooks design, of 13-inch channel, and the tender truck is the Brooks 100,000 pounds design.

The Brooks improved piston valves are used on these engines. The driver centers are of cast steel. The special equipment comprises Gould couplers, American driver brakes and Westinghouse tender and train brakes, Michigan sight feed lubricators, Consolidated safety valves, Hancock composite injectors, National springs, Jerome metallic packing for piston rods, and Brooks Locomotive Works special metallic packing for valve rods.

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## THE REHABILITATION OF THE PISTON VALVE.

BY ROBERT F. HOFFMAN, M. E.

Atchison, Topeka & Santa Fe Railway.

### IV.

It may be well to now ask permission to digress from the main features of design and result, to consider certain other matters which bear upon the subject of piston valves. The first digression should be in the nature of a response to the suggestion offered by one of the contributors to this journal, looking to the greater prolongation of the life of the piston valve. [See RAILWAY MASTER MECHANIC for March, 1900, page 136.] The suggested course of treatment was that of chilling and grinding the metal, primarily, and, second to that, so proportioning valves for various classes of engines as to make it possible to turn down and re-use, upon smaller engines, valves that were outworn upon larger engines.

Chilling would greatly increase first cost; would offer material difficulties in the obtainment of homogeneity, and would therefore probably tend to defeat the prime object of insuring evenness of wear, slight as the wear may be. The cage could not be chilled, nor could its bushing be so treated. There is really no good purpose to be served by chilling, while the entire work of valve renewal and reboring of the cage can be performed for as little cost as would be entailed by chilling, if successful chilling were possible. The cage would still wear.

The using of valves for smaller engines, after they have been discarded from engines of larger bore, would also be impracticable. The valves are preferably made light of body. Any class gradation that would recognize a decided difference of port area, would probably be so widely at variance in other valve dimensions as to render the old valves insufficient in stock for turning and facing.

Having thus reverted to the consideration of life of the plug valve by reason of its wearing qualities, this also should be said: The full measure of credit was not dealt out when, in closing the writings in previous issues, it was stated that about one year's endurance had been observed "in an average fair water country." All things are good or bad, foul or fair, by comparison. The conditions under which the observations of that year's wear were taken, were fair conditions as compared with those existent where encrusting solids register as low as 80 grains and higher than 100 grains per gallon of water. For example, where that engine ran, water from the cylinder cocks when the water is foaming and priming, will effectively whitewash fences along the right of way, but will not whitewash the knot holes in the fence. Farther west, in some of the wholly favored alkali districts, it is quite feasible to thus whitewash the knot holes also. This statement cannot be verified in any laboratory known to the writer, but will doubtless meet with the cordial support of many otherwise trustworthy locomotive engineers.

The freedom from wear, and the almost complete removal of evidence of valve friction from the action of motion parts, leads naturally to the thought of what effort must be constantly expended in the propulsion of the ordinary valve. Certain it is, that power drawn from the boiler and expended upon the sliding of the valves, is there absorbed finally; is not available in any measure to draw the train, and is therefore a total loss, in just the measure that one type of valve requires power to propel it, in excess of that required by a better valve. Various values have been placed upon the power required to impel plain D valves and D valves partially balanced, at diverse relatively low steam pressure. These values are recorded in horse power ranging from one-half to six horse power per valve, or as high, therefore, as twelve indicated horse power, per locomotive, lost in the driving of the valves alone. Those who have intimately studied the working of the larger types of engine now in vogue, will not, I believe, challenge the statement that many thousands of engine miles are daily being made under conditions where this loss in power can, very conservatively be estimated as being double that of the highest record yet taken. It is not difficult to find, upon

roads using the heavier locomotives, many valve stems that are quivering and buckling behind a load which plainly would drag to a standstill the best regulated twenty-five horse power stationary engine that was ever built.

The foregoing paragraph means just so many horse power hours, dependent upon the duration of conditions such as those mentioned. Each horse power hour is worth from five to seven pounds of coal—according to the degree of enthusiasm and the extent to which the individual reader is willing to asseverate for his particular design of locomotive. It offers the opportunity to give a definite value to the statement that with the use of plug piston valves this loss is reduced practically to zero. The loss from excessive wear of valve motion parts is likewise reduced, and this difference in repairs cannot fail to be greater than 50 per cent.

Just one other consideration, and that will suffice in the way of generalities: It cannot be going far aside from the material issue to become for once the self-appointed champion of men who must run the locomotives of today. Men, these, who as a type, dare all things within reason and know that in the nature of railway matters and discipline there can be for them little toleration for the doing of "those things which we should not have done, or leaving undone the things which we should have done."

Is it a quite fair or reasonable proposition to start a man out with a handful of train orders that sometimes rival in proportion, and always exceed in importance, the average magazine, give him charge of an engine and train that are worth several hundreds of thousands of dollars, and dispatch him to meet and pass ten times the value of his own train while, standing in a narrow cab room, he must reach for the business end of a very energetic mule that kicks, and kicks hard, at the first touch; reach for his foot a hundred times; get it, and, while he kicks, deposit that mule's foot just an inch farther ahead or farther back upon the standing room, and fasten it there? Is it?

The parallel is not exact. It would be so nearly absolute, if there were two reverse levers rather than one, however, that the average engineer of today would find no flaws in the comparison and would express little choice between the levers and the mule.

Like Mark Twain's sketch of a neglected graveyard, these remarks, "dear reader," are not directed at "your town," or at your engines, but are leveled most "venomously" at your neighbor's engines—upon the next road, in the next town.

## HANDLING LONG FREIGHT TRAINS ON MOUNTAIN GRADES.\*

### *Air Supply.*

The brake force being based on a predetermined auxiliary reservoir pressure, it follows that any reduction in this is accompanied with a corresponding loss in the brake efficiency. All trains tested were supplied by 9½-inch pumps and large capacity reservoirs, and the improvement in the ability to recharge and maintain pressure over the former conditions of 8-inch pumps and small main reservoirs was very noticeable. The tests demonstrated the wisdom of increasing the air supply and storage on all engines hauling long, heavy trains, particularly those operating on grades, or where the winter temperature is very low.

### *Driver and Tender Brakes.*

The value of a good driver and tender brake in mountain, as well as in other, service is not generally appreciated. It may be here stated that the braking power of an engine weighing about 132,000 pounds on drivers, and an empty tender weight of about 38,000 pounds (which by no means represents the heaviest power used in mountain service) is equal to the brakes on about seven cars of 30,000 pounds light weight, and although such driver brake may not, at its maximum efficiency and at any considerable speed, be used continuously down a long, heavy grade without excessive tire heating, it may occasionally at the most difficult parts, or at all times at lower speeds, or on levels and ascending grades.

### *Water Brake.*

Experience in the use of the water brake has demonstrated it to be as practical on compounds as on simple engines, and the almost unlimited retarding power offered by its use should be taken advantage of. Where the driver brake piston travel is maintained reasonably short, and its continuous use on a long descending grade would cause excessive tire heating, it can be cut out on any portion of the grade and the water brake substituted. With train brakes and retainers of low efficiency, the

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\*From a committee report on "Successful Handling of Passenger and Long Freight Trains," presented at the Jacksonville meeting of the Association of Railway Air Brake Men. Committee: J. E. Goodman, J. C. McCullough, S. D. Hutchins, G. R. Parker, H. S. Belton.

value of the water brake as an auxiliary cannot be overestimated. We believe the best results are obtained from the use of the water brake by providing each cylinder or exhaust cavity with an independent water pipe and valve from the boiler head. This is particularly desirable on cross compounds, in which the cylinders are of unequal diameter. The temperature of the main pipe at the foot of a long grade, after the water brake has been used continuously, demonstrates the fact that the engine has been doing work, and in view of that it is apparent that the cylinders and valves require lubrication during the operation of the brake, and from the experience of some of the members of this committee, the supply of oil to the parts mentioned should be more liberal than when the engine is doing work in the ordinary manner. It is often desirable to release and cut out the driver brake and substitute the water brake when the brakes are applied without releasing the train brakes. To accomplish this there should be a release valve in the pipe between the triple valve and the brake cylinder, and in addition there should be a cut-out cock to permit of releasing the train brakes without releasing the driver brake.

#### *Retaining Valves.*

The impression prevails to a great extent that the retaining valve holds better standing than running; that the contrary is true was demonstrated by the test, and the explanation offered for this is that the resultant jar when the car is running has a tendency to seat the valve accurately, which is less likely to occur when the car is standing. The value of a good retaining valve was shown on one train tested, which was fitted with the modern retainers, the speed sheet showing a fall in speed after the release. The retaining valve on the test car being new, held about 17½ pounds, but the test showed that it is possible to increase the value beyond that amount. This was accomplished by recharging and reapplying quickly, thus closing the triple valve exhaust port before the pressure had reduced to the amount held; the pressure in the cylinder at the time of release will, of course, affect the results. Where leakage would reduce the amount ordinarily held by the retainer, the described method of increasing its value serves to render the defect less serious.

#### *Leakage.*

The opportunities for air leakage on the modern engine are numerous; in many cases main reservoir pressure is utilized for operating bell-ringers, sanders, blow-off cocks, ash pan slide cylinders and separate exhaust valve (compound engines), and with the latter open, when the engine is drifting, the loss of air by the piston is, as a general rule, very

appreciable. Train line leakage on freight equipment is ever on guard and in some sections of the country at low temperature the leakage past hose coupling packing rings is very serious. Old hose, with covering full of minute cracks, will, in damp weather and moderate temperature, absorb more or less moisture into the outer laying of ducking, and when subjected to extremely low temperature attain a degree of rigidity not realized except by those with experience. With the upper end of such hose improperly located so as to increase beyond standard the distance to be covered in connecting with another, and with draw bars pulled out to the extreme limit, leakage is sure to occur, and, altogether it has a very detrimental effect in the operation of the brakes, especially on mountain grades. Brake cylinder leakage is, no doubt, affected by the same conditions as the hose coupling packing rings, and the loss to the efficiency of the brakes occasioned by this leakage, particularly at low temperature, can only be comprehended by those who have operated and observed the operation of the brakes on steep descending grades. At low temperature, with the first application of the brakes following a long interval of non-use, the effect of brake cylinder leakage on the efficiency of the brakes is made apparent by the sluggish reduction in speed, and to make the brakes more effective under such conditions better results are obtained by making the first application a heavy one. This will have a tendency to expand the leather packing, making it more pliable, and the continual applications and release, incident to mountain service, will reduce the original leakage to the amount caused by conditions other than the temperature.

#### *Large Capacity Cars.*

The large capacity cars have made their presence felt in descending as well as ascending mountain grades, but at present there is no immediate cause for anxiety, for, so long as they are air braked, leveraged properly, kept in good condition and excessively high speed guarded against, they can be safely handled. The practicability of braking these cars higher than 70 per cent of the light weight has been established, and this, with an increasing number of air brakes, improved retainers, better general condition of brakes, the use of higher train line pressure, greater air supply and storage capacity and the possibilities offered by the water brake, will render trains of such cars even safer than trains of smaller capacity cars have been in the past.

#### *Speed.*

It is usual to make rules concerning speeds permissible down steep

grades; but occasionally, at least, the object sought is not attained. One reason is found in the limitation being only for the maximum speed, and in making this such that the average speed would be too low for justifiable expedition. In using air brakes to control a train down steep grades it is impossible to maintain a perfectly uniform speed; though with fair handling, the average variation should not exceed nine miles an hour, and five miles an hour is easily possible. For this reason if the speed "must not exceed," say, fifteen miles an hour, and the method of handling results in an average variation of ten miles an hour (average variations of 14.5 to 15 miles an hour have been noted in service), the average speed will be about ten miles an hour, being probably unsatisfactory to those concerned with train service. On the other hand, if "speed must not exceed" fifteen miles an hour is interpreted as requiring that the average must not exceed this, then, without considering time lost in reporting out and in, it has been demonstrated in practice that the maximum speed, the measure of safety, will reach twenty-five to twenty-eight miles an hour. Finally, owing to occasionally concentrated loads and low brake efficiency, whether the latter is due to defective brakes or non-air cars, the speed limits that would ordinarily insure ample safety would here become dangerous. For these reasons the rules should comprehend both an average speed and a maximum speed; and where, for the reasons stated, a train was unusually hard to control, the rules should hold the engineer responsible for maintaining a speed sufficiently below the limit, and enough use of the "water brake," with which all mountain engines should be provided, to insure ample safety. It should always be borne in mind that it requires far less brake retardation to keep a train from increasing in speed than is necessitated to stop it on the same grade. Hence, that the speed which may not endanger a runaway, will, at the best, require a long distance in which to stop.

### *Conclusions.*

Summing up: (a) the relation between the number of good brakes and tonnage of train should be known before beginning the descent; (b) the indicated ability to control the train should be tested by the first running application; (c) this is especially important when commencing the descent of a steep grade; it should be done while the speed is low, a sufficiently strong reduction being made to insure that all brake pistons pass over the leakage grooves, and the average speed down such grades should be determined by the results of such tests; (d) the maximum and average maximum speed should be held as near the average as practicable;

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(e) auxiliary reservoirs should be kept as near the maximum pressure as possible, this necessitating recharging whenever the grade, curvature and main reservoir pressure offer an opportunity, or, where the previous conditions are far apart, by slowing down sufficiently; this means, as a rule, short holds, slightly heavier initial reductions, but a lighter total application between recharges than in holding longer distances, a quicker recharge and application and more uniform speed; (f) keep the driver and tender brake in good condition; use latter always, and former as much as practicable, testing their condition wherever possible, after they have been used for any distance down a grade by ascertaining the wheel tread temperature, this indicating the amount of work done. In addition, it should be borne in mind that where a stop of any considerable duration, more than about ten minutes, must be made on a grade, the air brakes should be released and hand brakes used to hold the train, the object being to guard against the train starting from the air brakes leaking off, and where the engine remains attached to the train, to have latter fully recharged when it is desired to start. When, by reason of the engine having been away from the train, the air pressure has leaked rather low, hand brakes should not be released until sufficient has been accumulated to render it safe to start, the engineer to indicate this by whistling "off brakes." Where hand brakes are released prematurely it is generally possible to hold the train with steam if it is not given a chance to start.

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## CEDAR TANKS.

BY HOWARD F. BURKHARDT.

Cedar was probably first used in the manufacture of ship tanks at a very early period, and it was the custom of the ship builders of the South Jersey coast, many years ago, to utilize the cedar of that neighborhood for this purpose; as the water tank of most ships of any size is placed in a very contracted and inaccessible place, it was prudent to have as durable a wood as possible.

The use of cedar for tanks for railways, storage reservoirs for cities, towns, factory supply, etc., was first commenced on a comparatively large scale by Mr. George J. Burkhardt, of Philadelphia, in 1840. Being an architect and builder of some note, and seeing the necessity for a more durable wood than pine, spruce, etc., generally used for this purpose, he commenced the use of cedar in tanks called for in buildings, for

which he had contracts and where, in case of early decay, they were so enclosed that it would make it a difficult matter to tear out and re-erect in a few years. The idea became so successful that in a short time the demand for tanks of cedar wood increased to an extent to justify Mr. Burkhardt in building a factory especially adapted to their manufacture. This was in 1840, as before stated, and the business steadily grew until this one firm, of late years, has used nearly 1,000,000 feet of cedar per year for tanks alone.

Until about twenty years ago, all of the cedar used came from New Jersey. The New Jersey cedar was a very durable grade, but the trees were of very slow growth and small and very narrow; and the wood, if left too long to season, would twist and curl into all conceivable shapes, unless piled very carefully. North Carolina cedar, which is now used, is straighter grained and free from this objection.

The cedar of the different States, from Maine to Georgia, varies quite a little in character—that of the South being much larger and of quicker growth. The demand for cedar for tanks soon denuded New Jersey of her cedar, and few swamps are left of any magnitude. New and improved machinery coming into use, the large mills of Virginia and North Carolina commenced sending their output to the eastern markets, and much larger and clearer plank can be procured at the present time than formerly, although even today the supply of cedar for tank stuff is somewhat behind the demand.

Cedar varies so much in size, and the trees being mostly smaller and of less diameter than pine or cypress, it has to be cut to the most advantage (following the taper of the tree) so that the planks come to the market varying greatly in taper; this makes it more difficult to work cedar into tanks than any other wood. When working pine, cypress, etc., a uniform taper can be given to each stave, and a tank can be set up and the staves put on from No. 1 to the last, knowing that the required draft will be correct when finished. In putting the staves on a cedar tank, however, the four quarter staves have to be put on first and given the required draft or taper and braced in position; then as we work around from one quarter to the other, we have to sight the next quarter stave as we go around, and keep wide end up or down as required so as not to run out or in at top. The majority of the knots, being tight, do not require plugging, but the material is all carefully examined before shipping or knocking down, and the few loose knots are plugged, or "spiled," as we call it.

All work is set up at the factory and made to fit perfectly. It is then marked, numbered or witnessed so that it can be erected again by any one possessing ordinary mechanical ability. The tank is measured with a wheel of a diameter to make each revolution three feet—the difference between top and bottom is marked on the wheel and the size is then “taken up” or made less about one quarter of an inch to the foot of diameter of bottom. All of our staves are planed, convex or concave, to conform to the circumference of the tank. This, as is well known, makes the hoops fit snug, resists pressure better, and prevents the dampness getting behind the hoop and rusting it rapidly.

Regarding the preservation of the hoops, we recommend a good coat or two of asphalt, or any good paint, in preference to galvanizing or any other method; we do not consider that the painting of the wood portion of the tank adds much to the life of it, but it certainly improves its appearance. It is better that the inside of a tank should not be coated when it is to be used to contain water; in breweries, however, shellac and enamel are used to make a smooth surface and to prevent sediment clinging to the sides. We always work our cedar with the sap side inside. If we had no theory at all regarding this, we would do because we have seen many cedar tanks, made sap side out, that were only seven or eight years old, in an advanced stage of decay; whereas, on the other hand, we can show tanks thirty to forty years old still in use, that were made with the sap side inside. We are frequently requested to furnish cedar tanks free from knots and sap. The impossibility of this is apparent to anyone familiar with cedar wood; and we would say further that a very long experience has shown that there is much misconception regarding the durability of sap in cedar. In taking down very old tanks we have seen the clean white sap in a perfect state of preservation, while the heart wood had decayed. It all depends upon the selection of the material when the tank is being constructed. The sap side of the wood should be placed inside where it absorbs the water, which tends to preserve it, and the heart side placed outside exposed to the air. Made in this manner a cedar tank will last a lifetime. We have in mind one particular tank made for the Philadelphia water works in 1859, and still in use by that city.

Regarding the use of lugs for hoops, we consider them a good thing when necessary, but look upon them as a useless expense in many cases. There is nothing as good or as strong as a properly riveted hoop; as a rule we put lugs on the upper hoops only of tanks, and where a tank is kept nearly full of water all the time there is no necessity for them.

Lugs are an excellent thing in repairing old hoops, where a roof is over the tank and the hoop cannot be thrown over, or where the space is too small to admit getting around the tank to drive the hoop.

We saw some time ago an article in which the writer advised to beware of all friction lugs. We would say that we have used a popular friction lug for many years and have never yet seen or heard tell of one breaking under pressure from the contents of a tank or in practical use; in fact, we use friction lugs now altogether, although at first we looked upon them with suspicion. We have since put them on tanks up to 50,000 gallons capacity—*on all* the hoops—and have yet to hear of a failure; this, of course, is only our experience.

A great deal of miscalculation—or no calculation at all—is shown in the supports provided for tanks. Few people outside of the experienced railway man or a practical builder, put up foundations in keeping with the capacity and weight of water used. They are often out of all proportion to the weight—one way or the other. We have seen the bottom punched out of a 30,000 gallon tank and the staves and hoops torn to pieces because under it were only 2x12 joists—12 inches apart—with no bridging between joist; the consequence being that the joist flopped over like a pack of cards as soon as the tank was filled, and the bottom was punched out by the framework. Joist supports should always be bridged.

Cedar for tank work comes to the market in thicknesses of 2, 2½ and 3 inches thick. We take ¼-inch off these thicknesses in planing. We usually use 2-inch material for tanks up to 10 feet diameter, 10 feet high (5,000 gallons), and 2½-inch cedar for intermediate sizes up to 13 feet diameter and 12 feet high (10,000 gallons), and 3-inch material up to 100,000 gallons—35 feet diameter and 16 feet high.

In our experience we have always found a plain square joint the best for staves and bottom. We know that it is the practice of some of the eastern railways to tongue the joints of tanks, but we believe it conducive to early decay, as the tongue and groove are in the center of the joint, where the tank will decay first under most conditions; and, moreover, the groove tends to collect dirt, etc., and hasten decay, and it also stops dampness at the tongue, therefore the outside of the joint, particularly if exposed to the weather, shrinks open to the tongue and presents a bad appearance. For jointing our work we use a circular saw with a small planer knife inserted and standing out just beyond the saw kerf or set of saw. These diagonal kerfs cross one another on opposite staves when the tank is erected, thus preventing leakage if there happens to be any

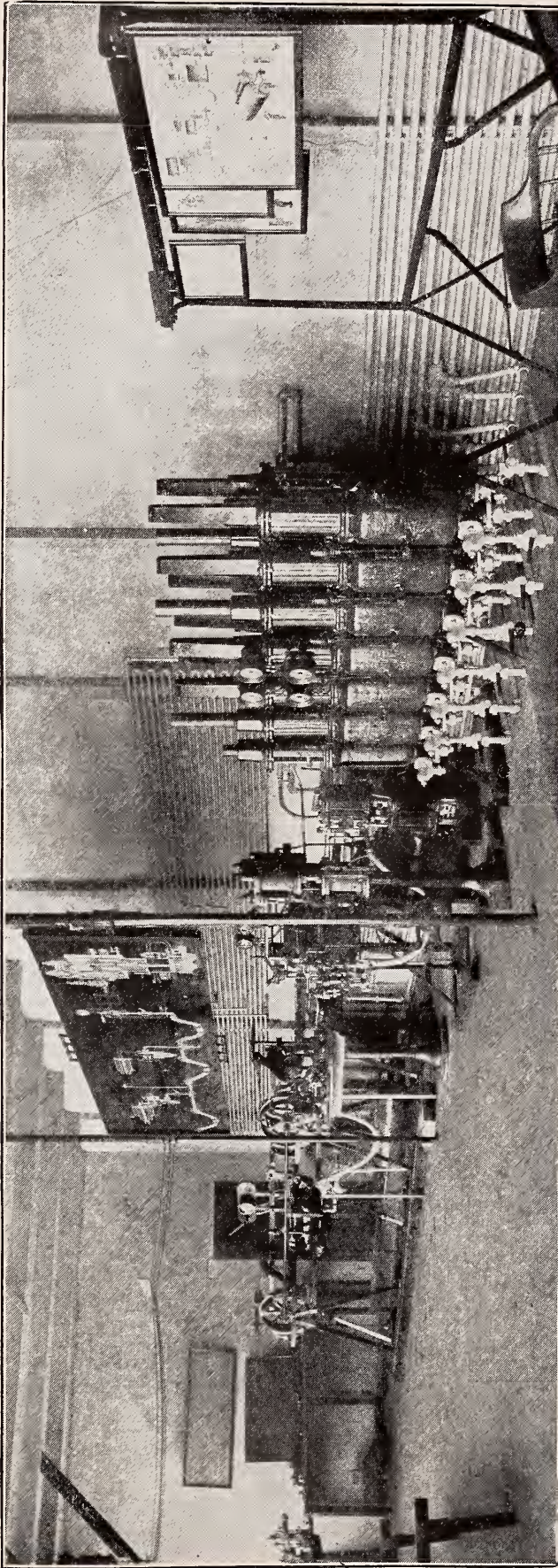
roughness of joint caused by play in the saw mandrel, as sometimes happens. If in a stave or bottom piece jointed on a buzz or hand jointer, or upright side jointer, there should be the least corrugation, it (being at right angles) goes directly through the joint and makes it more liable to leakage. Our staves are all planed, concave and convex, to suit circumference of tank, as before mentioned, and after being jointed are crozed with a radial swinging cutter to suit circles of tanks. The bottoms are all cut out on a band saw and then thickened to suit the groove or croze. The tanks are then set up as before described and staves marked from No. 1 up, working to the right from the outside of the tank. An arrow is stenciled on the bottom, showing which direction to go in setting up the tank; the joints of bottoms, when they are broken apart, are witnessed, and if the tank is to be shipped the ends of the bottom pieces are protected with strips nailed on so as to prevent the corners being knocked off by rough usage.

We have made tanks for all the leading eastern railways, and for mills and factories all over the country, and 99 per cent of them have been cedar; and we really believe that this material is superior to cypress for general use, for many reasons. It is certainly much cheaper; it is easier to handle because lighter, and its durability is unquestioned.

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## WASHING OUT BOILERS WITH COLD WATER.

In our issue for January, 1900, we gave an article on the use of cold water for washing out boilers, from the pen of Mr. Edward Grafstrom. Mr. William A. Foster, formerly for many years master mechanic of the Fall Brook Railway, wrote to us some weeks ago to the effect that he coincided with the views expressed by Mr. Grafstrom. Mr. Foster says further: "We have practiced washing out boilers on the Fall Brook with cold water for fourteen years, and we never had a cracked sheet, during this time. We blow the steam off from boilers before letting the water out, and as soon as the water is let out we proceed to wash them before cooling. I know this is contrary to the general opinion that it is injurious to the boiler, but I think this practice is proof enough that it is not. Some of these boilers have had their crown bars taken off twice in the fourteen years to clean the scale on crown sheet. They would fill up solid with scale between crown sheet and crown bars, the space being an inch and a half. These boilers are now seventeen years old, and none of them have had new fireboxes. Several of them have had



### AIR BRAKE INSTRUCTION ROOM, CHICAGO GREAT WESTERN RAILWAY.

At the Oelwein shops of the Chicago Great Western railway, which we described in our issue of March, 1900, a completely fitted up air brake instruction room is an important feature. The view given above affords a good idea of the general arrangement of this room. No pains

have been spared to make this room all that such a room should be. It is located in the balcony of the main building, next to the air brake repair room and to the space in the balcony devoted to air hose and injector work.

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new half side sheets covering the seam well up out of the fire, and they are as good as new fireboxes. Quite a number of them have had new flue sheets. Many of them have been double-crewed, making a trip from Corning to Williamsport and return every day—making 6,900 miles a month, which is a good mileage on single track road. This is almost ten miles an hour for every hour in the month.”

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## SOME POINTS ABOUT STEEL FORGINGS FOR LOCOMOTIVES.\*

BY H. F. J. PORTER.

In the early history of the locomotive there was no material available for its forged parts except wrought iron, and this material was sufficiently strong for the small duty that it had to perform. Subsequently, as the introduction of the Bessemer process developed the steam railway, and the demands for stronger metal became urgent, the substitution of steel for wrought iron in the forged parts of locomotives began.

Little was known at this time about this new material, and early attempts on the part of railway men to use steel forgings were very disastrous. The unexpected great mortality of forgings made of steel, which was giving excellent results in other directions, called for explanations. Chemistry, already assuming a prominent position in the Bessemer process, came forward to claim for itself a cure-all for the ills which were fast assuming a serious nature in the steel forging industry. It was given out that steel with a high percentage of carbon was brittle in certain service; that mild steel of definitely prescribed composition would be the ideal metal. Thus the tendency was encouraged to use a soft steel approaching wrought iron in the ease with which it could be handled in the shop, especially in machining. Still it was found in practice that a harder steel, when great precautions were taken with its manufacture, possessed a remarkable quality of elastic strength combined with ductility or toughness. Tests were made to establish some relation between composition and resistance to stress. A testing machine was devised which would subject the bar to be tested to stresses similar to those which occur in actual practice in such forgings as axles, crank and cross-head pins, piston and connecting rods, where the fibers of the metal are strained successively in tension and compression.

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\*From a paper on "The Standardizing of Specifications for Locomotive Forgings," read before the Northwest Railroad Club.

The following results are the average of bars rotated 1,500 times per minute under 40,000 pounds fiber stress :

	Elastic Limit. Lbs.	Breaks Under. Rev.
Wrought iron.....	20,000	60,000
.15 per cent carbon steel.....	25,000	125,000
.25 per cent carbon steel.....	30,000	250,000
.35 per cent carbon steel.....	35,000	500,000
.45 per cent carbon steel.....	40,000	1,000,000
.55 per cent carbon steel.....	45,000	2,000,000
.65 per cent carbon steel.....	50,000	4,000,000
3¼ per cent nickel steel.....	60,000	5,000,000

Careful consideration of the results of these tests led to the recommendation of material for forgings which should have a high elastic limit. In order to obtain this property an increase in the carbon content, or the addition of some special element, was primarily necessary.

Owing to the appearance of the fracture in forgings broken in service, it had been supposed that they crystallized from shock or vibration. Tests of the character shown, however, soon proved that no such change in structure took place. It was further proved that materials of this kind are incapable of cold crystallization when exposed to the conditions of service mentioned.

Forgings made of the higher carbon steels continued to break in service, however, and engineers became convinced that there was something else which governed the life of steel forgings besides the chemical composition of the metal from which they were made. The metallurgist began to point to defects in the process of manufacture. Theories were put forward regarding certain features in the melting, pouring, cooling, re-heating and forging processes. It was shown that certain defects were inherent in the ingot, due to improper methods of manipulation in its manufacture. Various methods were suggested to overcome them, the most successful being the "Whitworth Process of Fluid Compression." This process consists of compressing the fluid metal in the mould under hydraulic pressure, if necessary, up to 7,000 tons. By this means ingots could be obtained which were practically homogeneous throughout and free from internal defects.

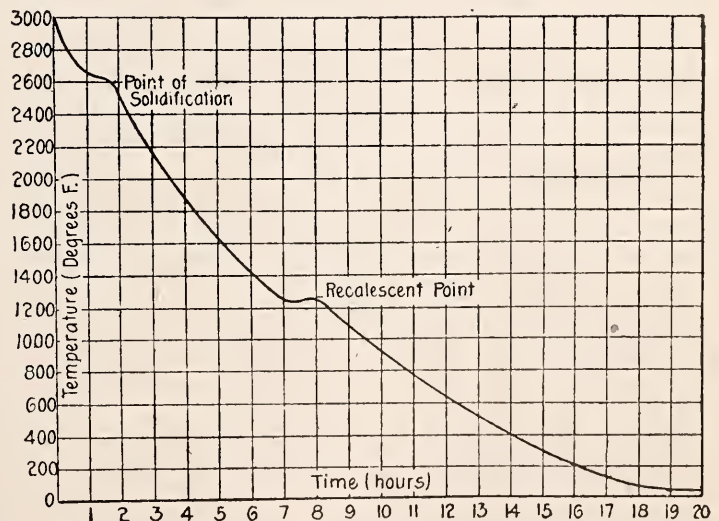
It was also found that the small hammers then in use for welding together small pieces of wrought iron to build up large forgings, were inadequate when called upon to forge down the large sized ingots to produce steel forgings. It is evident that for such work the pressure applied

should be great enough, and of such a character, as to penetrate to the center and cause flowing throughout the mass. This flowing of the metal requires a certain amount of time and the requisite pressure should be maintained throughout a corresponding period. The effect of the rapid blows of a light hammer on a large mass of metal is absorbed at the surface, and the central metal is scarcely affected. Forgings produced under hammers of insufficient capacity were found to possess cracks and cavities in their center, due to uneven working of the metal. Thus heavier hammers were introduced, and, in turn, superseded by hydraulic forging presses.

Later, when it was found that unexplained failures still continued to occur, the microscopist advanced his theories, drawn from examination of the minute internal structure of the material, that heat treatment subsequent to the manufacture of the finished product would overcome all difficulties.

If we note the rate of cooling of a steel ingot from the point of solidification to coldness, we will see that the temperature falls with regular retardation the same amount in equal divisions of time until between 1,300 and 1,200° Fah., a point (depending on the carbon content) is reached where the temperature suddenly stops falling and for a time either remains stationary, or perhaps rises for a short time, and then the same rate of cooling continues as before. This point, where the change of rate takes place, is called the "recalescent" point, and from chemical and physical tests we know that a change in the structure of the steel occurs here (see diagram).

The fluid steel begins to crystallize at the point of solidification, and the slower the rate of cooling from there down the larger the crystals will be when the ingot is cold. At the point of recalescence, however, it would seem as if the crystallization, so to say, locks itself, for, after the ingot has become cold, if we reheat it to a temperature below this point, on again becoming cold we will



THE COOLING CURVE OF STEEL.

find that the crystallization is not affected, but if we reheat it a little above the recalescent point, when it is again cold the crystallization will be found to be much smaller than before.

In fact, it is known that if steel is heated slightly above the recalescent point all previous crystallization is destroyed, and a fine amorphous condition is produced at that temperature. As soon as cooling begins again, crystallization sets in and continues until the ingot is cold. As, however, the time of cooling from the recalescent point is comparatively short, the resultant crystallization is correspondingly small. It can be readily understood that when heat treatment can completely change the internal condition of steel, it should bear an important part in the manufacture of forgings made of that metal.

Let us for a moment consider the changes which take place in the condition of the metal as it passes through the forging process. Beginning with the cold ingot, (which we will assume has cooled slowly and is, therefore, composed of large crystals) we first reheat it up to a forging temperature of from 1,800 to 2,000 degrees F., thus passing through the recalescent point, destroying all crystallization and producing an amorphous condition. As we put it under the forging press it begins to cool, crystallization at once setting in; at the same time, however, we begin to work the metal.

The work of forging tends to check crystallization, just as disturbing water which is below freezing point will delay the formation of ice crystals. The work of forging may or may not continue (depending upon the size and shape of the finished piece) until the temperature has fallen below the recalescent point, but during this time more or less crystallization has occurred, and has been disturbed and distorted. The work of forging has, moreover, proceeded from one end of the piece to the other, the part last worked upon having crystallized considerably before work was applied to it, so that the two ends may be entirely different as far as their internal condition is concerned.

If, as is generally the case, the forging is now considered finished, it is full of pulls and strains about which we know nothing, except that they may amount to several thousand pounds to the square inch. The extent of these strains is made evident when a forging, finished as above described, has a cut taken from it in a lathe or has a keyway cut on one side. The strains in the fibers which are cut are relieved, and the piece invariably springs out of "true." To relieve these strains the forging should be carefully and slowly heated to a temperature slightly above

the recalescent point and then allowed to cool slowly. By this treatment, which is called "annealing," an entirely new crystallization is established, leaving the molecules of the metal completely at rest. If the forging, on being heated slightly above the recalescent point, is suddenly dropped into a bath of cold oil, no time is allowed during the cooling process for crystals to form, and the amorphous condition of its structure at that temperature is retained. This character of heat treatment is called "oil tempering," and is followed by further heat treatment to relieve the metal of any hardening effect due to the cooling process.

An annealed forging has its elastic limit somewhat reduced as compared to its tensile strength, but its ductility is increased very considerably, as shown by its contraction and elongation in test pieces. The elastic limit of an annealed forging is invariably less than one-half of the tensile strength. By "elastic limit" I do not refer to the point usually determined by the drop of the beam in an ordinary testing machine, but rather to the carefully defined point obtained by more accurately determined methods, which is from 2,000 to 10,000 pounds lower.

This process of annealing to relieve internal strains is a very important one. These strains are apt to develop in service, thus constituting an initial load, and may throw a forging out of true, or even cause its complete failure, if they happen to act in the same direction as the external working stress.

We have already seen that bars of very high physical properties will not endure indefinitely repeated alternating stresses amounting to 40,000 pounds to the square inch. A forging strain of quite small intensity may easily act in conjunction with an external stress, closely approaching the elastic limit and bring the total working stress up to a load which, acting continuously, would soon cause failure.

The lowering of the physical properties by the process of annealing may be corrected by a subsequent treatment of "oil tempering." In this treatment the forging is first reheated to a definite temperature and then dropped suddenly into a bath of cold liquid, which may be composed of oil or any suitable fluid. The forging must be subsequently annealed, as before, to relieve it of cooling strains. The hardening effect of the sudden cooling is accompanied by a "setting" of the amorphous condition brought about by the first heating, with the result that the irregular and often coarse crystalline condition existing after forging is broken up and a uniform and finer grain ensues. By the subsequent

annealing, strains are relieved and the hardening effect of sudden cooling is removed to a desired degree; at the same time the elastic limit is increased proportionately to the tensile strength and a greater toughness is imparted to the metal, as shown by a higher elongation and contraction of area in test pieces.

In order to successfully temper a piece of steel great care must be taken, both in the process of re-heating it and also in cooling it in the bath. In re-heating it, the surface metal is apt to expand away from the center and thus cause cracks in the latter, and in dropping it into the cold bath the surface metal is apt to contract onto the center to such an extent as to cause cracks in the former. In order, therefore, to successfully temper a forging it should be hollow. By taking out the center it can be re-heated without danger of cracking, because the center metal is absent and the heat gets into the interior and expands both it and the exterior together. Also, in dropping it into the cold bath, there is no solid center on which the surface metal is contracted, and in that way the danger of cracking the surface during the cooling process is eliminated.

The theories of the metallurgist regarding the omniscient properties of heat treatment are in turn being modified so as not to be so sweeping. The result of a vast amount of experimenting in all directions has, however, taught us that the more we study the more there is to be learned, and now that scientific methods have been introduced and become established, our steel plants and forges are not considered modern unless they are equipped with chemical, physical, metallurgical and microscopical laboratories, with skilled experts in charge, who follow each forging through every process, holding it in complete control until it is finished.

Small forges and blacksmith shops, not so equipped, should confine themselves to wrought iron and mild steel forgings, which being of material elementary in its composition are susceptible of being handled in a crude manner. Only such concerns as are handling large amounts of product can afford to keep, continuously, a staff of skilled technists in the various sciences above mentioned, and they only are now considered competent to manufacture high grade products. Now that we understand better how to make them, steel forgings, strong and reliable, can be manufactured with a certainty heretofore impossible, and the lack of confidence so long established by early failures is losing ground rapidly.

## LUBRICATING AIR BRAKE PARTS.\*

### *The Pump.*

The committee recommends lubricating the steam cylinders with ten drops of Galena valve oil per minute, fed through the lubricator for the first five minutes, and one drop per minute for the remainder of the run. This for pumps in good condition and to be varied with the condition of the pump, quality of oil, speed of pump, etc.

For the air cylinder the generally commended practice is valve oil. The constant increase in the number of air cars in trains, and the extra duties imposed on the pump in furnishing air for sand blower and bell ringer, causing the air to obtain a higher temperature under compression than formerly, gives the necessity for employing a lubricant in the air cylinder that is capable of standing a much higher thermal test than those formerly employed. The term "valve oil" should be used advisedly; preferably, an oil that does not gum up readily in the locomotive cylinders and exhaust pipes and does not form hard balls in the cylinder packing rings, will seldom give any trouble in the air cylinders. The committee would not recommend the use of engine oil in the air cylinder, on account of the flash point being at such a low temperature; its lubricating qualities would be lost on account of the heavy duty required of the pump. A steady feed of oil should be provided, and to accomplish this a good many roads have adopted an oil cup, secured to the top of the center piece of the pump, having a copper or brass pipe running down to a swab on the piston, with the feed set so as to constantly keep a small quantity of oil on the swab. With the piston working, it will not only serve to keep the metallic packing lubricated, but the oil will be carried in thin films to the air chamber.

### *Brake Valve.*

From different expressions received, it has been found that vaseline, Kent's compound and mutton tallow have been used, with good results, between the rotary valve and seat; one member expressing a preference for a composition of two-thirds mutton tallow and one-third beeswax, on account of its lasting qualities and resistance to hot air. Preferably what is needed for this is a lubricant with a good, heavy body that will not restrict the passages or ports; the concensus of opinion of the committee being that mutton tallow should be used for this purpose, also for the leather washer above the rotary valve. Piston 17 and its packing

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\*From a report presented at the Jacksonville meeting of the Association of Railway Air Brakemen. Committee: W. P. Huntley, Jr., F. B. Farmer, J. L. Andrews.

ring should be lubricated sparingly with some good oil of light body; engine oil is generally used for this purpose, about five drops being distributed evenly on the packing ring and its cylinder. The length of time between cleaning should be determined by a roundhouse test at the end of each trip, being entirely dependent on the amount of air pressure carried and whether the pump has been running hot.

#### *Triple Valves.*

In answer to queries sent out relative to the lubricants employed in triple valves, the following kinds were specified: vaseline, Kent's compound, valve oil, signal oil, a mixture of headlight and lard oil, 32-degrees West Virginia well oil and the ordinary car oil; one member expressing the opinion that where headlight and lard oils were used, the headlight oil would eventually evaporate; this would leave the lard oil, and acid contained therein would have a tendency to clog the piston packing ring in its groove and interfere with the proper working of the triple. The general opinion prevailing, however, is in favor of 32-degree West Virginia well oil, or car oil. Manifestly, what is needed for this service is an oil with a good body, which will not gum up or clog the parts. Particular care should be taken in applying the lubricant to working parts; it should not be applied in a manner that would bring it in contact with the emergency valve seat. The expressions received tend to show that from three to ten drops of oil, properly distributed on the working parts, are generally followed in lubricating a triple. The committee would recommend the employment of about eight drops for this purpose, to be smoothed over the different surfaces with the finger; one drop to be put on the slide valve, one on the seat, three in the piston cylinder, and three around the piston packing ring.

#### *Brake Cylinders.*

The same lubricant should be employed in freight and passenger cylinders, as an item of economy as well as to get efficient service. In answer to inquiries the committee finds Kent's compound, Paragon grease, Marvin air brake compound and 32-degree West Virginia well oil used largely as lubricants for air brake cylinders in different parts of the country. In order to determine their relative values, comparative tests were started with Paragon grease, Galena valve oil and summer and winter weight car oil, by one of the members of the committee. Passenger cars having 10-inch brake cylinders were used. Leathers were allowed to remain over night in the different lubricants. The cars started in service June 25, 1899. A sample of the Marvin air brake

compound was received and applied to a passenger car Dec. 22, 1899. The car had a 10-inch cylinder, and the leather was treated similar to the others. The cylinders were examined Feb. 10, 1900.

Notes on Cylinder Lubricated with Paragon Grease.—Cylinder walls in good condition, with no signs of sediment or hardness of lubricant; packing leather soft and pliable and in good condition.

Notes on Cylinder Lubricated with Galena Valve Oil.—Cylinder walls in good condition, and no signs of sediment or hardness of lubricant; packing leather soft and pliable. It was noticeable, however, that there was but a small amount of oil left.

Notes on Summer Weight Car Oil.—Leather showed signs of dryness at top. Cylinder walls were lubricated about two inches above center of cylinder. It appeared what had been absorbed by the packing leather was furnishing this lubrication, as the oil had settled to the bottom of the cylinder.

Notes on Winter Weight Car Oil (this was of lighter consistency than the summer weight).—Packing leather was dry at top. A light film of oil could be noted on the walls of the cylinder, but not as marked as in the preceding case; it was apparently derived from the oil absorbed by the leather, and extended below the center line of the cylinder. A small quantity of oil was found on the bottom of the cylinder.

An examination of cylinder containing the Marvin air brake compound was also made at this time, and both cylinder and packing leather were found in good condition. This lubricant is of a soft, pliable nature, and adheres to the cylinder walls very satisfactorily.

In these tests the same amount of lubricant was used in each cylinder, viz.: 1 gill, or about  $3\frac{1}{2}$  ounces.

It is the opinion and belief of the committee that the method of applying the lubricant governs largely the results that will be obtained. In applying lubricant the cylinder walls should be sparingly lubricated throughout its entire length; the bearing face of leather and the narrow crevice where it joins the piston should be given as much as will adhere, and the space above the expander should be given a liberal quantity. The lubricant should be applied with the hand. Care should be taken, when applying the lubricant, to keep the leakage groove open. The packing leather should be thoroughly saturated for some time before forming on the piston. Preferably it is best to divide the time up for cleaning cylinders on passenger cars for winter and summer service, where practicable. One member of the committee has followed the

plan, for the last three years, of completing the semi-annual cleanings June 1 and January 1, the cars running in each train being cleaned as near as possible together. This insures more uniform action of each brake, and they are better able to stand climatic conditions. It has given most excellent results.

#### *Driver Brake Cylinders.*

Valve oil, Paragon grease, Kent's compound, 32-degree West Virginia well oil and Marvin air brake grease have been specified by different members as giving good results. The same lubricant used in a car cylinder should prove satisfactory in this service also. The time between cleaning and oiling is specified by different members as from six months to the time engine is returned to the shops; one member stating his engine ran eighteen months between shopping, and the cylinders were cleaned and lubricated only when the engine was in shops for overhauling. The cylinders of engines referred to are located away from the heat of the firebox. The driver cylinders should run successfully from one shopping to another, if properly located away from the firebox. The committee believes that considerable saving in packing leathers will result by changing the location of cylinders subjected to firebox heat to a much cooler place. It is impossible to have a fixed rule regarding the length of time between lubrications of a "pull" brake, or where the cylinders are located close to the firebox sides subjected to heat. The reliability of the brake should be determined by the roundhouse inspector on testing the brakes at terminals. Where it is possible to convert a "pull" brake into the "push" type, much better results will follow.

#### *Tender Brake Cylinders.*

The general opinion is that the same lubricant used in car cylinders will be acceptable for this service. A tender cylinder cleaned and lubricated each time the locomotive goes through the shop for repairs should give good results.

As near as could be determined, it is believed, in lubricating cylinders, the following amount should prove sufficient and give good results: 8-inch cylinder, 3 ounces; 10-inch cylinder, 3½ ounces; 12-inch cylinder, 4 ounces; 14-inch cylinder, 4½ ounces, applied in the manner hereinbefore described. It is the belief of the committee that more successful results will be obtained in lubricating brake cylinders by employing a grease. It should be of medium weight and of an adhesive nature, to more thoroughly engage the cylinder and packing leather. It should be of such composition as not to be materially affected by change from hot to cold weather. It should act as a preservative to packing leather, and contain no ingredient liable to form gum in the cylinder.

# THE STANDARDIZING OF SPECIFICATIONS FOR LOCOMOTIVE FORGINGS.\*

BY H. F. J. PORTER.

Americans are peculiarly prone to standardizing. This tendency has put them ahead of other countries in the commercial field. In talking with representative railway men I am made aware of the fact that you are standardizing the various parts of your engines; that, for instance, after having run engines for a number of years over your road you find that a certain size of piston rod for a given type of engine is weak, and a certain other size is strong, and you replace the weaker size by the stronger one, which then becomes standard.

In this way, also, your superintendent of motive power determines upon his standard specifications covering materials of which these various parts shall be made. How these specifications come into existence is determined by various considerations, of which there are so many that I can mention but two general classes. One, where the superintendent of motive power works his way up from the ranks, and, not being technically educated, looks for precedents to a similar official of another road and copies the main features of his specifications. The other, where he may be technically educated; he may have his experimental plant in which he tests material of various grades and determines for himself what his specifications shall be.

The specifications which I have seen during the past year have been so limited in their requirements that I have been influenced to think that many have been drawn from impracticable sources and that others have been copies with mere personal modifications. The result is that a great variety of unimportant and yet troublesome restrictions are being presented to the manufacturer, requiring him to keep a large variety of grades of material on hand, ready to be supplied on short demand. There is always, also, the possibility of a change in the personnel of officials, followed by a change in specifications, thus rendering unavailable considerable manufactured stock, unless the specifications are so loosely drawn, as they are in many instances, that they cover a variety of low grades.

In looking over these specifications it is very evident that those

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\* From a paper read by Mr. H. F. J. Porter, of the Bethlehem Steel Co., before the Northwest Railroad Club.

drawn by one of the largest railways in the country have been very generally copied as being those on which considerable time and thought must have been concentrated, and that, therefore, they must be representative of best practice; and yet within the past week the official of this road who had more to do with the drawing of these specifications than any one else, has come to our works and advised us that his specifications are wrong and asked us to be kind enough to supply him with other grades of material on which he could experiment in order to modify his requirements.

What you railway men want for your crank and cross-head pins, piston and connecting rods and axles, is a material which is sufficiently strong to resist for a long time the alternating stresses to which they are subjected. In order to obtain such material you should specify definitely what you want, and then follow up your specifications by inspection which will insure your receiving what you have ordered. Such specifications should be so drawn as to call for material possessing the requisite physical properties. You do not care about its chemical composition nor the metallurgical processes through which it has passed. All of that belongs to the province of the manufacturer. I have, however, seen specifications for crank pins that called for "nickel steel" or "carbon steel" and have no physical requirements mentioned. Let me tell you that such specifications are absolutely good for nothing. There are all kinds of "nickel steel" and "carbon steel." I take it that you want something strong, and that you do not care what its name may be nor who makes it.

At the meeting of your Master Mechanics' Association, last year, at Old Point Comfort, I found that many of your railways were purchasing nickel steel blooms in the open market without specifications, and that these were subsequently forged into your engine parts at your local blacksmith shops, with the result that the mortality of your so called "nickel steel" forgings was very great. The nickel steel that you were thus obtaining was by no means that nickel steel which, under government specifications and inspection, has gained the reputation for itself of being the strongest and toughest material known. That material is a specialty which can be turned out only under the most carefully conducted processes. When you wish to purchase a rubber boot you go to a dealer in that commodity; you do not purchase rubber and work it up into a boot. Nor is nickel steel less of a specialty than rubber.

Having introduced nickel steel very generally in commercial work throughout the country where the service called for material to resist

severe alternating stresses ; having furnished it also to the United States government for gun and marine engine forgings, where it is giving excellent results, as were publicly evinced during the recent unpleasantness with Spain ; having also furnished it to some of the representative rail ways of the country for crank pins, piston rods, axles, etc., where it has been giving perfectly satisfactory service, we felt warranted in offering the material which had thus been thoroughly tested, for further service in the latter direction, in order that your various railways could become more generally acquainted with it. At the meeting above mentioned I made an offer on the part of our company, under certain conditions and for a limited length of time, to furnish it to the railways at practically cost price. The conditions were that records of the service of these forgings should be kept and reported to us. These conditions were imposed for our mutual benefit, that we all might gain what information would be evolved from such a test. Upwards of fifty railways in the country are now testing this material, and when the committee is again prepared to take up the subject we will hope to have heard from these various railways under the agreement entered into between us, and these records will be tabulated and made available for future use. The specifications under which these forgings have been furnished are those drawn by the United States government, and under which nickel steel gained its present high reputation.

The strongest metal known is obtained by the use of a small percentage of nickel in the composition of the steel, followed by proper heat treatment. The high price of this metal is not due to the small amount of nickel used, but to the care required to produce the quality mentioned. "Nickel steel," so called, as ordinarily made, may not be any stronger than mild steel, nickel plated, and both would look alike.

Let me give you a series of grades of steel. You may select your grade and mention it in your specifications by its physical properties only, and not worry whether you are to get a nickel steel or carbon steel, nor whether either kind of steel is annealed or oil tempered. The manufacturer will have to put in nickel and will have to anneal or oil temper it in order to produce the grade called for.

	Tensile Strength.	Elastic Limit.	Ex- tension.	Con- traction.
Carbon steel, annealed . . . .	80,000	40,000	22%	35%
Carbon steel, oil-tempered .	90,000	55,000	20%	45%
Nickel steel, annealed . . . . .	90,000	55,000	24%	45%
Nickel steel, oil-tempered . .	95,000	65,000	21%	50%

Having drawn your specifications for forgings by mentioning the physical properties which you wish them to possess, see that what you receive meets your requirements by proper inspection. Then you are sure to get what you want.

All of this leads up to the suggestion that specifications for material should be standardized for ready reference. There is, however, one great objection to the standardizing of specifications for material, in that it is apt to lead to the retarding of progress, preventing the future introduction of superior material as it may become available. If, however, there can be established for the standardization of specifications a source of authority which both consumer and manufacturer will acknowledge as worthy of recognition its dictum would be observed and, if properly constituted, it would be expected to make changes as necessity demands, and such changes would readily be taken account of by those directly interested in its promulgations.

There is another direction in which standards should also be considered, and that is in the testing of the materials which you are to use, to see that they meet the specifications which you have already drawn. The production of various grades of steel at will has now become a specialty, particularly high grades. In order that the manufacturer may know just what he is doing, chemical and physical tests must be made at various stages of the process of manufacture of his product, and finally when, by his tests, he knows exactly what he has produced, he raises or lowers the physical properties to meet the necessary specifications by heat treatment, carefully carried out under electrical pyrometers at temperatures which are predetermined by the data already on hand.

It seems to me that more information could be obtained by the superintendents of motive power and other representative officials of your railway companies by spending a short time in looking over the records of experiments which have been conducted at the works of large manufacturing concerns, which are completely equipped for experimenting and testing, than could be realized by months of individual tests or restricted experiments in their own more or less incomplete laboratories. It was with this idea in mind when, last year, at the meeting of your Master Mechanics' Association previously referred to, I made a suggestion during the discussion of their report on nickel steel. I invited the committee having the subject in hand to visit our works, which are ordinarily closed to the public; I offered, on the part of our company, to open our records to that committee, so that they might examine the tests which

we have been making during the past ten years or more, and begin where we are now, instead of spending months and possibly years in duplicating our experiments and investigations in their local laboratories, which could not possibly be as completely equipped as ours are.

There are certain conditions which arise from methods of testing and experimenting in local laboratories which are unjust to both manufacturers and consumers. The value of the test depends upon the efficiency of the outfit and experience of the operator. The value of the experiment depends upon the nature of the apparatus and the personal equation of the experimenter.

Mr. Paul Kreuzpointner, mechanical engineer in charge of the testing laboratory of the Pennsylvania Railroad at Altoona, Pa., read a paper at Pittsburg last summer on the discrepancies in commercial tests when the same material was tested in different machines, of which the following is an abstract:

“Even allowing for possible differences in the different specimens there is still enough of uncertainty and want of uniformity in results to warrant the conclusion that either the testing machines vary, or the measurements of dimensions are at fault, or the weighing is done carelessly, or the preparation of test pieces is defective. There may be also a combination of these and other factors. I have found that the use of different styles of micrometers at two different places, used by two different operators, caused rejection of the material in one place and its acceptance in the other, the main cause of such difference being a slight difference in the reading of the micrometers and a too hard screwing up of the micrometer by the operator while measuring the test pieces.”

Our company sends out a great many specimens of metal to be tested on request of those who wish to experiment, but when any of our work is to be passed on tests it must be done on our own machines, which are of the finest make and kept constantly standardized.

We and others are greatly hampered also by the varieties of standard test bars required. We are called upon to take a test bar from a full-sized prolongation forged on the end of each forging, after it has been subjected to final heat treatment, which is the standard method now of obtaining metal representative of what the forging is made of. The standard test bar of the United States navy is  $\frac{1}{2}$ -inch diameter and 2 inches long between measuring points, and has been adopted by a very large number of railways and representative engineers throughout the country. We are, however, called upon frequently to take from our forgings test bars of many other sizes up to 1-inch diameter and 10 inches long between measuring points. This size of bar necessitates our leav-

ing a full sized prolongation on the end of a forging about 16 inches long. You can see that if the forging is not large this amount of metal may be a very large proportionate part of the forging, and as it must be cut off and returned to scrap it will add materially to the cost of the forging.

Below I give a list of sizes of test bars, given to me by Mr. Wille, engineer of tests of the Baldwin Locomotive Works, Philadelphia, showing the various sizes of bars called for by some of our railways for axles and for other locomotive forgings, such as crank and cross-head pins, piston rods, etc.:

	TENSION TESTS.	
	Axles.	Forgings.
Pennsylvania Railroad . . . . .	$\frac{5}{8} \times 2$ inches.	None.
Baltimore & Ohio . . . . .	$\frac{1}{2} \times 2 \frac{1}{2}$ inches.	None.
Lehigh Valley Railroad . . . . .	None.	$\frac{5}{8} \times 2$ inches.
Chicago, Burlington & Quincy . . . . .	(No dia. given) $\times 4$ inches.	None.
Alabama Great Southern . . . . .	$\frac{1}{2} \times 2 \frac{1}{2}$ inches.	$\frac{1}{2} \times 2 \frac{1}{2}$ inches.
Erie Railroad . . . . .	None.	$\frac{7}{8} \times 2$ inches.
Wabash Railroad . . . . .	None.	$1 \times 4$ inches.
Philadelphia & Reading . . . . .	$\frac{1}{2} \times 3$ inches.	None.
Chicago & North-Western . . . . .	None.	$\frac{5}{8} \times 8$ inches.
Norfolk & Western . . . . .	None.	$\frac{5}{8} \times 2$ inches.

I have spoken to the superintendents of motive power of two of the roads on the above list regarding the size of their bar, and they at once expressed their willingness to change it to conform to the U. S. standard size,  $\frac{1}{2}$ -inch diameter  $\times$  2 inches long.

All of this leads up to the subject, how shall we standardize our methods of tests, and in connection with the subject previously referred to, brings me to the consideration of the work in which I have been more or less active during the past year in connection with the American section of the International Association for Testing Materials. Undoubtedly some of you are members of this organization, but for the benefit of those who are not, let me make a few remarks regarding it.

This association was established in Munich in 1884, and meetings have been held subsequently in Berlin in 1886, Munich in 1888, and Vienna in 1893, at which the American Society of Mechanical Engineers and all the European countries except England, France and Turkey were represented. At the congress at Zurich in 1895 and Stockholm in 1897, England and France were both represented and the U. S. government

also by an army officer. Australia and Japan are now represented, and South America by engineers from Argentina and Chili.

The American section, established in 1898, has for its officers: Chairman, Prof. Mansfield Merriman, Lehigh University, South Bethlehem, Pa.; Secretary, Richard L. Humphrey, Philadelphia Testing Laboratory, City Hall, Philadelphia; Treasurer, Paul Kreuzpointner, Pennsylvania Railroad, Altoona, Pa.

The objects of the association are "the development and unification of standard methods of testing, for the determination of the properties of the materials of construction and of other materials, and also the perfection of apparatus used for that purpose."

Anyone can become a member on proposal by two other members. The annual dues are \$1.50; there is no initiation fee.

I will state that membership in this association is not confined to individuals only, but to organizations as well, so that it is perfectly practicable for your club to join it as a member. I feel strongly that it would be to the interest of the railway companies to have a large representation in this association.

The work in which I have been interested is in connection with Committee No. 1 of the American section, which has in hand the establishment of "International Rules and Specifications for Testing and Inspecting Iron and Steel." A great deal of work has been done by this committee toward standardizing methods of testing materials. Subcommittees have been at work standardizing specifications and methods of testing tires, axles, and miscellaneous forgings. The work of these various bodies is in process so that it is not within my province to lay results before you. Within a few weeks, however, it is expected that these committees will report to the American section, and their reports will undoubtedly be distributed among the railway companies throughout the country, and will also appear in the technical press. It is hoped that they will receive the careful consideration which the great amount of work expended upon them would demand. When these reports are presented to the convention, which will be held in Europe next year, they will probably be modified in accordance with the discussion and criticism which they will produce both from outside and from within the organization, resulting in tentative standardizing. It is hoped that when these standards are adopted by the association, they will be taken up and observed by the various railways and designing engineers throughout the world.

The scope of this association covers all of the various materials of construction, and it is probable that standing committees will be appointed on each of the various problems presented, and that the various tentative standard specifications and standard methods of testing will be modified from year to year as necessity demands.

Meanwhile, I trust that you railway men will use your endeavors to adopt a standard test bar in conformity with that long adopted by the U. S. government, and will endeavor to specify your forgings by giving their physical requirements only.

## THE CAR FOREMEN'S ASSOCIATION OF CHICAGO.

### APRIL MEETING.

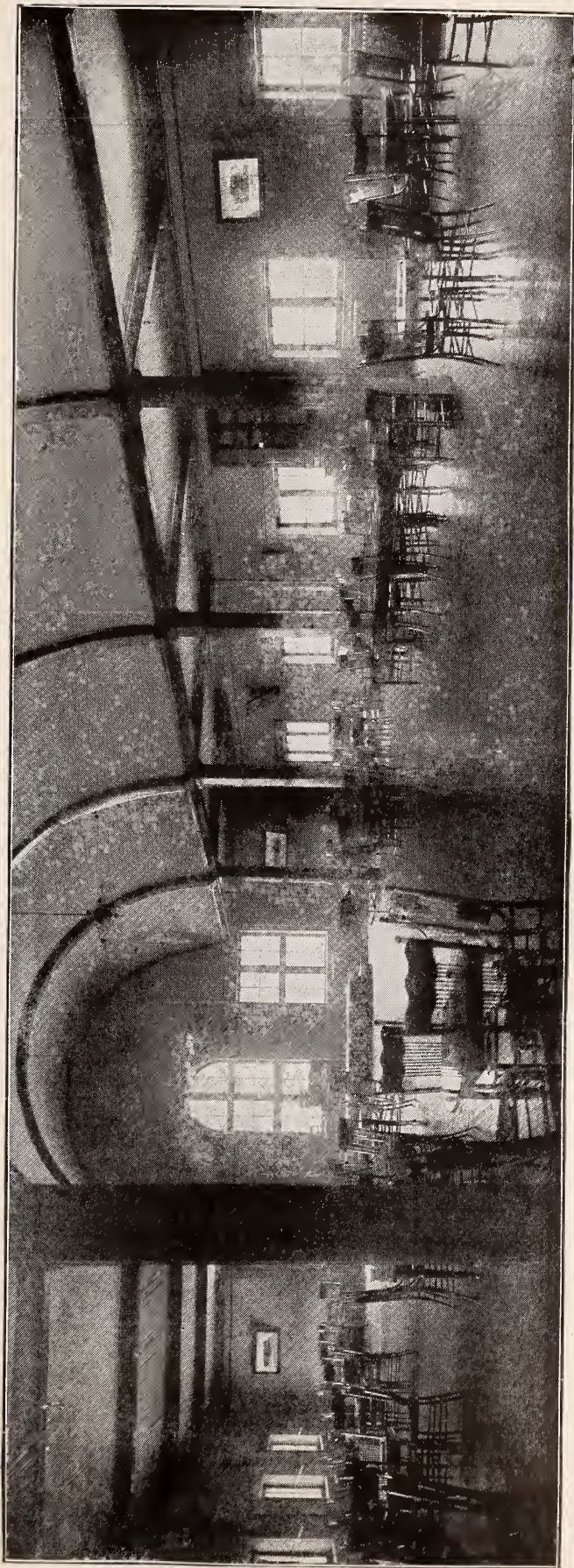
The regular meeting of the Car Foremen's Association of Chicago was held in the rooms of the Western Society of Engineers, Monadnock Block, Chicago, April 12, 1900.

President Morris called the meeting to order at 8:00 p. m. Among those present were:

Alderson, A. S.	Hedrick, E.	Nordquist, Chas.	Shutt, W. F.
Bates, G. M.	Hultman, Chas.	Olsen, L.	Stagg, C. S.
Buker, J.	Hansen, A. P.	Peterson, A. F.	Schroeder, F. A.
Bond, L. E.	Hanson, N. L.	Pettis, C. D.	Thomson, Geo.
Bundy, C. L.	Harvey, H. H.	Rieckhoff, Chas.	Vogel, Aug.
Barton, J. E.	Johannes, A.	Ruff, A. W.	Wentsel, Geo.
Blackburn, D. W.	Jones, R. R.	Roof, C. S.	Wolfe, Chas.
Cook, W. C.	Jones, A. A.	Schmeckpiper, J.	Wensley, W. H.
Depue, Jas.	Kline, Aaron	Schoeneberg, C.	Williams, Thos.
Earle, Ralph	Kaufmann, N.	Sharp, W. E.	Wessell, W. W.
Godfrey, E.	Morris, T. R.	Schultz, A.	
Grieb, J. C.	Marsh, Hugh	Saum, G. N.	
Groobey, Geo.	Manchester, A. E.	Shoemaker, C. A.	

The minutes of the previous meeting, as published in the RAILWAY MASTER MECHANIC, were approved. The following list of new members was then read:

A. N. Morrow, C. & E. I. Railroad; C. S. Roof and W. W. Wessell, Swift Refrigerator Line; C. W. Smith and A. Trepton, L. S. & M. S. Railway; J. M. Browndale, I. C. Railway; C. R. Gilman and Owen Ross, C., M. & St. P. Railway; W. L. Hanson, Consolidated Cattle Car Co.; A. F. Keith, Chicago, New York and Boston Refrigerator Co.; N. Kaufmann and A. Vogel, C., B. & Q. Railway; J. Lauer, G. H. Toringhaus, C. Vandrake and Chas. Grund-



### LIBRARY AND SOCIAL HALL AT OELWEIN SHOPS, CHICAGO GREAT WESTERN RAILWAY.

In our issue of March, 1900, we gave an extended description of the notable shops of the Chicago Great Western railway at Oelwein, Iowa. On the plan view then given the lavatory was shown as being next to the main building. The upper story of this lavatory is given up to a large hall for the use of employes as a reading

and social room. Here the men hold their meetings and give their dances, social entertainments, etc. It is a beautiful room, handsomely finished, well lighted and adequately furnished. The men use it as their own for every purpose that suggests itself, the only restriction, we believe, being that it shall house no political meetings.

lach, B. & O. Railway; G. A. Woodman, American Car and Foundry Co.; S. D. Anderson, Hutchins & Sons Co.; F. O. Brazier, Lappin Brake Shoe Co.; C. H. Ferry, Latrobe Steel and Coupler Co.; S. W. McMunn, Kindl Car Truck Co.

President Morris: At our last meeting the question of broken center pins and defective center plates was taken up, and after some discussion it was continued until this evening. The Committee on Subjects thought that the best way to handle this would be to appoint a committee, who would send a blank form to the different members, asking for any information they could give in regard to broken center pins and center plates, in order to get it in proper form, and if there are no objections I will appoint a committee on the subject of center pins and center plates, to report at the next meeting if possible. On this committee I will appoint Mr. Reinhard, Mr. Sharp and Mr. Kroff. We now come to the discussion of our regular program, changes in the M. C. B. rules coming first.

Mr. Grieb, chairman of the committee appointed on the subject, reported as follows, and the recommendations as given were approved by the Association:

#### REPORT ON REVISION OF M. C. B. RULES.

In presenting the report of your committee on the revision of the M. C. B. rules, I presume it is understood that the committee approves of any rule not mentioned in the report, as it exists at present. It seems, however, that the good effects to be expected from the committee's report have been realized to a certain extent, as one of our neighboring clubs has seen fit to incorporate a number of our recommendations in their report. In fact, their report consists of about two-thirds of the recommendations presented by your committee this evening.

Page 3, Rule 3, paragraph 2, line 4: Add the words "20 and," so that it will read "as provided for in sections 20 and 32 of Rule 3." This refers to issuing defect card for material missing from bodies and trucks in interchange. It is apparent that section 20 has been inadvertently omitted, as this provision applies with equal force to both body and trucks. The idea is to have section 20 inserted in the reading of paragraph 2 of Rule 3, so that when cars are offered in interchange that have material missing from bodies or trucks, a defect card may be expected.

Page 3, Rule 3: Omit "section 34" from second to last line in second paragraph. Of course it is understood that when the Interstate Commerce law goes into effect, on the first of next August, the use of link-and-pin drawbars is supposed to cease, and anything in the Rules now relating to same should be removed.

Page 12, Rule 3, paragraph 16: Add the words, "Back fillets worn out" after the word "journal," on the first line. This in order to make

the understanding uniform that the renewal of axles having the fillet at back shoulder worn out may be charged to the car owner. Arbitration decision No. 362 governs this position, but it has never been incorporated in the Rule and the question crops up now and then, and in order to avoid any controversy or misunderstanding the committee thought best to make such recommendation.

Page 14, Rule 3, Section 34: Omit entirely. Page 17, Rule 4, Section 6. Omit entirely. With the Interstate Commerce law taking effect Aug. 1, 1900, the use of link-and-pin drawbars is supposed to cease to exist.

Rule 5, Section 10: Add the following: "When the bill is permissible whether repaired on defect card or not," after the words, "weight of scrap credited must be one-half the weight of the bearing charged." This to make the understanding uniform that no labor charge is to be made, and the arbitrary one-half credit allowed for journal bearings renewed on defect cards.

Page 31, Rule 5, Section 13: Insert the words "and wrought" after the word "malleable." This because the Rules, as they stand, do not designate a charge to be made for wrought iron knuckles, and experience has shown that some people wish these charged to them at the prices designated for bolts, nuts and finished forgings—3 cents per pound. While on the subject of prices, will say your committee has not seen fit to cope with that portion of the Rules. Of course, we all appreciate the change in the price of material, and how it affects the Rules. There is a special committee appointed to consider the matter of prices; still, there is no good reason that we know of, why some provision should not be made for wrought iron knuckles in Section 13, Rule 5.

Page 36, Rule 5, Section 19, last item: Add "for ordinary and refrigerator cars; truck transoms, two, wood, renewed in same truck, 12 hours, \$2.40." Cases have arisen where two truck transoms were renewed in the same truck and parties attempted to double up the labor charge specified for replacing one, i. e., ten hours.

Page 37, Rule 5, Section 21: Add "Check valve ground in, 5 cents."

Page 40, Rule 5, Section 26, relating to that portion of the Rules designating parts which switching roads may be allowed to render bills for, it is suggested that the words "worn-out brasses" after "faulty construction," in the fourth line, be added; also add the words "draft timber bolts," after the words "arch bars," in the fifth line.

This completes the recommendations of your committee as far as any changes in the Rules are concerned.

In addition to the above, and in view of the fact that there are some questions arising under the M. C. B. Rules which are not covered by any specific rule, and concerning which it would be very desirable to have a formal interpretation from the Master Car Builders' Association, in order to secure a proper and uniform understanding as to the intention of the framers of the Rules, your committee begs leave to suggest, if it is

entirely agreeable to the Master Car Builders' Association, that the following questions be taken up at the noonday discussion for topical subjects and a decision arrived at:

“Is a charge against the car owner for repairs account tapered journal, correct and proper?”

“Are sills of refrigerator cars to be considered as hidden parts, and if more than two are found broken, is the delivering company released from responsibility in cases where there is no other evidence indicating unfair usage?”

“Can bill be made against the car owner for temporary repairs to such defects which, if properly repaired, would be subject to bill under the Rules?”

In view of the fact that considerable controversy has arisen as to the exact meaning of the word “replaced,” as used in connection with the items shown in Section 19, Rule 5, it is thought desirable to change the word “replaced” to “renewed.” This has come most prominently into play in connection with the renewal of draft timber bolts when the draft timbers are down and the same draft timbers are returned to the car, some people charging labor as if an entirely new draft timber had been substituted. In explanation of this latter recommendation, I would say that reference to the dictionary will at once show very good reason for making this change. The definition of the word “replaced,” as given, is: “1. To put again in the former place, as to replace a book, for instance. 2. To put in a new place. 3. To repay; to refund; as to replace a sum of money borrowed.” The definition of the word “renew” is: “1. To restore to a former shape, or to a good state after decay; to rebuild; to repair. 2. To make again. 3. To make new; to make fresh or vigorous.” I think everyone will readily see that there has been a grammatical error committed in using the word “replaced,” and that it should be changed to “renew” in this particular section.

#### **RESPONSIBILITY FOR LAMPS OR TOOLS IN PASSENGER EQUIPMENT.**

President Morris: We now come to question No. 2: “Is a delivering line responsible for lamps or tools missing from the interior of passenger equipment in interchange, regardless of whether the car can be inspected on the inside or not?” In regard to this question I will say that the Chicago, Milwaukee & St. Paul Railway has had a great many questions come up in regard to responsibility for parts gone from the interior of passenger equipment, especially baggage cars, and there have been a great many different opinions in regard to whether the delivering company was responsible or not.

Mr. Jones: I do not think that a delivering road should be held responsible for tools or lamps in baggage cars, where it is almost impos-

sible for an inspector to get in and look at them. They are sometimes filled up to the end with baggage; the doors are locked and often the keys to get in them are not obtainable. Coaches, I think, are different, for almost anyone can get into a coach. I know we had several cases at the time we were handling troops. The baggage cars came in filled to the roof, and when we delivered the cars back we were asked for a lamp, a saw, or ax, and it was impossible to get in the car to see whether they were in there or not, when we received it.

A Member: I see no way by which a company receiving either a passenger or a baggage car can escape the responsibility of missing tools. Reference has been made to the handling of soldiers, where the baggage car was fully loaded; unquestionably, that car was equipped with tools and if the soldiers threw them away and the company handling the car permitted it, it is certainly responsible for the missing tools. There are no coaches offered in interchange unless the keys are furnished also, or even baggage cars, and it is the duty of the inspector of the road receiving those cars to make an examination and take record of missing material, and when the cars are delivered back why the owners must be, and are, held responsible.

Mr. Jones: How is an inspector to get in? We had several cases where the soldiers would not allow the men inside the door. How are we to know whether the tools were in those cars when delivered to us? How would the company know itself? I know we had some trouble with a certain line. The cars went to that line and were returned to us with missing lamps or tools, and we were not able to go in the cars and see whether the tools were there or not.

Mr. Bond: There are very few roads who will deliver passenger cars without the full equipment of tools. I have inspected passenger trains for about twelve years and I have never been allowed to go in them. We have never had any instructions to go inside the doors, and it has been the general thing, where a passenger coach is equipped with lamps, or is supposed to be, and with ax, saw, etc., that the road owning the car is responsible for what is inside. It has always been considered, in case of a wreck, for instance, where the tools are stolen out, that the car owner is responsible, and has been ever since I have been about passenger cars. It is very seldom that an inspector is allowed to go inside a passenger coach. After a train leaves the station the conductor is responsible for what is in the car.

Mr. Roof: I wish to state here, that through the various states of this country there is a law compelling railway companies to so equip their

cars and maintain them, and there is not a trunk line road in the country today that is going to do anything to violate this law. Therefore, they are not going to offer cars with tools missing, and I have never heard the question raised before. I do not think there is a railway in Chicago today that would attempt to run its cars unless they contained the full complement of tools.

Mr. Saum: I would like to ask this gentleman if he refers to both baggage cars and coaches?

Mr. Roof: I refer more especially to the passenger equipment.

Mr. Saum: We receive a good many baggage cars loaded with Asiatic freight under bonded lock. What would you do in a case of that kind? There is no chance for the inspector to see the inside.

Mr. Jones: I move that in the handling of passenger equipment cars, the owner be held responsible for missing material inside.

Carried.

#### A DISPUTED SHEATHING BILL.

President Morris: We now come to question No. 3; a case in dispute between two railway companies in regard to a bill:

A issues defect card for damage done to B's car, as follows:

11 pieces siding,  $\frac{7}{8} \times 4 \frac{1}{2}$  in.  $\times 8 \frac{1}{2}$  ft. long.

14 pieces siding,  $\frac{7}{8} \times 5 \frac{1}{2}$  in.  $\times 8$  ft. long.

71 pieces siding,  $\frac{7}{8} \times 3 \frac{1}{4}$  in.  $\times 8$  ft. long.

When B gets the car home he makes repairs, and bills against A, charging him for:

11 pieces siding,  $1 \times 5$  in.  $\times 8 \frac{1}{2}$  ft. long.

14 pieces siding,  $1 \times 6$  in.  $\times 8$  ft. long.

71 pieces siding,  $1 \times 4$  in.  $\times 8$  ft. long.

A refuses to pay the bill, and asks that it be rendered in accordance with the sizes of siding as shown on the defect card. B claims that the bill is correct, and that he has charged for the siding in the rough, as is the usual custom among the railway companies, and refers to Section 10 of Rule 5.

Is the bill, as rendered by B, correct?

Mr. Sharp: I would hate to have very much to say on that subject for fear I might tread on somebody's toes. I think, as an association, we ought to pass that question up. I do not think we ought to discuss it at all. It is settled by the Rules and by all ordinary practices. I never in my life saw a bill for a  $\frac{7}{8}$ , or  $5 \frac{1}{4}$ , or  $5 \frac{3}{4}$ -inch sheathing. I think the bill is proper and should be paid.

Mr. Bates: I am of the same opinion that Mr. Sharp is. I think the Rules fully cover the case, and besides that there have been arbitration cases on the same thing. If you will refer to case 434, which I think is a parallel, you will find this matter explained thoroughly.

Mr. Sharp: I move that it is the sense of this meeting that the bill, as rendered by B, is correct and should be paid.

Carried.

#### REPLACING MISSING BRAKE WHEELS.

President Morris: We now come to topical discussions. Question No. 1 is: In replacing a missing brake wheel on a foreign car (owner's defect) where the brake staffs and attachments are intact, can bill be rendered for labor and material, or for labor only?

Mr. Wensley: I have looked up this brake wheel question pretty carefully, as I have one or two cases of this kind, and I think the owners of a car, where the brake staff and other attachments are intact, should be held responsible for both the wheel and the labor. I asked a brakeman, if he went out on a car and found the brake wheel broken what he would do, and he said he would drop that and run to the next car, and after the train had been stopped he would take the nut off and throw the wheel away. I think in a case of that kind, where the brake wheel is broken or missing, not having had any rough usage, that the owner should be held responsible for the wheel as well as for the labor.

Mr. Buker: I hardly see how a brake wheel could be broken under fair usage. If it was inspected and found perfectly sound, how could it break without meeting with some unfair usage? Breakage might be caused by using a "persuader," but I think there are few cases where a brake wheel could be broken under fair usage.

Mr. Bates: I think that brake wheels are broken quite frequently under fair usage, especially on flat and coal cars, (of course I do not suppose that it occurs very often on box cars) when the load shifts and breaks a wheel. I believe that that is fair usage.

Mr. Grieb: I am of the opinion that, in a case of that kind, especially as the question is put, its being decided to be an owner's defect, that the owners should be chargeable both for the labor and material.

Mr. Bundy: I believe that the party making the repairs is entitled to charge for labor and material both.

Mr. Marsh: I think that the owner is responsible for the material and the labor, as long as it is specified here as an owner's defect. If he is liable for one, he is for the other.

#### CAUSES FOR LOSS OF BRAKE SHOES.

President Morris: There seems to be one opinion in regard to that. If there are no further remarks we will pass to the next question,— "Causes for loss of brake shoes." This is something that is certainly

very serious. I do not suppose there is a road in Chicago that has not had a great deal of experience with lost brake shoes, and it seems to me there ought to be some way of preventing this loss. Of course, it is understood that this refers to the Christie head. A great many keys are stolen by boys and men around the track, but I do not believe that it can be charged to that altogether.

Mr. Bates: As our President has already said, all of us have had some experience with loss of brake shoes and keys. On our road we still have considerable trouble, but not as much as formerly. Some time ago we went into the matter pretty thoroughly, and we found that the Christie brake shoe key, as made by many of the different railways, was not strictly in accordance with the M. C. B. drawings, and a majority of them were loose and apt to jump out. Of course, a great number of keys are taken out by boys, especially around a big city like Chicago. In our lumber district we have had quite a number of such cases recently, and when I investigated I found that the boys were removing them to pry out the lining boards so as to get at the grain in the cars. We looked up the matter on our line and found that about all the different shops made a different sized key, and we at once stopped this practice. We now make all of our keys at one shop, according to the M. C. B. drawings, and we have very little trouble where they are put in properly. I think it is a very important thing to have these keys made M. C. B. standard, because a key that is made properly will not go down to its full length, and when it is driven in tight it is very difficult to remove without using tools. I believe that everyone who is interested ought to investigate this matter personally.

Mr. Wentsel: We have a great deal of trouble with lost brake shoes; and there are a good many of the keys taken out by boys, as Mr. Bates says. But then, I think there are a great many of them lost in handling cars, on account of their being loose, the keys being too small.

Mr. Thomson: I have noticed many times that the boys would steal the keys and the shoes would eventually get lost. I have also noticed that there are a lot of small keys in use which work out, but the most of the trouble arises from boys stealing them to pry out the lining boards, as Mr. Bates stated.

Mr. Bundy: I have found a great many keys that were too small, and I think that this is responsible for some of the trouble. Another thing that I think causes more of the trouble with the Christie brake head that we have been getting is that the loop is full of blow holes and

breaks off easily. Of course we cull them out, but I do not think we get all of them, and I think they break, and that some brake shoes are lost on that account.

Mr. Wensley: Where the shoe and the key have been well made, and a good heavy key is used, set down well into the head, there is no chance for the key to fall out, and if the shoes are lost it must be because the keys are stolen.

Mr. Jones: Where the key is left in the head, and the shoe is gone, I am inclined to think that the shoe is worn rather thin and in setting the brakes the sudden application breaks the shoe, but where the shoe and key are both gone, it is very evident that they are stolen. I found a key last week on top of a car, where someone had been trying to pry off a retaining valve, and inspectors tell me that keys are often found on the roof.

Mr. Roof: I would like to ask the members of this Association if they do not find more brake shoes and keys missing on outside connected brakes than they do on inside brakes?

Mr. Bates: We find, of course, a majority of them on the outside brakes. I believe, though, that the majority of cars have outside brakes.

Mr. Wensley: We put in about 100 to 150 a month and we have no outside brakes; all inside brakes.

President Morris: It seems to me, both inside and outside brakes suffer, Mr. Roof.

Mr. Roof: I wish to state that the reason I put this question was that the majority of the lost shoes we attribute to being stolen by boys, and they would be more likely to steal a shoe from an outside than an inside hung brake. They are more easy to get at, and I thought this would throw more light on the subject. I believe that a great many of our shoes are lost by being broken. A great many of our engineers pulling trains at the present day do not use any more caution than they might in applying the air brakes, especially in cold weather, applying the air brake in the emergency position. We find a great many shoes broken in the center, and also jerking off the loop that holds them.

The meeting here adjourned.

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The next meeting of the Association will be held May 10. The program is as follows:

1. A receives a foreign car on his repair track with the coupler

knuckle and pin gone, and lugs of the coupler body broken. What would be a proper charge against the owner?

2. In case of a foreign car having two broken draft timbers, deadwood, timber bolts, carry iron, etc., and drawbar and attachments missing, can the party making the repairs bill against the owner?

3. What are the causes of slid flat wheels? Are we braking too high a percentage with safety? Can we attribute it to the parties handling the air? Is it due to the condition of the weather, or to a mechanical defect?

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## THE PREVENTION OF SMOKE ON LOCOMOTIVES.\*

Your committee has found its undertaking difficult, as there seems to be quite a diversity of opinion among the different motive power officers as to the value and merit of the various devices advocated for the purpose of preventing smoke. Some arrangements are indorsed heartily by certain parties and are pronounced worthless by others, while it is positively known that possibly the best example of smokeless firing is given by a road that uses no device but the brick arch.

This being the case, your committee finds it difficult to make any definite recommendations as to the feasibility of mechanical contrivances, some of them being so preposterous and *un-mechanical* that they could hardly be seriously considered.

With the exception of the brick arch, which is quite generally used, the air injector (or jet of air forced into the firebox through openings through the water space) seems to be the favorite method of smoke reduction, though some claim that it is more of a smoke *diluter* than a smoke *consumer*. Most roads using these air jets report successful results when they are properly manipulated, and particularly when used in connection with a brick arch. They are not claimed, however, to produce economical results, partly due, no doubt, to the fact that the air is more or less cold when it enters the firebox. There are some suggestions for heating the air before it is forced into the firebox, but most of the methods suggested seem to your committee to be impracticable.

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\* Extract from Report of Committee appointed by Western Railway Club, to Investigate and Report upon the Matter of Smoke Prevention by the Various Railroads Entering Chicago. Committee: G. R. Henderson, Chairman, R. A. Smart, R. D. Smith, J. C. McMynn, J. W. Luttrell.

Several roads reported that their trials of these air jets had been unsuccessful and especially when used without a brick arch.

One superintendent of motive power says: "I have not said as much in respect to the brick arch as I really think it deserves. I think that drawing air through the fire instead of over it, and having a brick arch that will equalize the heat of the gases and make a combustion chamber behind it, will do a great deal to prevent smoke and produce a more nearly complete combustion of the coal." In speaking of the steam jets he remarks that he considers: "That all these devices are more or less copies of the old idea known as Clark's steam jet, although having a number of other trade names. They are all effective in reducing smoke, although this is done, I believe, at the expense of economy in coal consumption. The efficiency of these devices also depends upon the intelligence with which the firemen handle them, and it may be truly said that an effective smoke prevention is very largely in the hands of the fireman. Authorities on combustion seem to agree that steam is not a good thing to introduce in the fire, and that in introducing air, as under an induced jet, there is no real combination, unless the air is heated up to about the temperature of the gases in the firebox."

In regard to the new engines built for service in and around Chicago, practically all the roads are equipping these engines with one or more of these devices, mostly consisting of brick arches and air jets. In addition, some of the roads are providing boilers with large grate areas and heating surfaces, the grates in some cases being as wide as six feet. Of course, only certain types of engines permit this arrangement, and its use is limited. A firebox over ten feet in length is handled with difficulty, so that there is practically a limit to the size of grate, unless a special construction like the Wooten is gone into, and this type has some disadvantages.

The smoking of coals depends largely upon their composition. Those high in fixed carbon and low in volatile matter, like the Pocahontas, of southwestern Virginia, will produce little smoke. The Pocahontas is, in fact, advertised as a smokeless coal. It contains from 75 to 80 per cent of fixed carbon and about 20 per cent of volatile matter. The Illinois coals have about half as much of fixed carbon and twice as much volatile matter. It is not always the fact, however, that the best coal for heating is the freest from smoke. Coal in the fine or slack condition will generally be more difficult to control in this

direction than if broken in proper sized lumps, because there is less opportunity for the air to pass through the grates.

The railroads entering Chicago use a great variety of coals. Those roads running east and south naturally draw from a different territory than those extending to the west and northwest. One road reports drawing altogether from over one hundred mines, and in times of scarcity, the inferior grades are of necessity bought for consumption in this neighborhood. Some roads in the east have the advantage of coke and anthracite where the prices are as low or perhaps lower than bituminous coal, but they would be practically prohibitive for railroads here, even more so than for factories, as many of the former burn upward of 1,000,000 tons a year. Some of the eastern roads advise that they have difficulty, and, in fact, cannot obtain a sufficient quantity of coke for their needs. Under these conditions the outlook for coke fuel in the west is not very encouraging, until some new sources of coke supply are available at low cost.

The importance of careful firing is recognized by all the roads reporting to your committee, the general sentiment obtaining that a good fireman without a special device is productive of better results than any of these devices poorly managed.

Nearly all of the roads have not only issued concise instructions to their engineers and firemen from time to time, but it is a common practice to select expert firemen and employ them to travel on the engines and explain and illustrate the proper methods of firing to those who are less expert in the matter. Nor can all be done by the fireman,—the engineer must also assist, both by handling the engine in an intelligent manner and by communicating constantly with the fireman. In fact, to produce the best results, there must be a hearty co-operation between those concerned. The engineer should be quick to appreciate the effects of his manipulations on the fire and regulate the “cut-off” and throttle as far as possible to produce the best results, keeping his fireman informed of his intended movements. The fireman should be on the alert to take every advantage of the physical conditions of the road or any cessation in the work and should fire lightly and regularly,—not five or six shovelfuls with a rest in between, but with one shovelful at a time and the door closed gradually—that is, cracked for a few seconds until there is sufficient air to consume the fresh distillates and then closed completely, except where a damper or register in the door is employed. The gauge should be scrutinized every few minutes and the supply of air regulated principally by the dampers; the blower and

smoke consumer must be ready for instant use on the closing of the throttle, as this is the time that the greatest volume of smoke is likely to be produced.

In order to effect these results, however, the motive power officials must perform their part. In European countries it is considered dangerous to make a man on an engine too comfortable, as such an arrangement may make him careless in his work; the theory obtaining on this side of the Atlantic, however, is that the more comfortably a man is installed, the better can and will he attend to his duties. With this end in view, fire doors should be at a convenient height and of a suitable size, the steam gauge should be in *comfortable* view both by day and night, the blower or smoke consumer valves should be quick acting and convenient of access from the foot plate, and water gauges should be arranged for constant observation. Sloping sides to the tank, and coal, properly broken up, will also facilitate the work so that the man with the shovel can give his complete attention to firing and other necessary duties. Many engines are so inconveniently arranged in the cab that it is almost preposterous to expect and ask good results, and a ride on the engine will often show the unintelligent manner in which the fittings have been placed.

The brick arch should be properly located, and if smoke consumers in the form of air and steam jets are determined upon, they should be maintained in good condition. Intelligent instructions should be given to all enginemen, and they should be taught and expected to take an interest in the results of their work. Individual fuel reports will show the economy of the different crews, on similar runs, and may be considered some index to the smoke consumption obtained.

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CONCERNING the use of a defective engine the supreme court of the state of Washington insists that, while it is true that such use is not negligence under all circumstances, it is equally true that it is negligence to use a defective engine under those circumstances where the defect is liable to cause an injury. For example, it holds, in *Allend* against the Spokane Falls & Northern Railway Company, that to haul its workmen from place to place with an engine which emitted an unusual quantity of sparks might not be negligence on the part of a company, but that when it hauls an explosive, liable to be exploded by sparks along with its workmen, to use such an engine is negligence; and that particularly is this true where it fails to inform the workmen that explosives are being hauled.

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## PERSONAL MENTION.

Mr. Alexander Laird has been appointed master mechanic of the Ohio & Little Kanawha, with office at Fair Oaks, Ohio.

Mr. R. F. Hoffman has resigned as mechanical engineer of the Atchison, Topeka & Santa Fe Railway. He goes to the *Railroad Gazette* as associate editor in the New York office of that paper. We reviewed Mr. Hoffman's career and gave his portrait in our last issue.

Mr. W. B. Gaskins has been appointed superintendent of motive power and machinery of the Pecos Valley & Northeastern, with office at Roswell, N. Mex., vice C. M. Stansbury, resigned. Mr. Gaskins has been previously for many years with the Fort Worth & Denver City, on which road he rose from machinist to general foreman of shops at Fort Worth.

Mr. G. H. Kimball, the new chief engineer of the Pere Marquette Railway, was at one time in early life in the motive power department of the Pittsburg, Cincinnati, Chicago & St. Louis Railway, serving as a draftsman in that department.

Mr. M. S. Curley has been appointed master mechanic of the Memphis shops of the Illinois Central, with jurisdiction over the Grenada district of the Memphis division and of the Memphis terminals, vice W. White, resigned. Mr. T. F. Barton succeeds Mr. Curley at Paducah, Ky., and Mr. J. G. Neudorfer succeeds Mr. Barton at Water Valley, Miss.

Mr. David Brown, who resigned some months ago as division master mechanic of the Delaware, Lackawanna & Western at Scranton, Pa., has been re-appointed to the same position.

Mr. G. C. Bishop, heretofore assistant master mechanic of the Altoona machine shops of the Pennsylvania Railroad, has been appointed assistant engineer of motive power in the office of the superintendent of motive power of the Northwest System of the Pennsylvania Lines at Fort Wayne, Ind.

Mr. C. Robbins, master mechanic of the Choctaw, Oklahoma & Gulf at Little Rock, Ark., has resigned.

Mr. W. White, heretofore master mechanic of the Illinois Central at Memphis, Tenn., has been appointed master mechanic of the Lake Erie & Western.

Mr. William Miller who, as previously noted, resigned as superintendent of car department of Nelson Morris & Co., has been appointed master car builder of the Erie & Wyoming Valley, with headquarters at Dunmore, Pa., succeeding Sidney D. King, resigned.

Mr. J. Naismith, foreman of the Union Pacific shops at Columbus, Neb., has been promoted to be master mechanic at Cheyenne, Wyo., and is succeeded as foreman at Columbus by D. B. Hines.

Mr. R. H. Soule has left Chicago for the east. He will open an office in New York as a consulting mechanical engineer.

Mr. Samuel B. Taylor has been made road foreman of engines on the West Pennsylvania division of the Pennsylvania Railroad.

Mr. S. W. Miller, general foreman of the Dennison shops of the Pittsburg, Cincinnati, Chicago & St. Louis, has been transferred to Indianapolis as assistant to the master mechanic. A. H. Thomas succeeds Mr. Miller at Dennison.

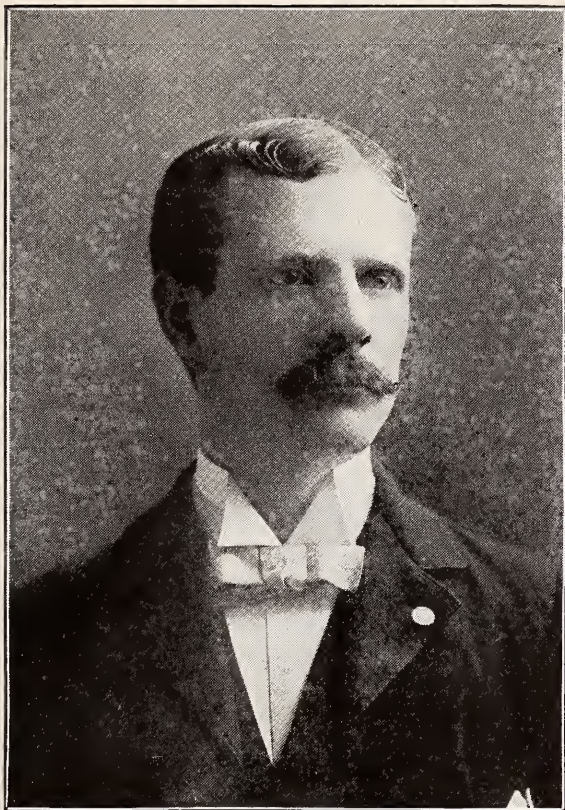
Mr. Joseph Murphy, master car painter of the Louisville & Nashville, at Louisville, Ky., died in that city on April 9, of pneumonia.

The supervision of Mr. J. G. Clifford, master mechanic of the Louisville & Nashville at Louisville, Ky., has been extended over the main stem, second division, including

Bowling Green and the supervision of Mr. J. V. Slusser, master mechanic at Memphis, Tenn., has been extended over the Clarksville division.

Mr. J. E. Gould, general foreman of the Columbus shops of the Ohio Central, has been appointed master mechanic of the shops of the Cincinnati Southern at Chattanooga, Tenn., and Somerset, Ky., with headquarters at Chattanooga.

Mr. Alexander Richmond, for many years chief clerk of the Armour Car Lines, resigned his position, May 1, to engage in the general practice of law in Chicago. Mr.



MR. ALEXANDER RICHMOND

Retiring Chief Clerk Armour Car Lines.

Richmond has formed a partnership with Mr. Charles E. Wyman, who has been an active practitioner at the Illinois bar for the last twenty years, and was for some time, and until a year ago, connected with the well known firm of Deneen & Chytraus, severing his connection when the latter went on the bench. Mr. Richmond was born in Scotland, thirty-five years ago. His connection with railway work dates back to 1878, when, at the age of thirteen, he entered the service of the Caledonian Railway, in Scotland, in a clerical capacity. He came to America in the winter of 1882. His first work here was as car cleaner with the Chicago & Northwestern Ry., at the West Chicago shops. His unusual energy and marked ability soon won for him higher and better places. Early in 1883 he entered the employ of the Lake Shore & Michigan Southern Ry., at Chicago, and rose to the position of chief clerk in car department. He resigned this, in 1886, to accept a position in the auditing department of the Chicago, Burlington & Quincy. As an accountant he soon won promotion, both in the auditing depart-

ment and freight claim department. On Mr. T. B. Kirby being appointed superintendent of the Armour Car Lines, in 1890, being desirous of obtaining the services of his old clerk, he tendered Mr. Richmond the position of chief clerk from which he now resigns. Desirous, however, of following the profession he had set his heart on when a boy, Mr. Richmond took up, in 1894, in addition to his other duties, the study of the law, and after graduating from the Chicago College of Law was admitted to the Illinois bar. In the profession of the law, because of the thorough legal education he had acquired, his business training and executive ability, we predict for him a very successful career, upon which he enters with the good wishes of a host of railway friends. Mr. Richmond's offices will be Suite 314 First National Bank Building, Chicago.

Mr. W. Cross, master mechanic of the Western division of the Canadian Pacific, has been appointed assistant to the manager of the western lines of that road, in charge

of the mechanical department, with headquarters at Winnipeg. C. R. Ord is appointed master mechanic of the Western division, with office at Winnipeg.

Mr. E. E. Brown has been appointed electrical engineer of the Philadelphia & Reading, and will have immediate charge of the electrical work in connection with the new locomotive and car shops at Reading, Pa.

Mr. Isaac W. Van Houten, formerly for many years general foreman of the shops of the Pennsylvania Railroad at West Philadelphia, died at his residence in Philadelphia on April 1, at the age of eighty-six years.

Mr. Wm. Edwards, who was master mechanic of the Baltimore & Ohio, at Martinsburg, W. Va., from 1847 to 1887, died at that place on April 2, at the age of eighty-one years.

Mr. E. M. Humestone, formerly master mechanic and assistant superintendent of the Philadelphia Reading & New England, which position he resigned in October, 1897, on account of ill health, died at Poughkeepsie, N. Y. on March 20, at the age of fifty-six years. He was born in Ulster county, New York, in 1844, and was with the Union Pacific from 1867 for a number of years as mechanical foreman. Later, he was until 1880, master mechanic on the Louisville & Nashville, and from 1880 to 1891 was with the New York & New England as division master mechanic and general master mechanic. He retired from the last named position, on May 1, 1893, owing to a change in management, and on January, 1894, went to the Philadelphia Reading & New England as master mechanic and assistant superintendent.—*Railway Age*.

Mr. William T. Reed, superintendent of motive power and machinery of the Seaboard Air Line, has been appointed one of the judges for the Paris exposition.

Mr. C. M. Marshall, road foreman of engines for the Peoria, Decatur & Evansville, at Mattoon, Ill., has been appointed general foreman of locomotive repairs of the Missouri Pacific, at Atchison, Kan.

Mr. W. Pippin, heretofore a locomotive engineer, has been promoted to be traveling engineer on the Mobile division of the Mobile & Ohio, with headquarters at Mobile, vice J. B. Cozart, resigned.

Mr. T. A. Davies, formerly master mechanic of the Union Pacific at Laramie, Wyo., but since December 1, 1898, foreman at the roundhouse at Evanston, Wyo., has resigned.

Mr. Thomas Tipton has been appointed purchasing agent of the Rio Grande Western, with office at Salt Lake City.

Mr. Adolph Onslow, who for many years was master mechanic of the Erie, died in New York on March 28.

Mr. Joseph Murphy, master car painter of the Louisville & Nashville, died in Louisville on April 9.

Mr. C. B. Brezinsky has been appointed general foreman on the Lake Shore & Michigan Southern, at Collingwood.

Mr. James Cullen, superintendent of motive power and machinery, of the Nashville Chattanooga & St. Louis, died at Nashville, Tenn., April 19, age 63 years. Mr. Cullen had been with the Nashville, Chattanooga & St. Louis for twenty-six years. A notable tribute to his memory was paid by his company, which directed, while the funeral ceremonies, April 21, were being conducted at the grave, the whole line be tied up for five minutes, as a token of the great respect in which Mr. Cullen was held. The following order was issued with this intention: "All engines and trains will come to a standstill, wherever they may be, promptly at 12 o'clock noon today and will remain standing five minutes. Work of all kinds will be suspended for five minutes at that hour. Train-

men must protect themselves out on the line. This is to commemorate the interment of our late superintendent of motive power, James Cullen." At whatever point on the line the trains were they all stopped at noon, and not a wheel moved along the entire system for five minutes. The bells of all of the engines were tolled as long as the suspension of traffic continued.

Mr. R. Atkinson, heretofore mechanical superintendent of the Canadian Pacific, has been appointed superintendent of rolling stock, with headquarters at Montreal, Que.

The title of W. T. Reed, superintendent of motive power and machinery of the Seaboard Air Line, has been changed to mechanical superintendent.

Mr. Joseph E. Gould, hitherto general foreman of the Columbus shops of the Toledo & Ohio Central, has been appointed master mechanic of the Chattanooga division of the Cincinnati, New Orleans & Texas Pacific, with headquarters at Chattanooga, Tenn., vice V. B. Lang, resigned.

Mr. Henry Neumeister has been appointed general foreman of the Chicago, Rock Island & Pacific, at Chicago, Ill., vice B. H. Hawkins, resigned.

Mr. W. T. Smith, heretofore assistant master mechanic of the Chesapeake & Ohio, at Covington, Ky., has been appointed division master mechanic, at Richmond, Va., vice T. S. Lloyd, who, as previously noted, resigned to become superintendent of motive power and machinery of the Delaware, Lackawanna & Western.

As already noted, Mr. J. S. Booth became master mechanic of the Carolina & Northwestern, with headquarters at Chester, S. C., on March 1. Mr. Booth was born in Gloucester county, Feb. 8, 1858. His first railway work was as machinist in Huntington, Va., for the Chesapeake & Ohio, in 1882. Since that date he has worked in railway and locomotive shops of the Cincinnati Southern, Illinois Central, the East Tennessee, Virginia & Georgia and the Western of Alabama. In 1889 he was made gang foreman in the shops of the Chesapeake & Ohio, at Richmond, Va., and in 1891 general foreman of the Richmond & Danville shops, at Salisbury, N. C. When the Southern built new shops at Spencer, S. C., he was made roundhouse foreman and later foreman of the erecting shop, in which position he remained until his recent appointment.—*Railroad Gazette*.

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## SUPPLY TRADE NOTES.

Mr. Thos. P. Egan, president of the J. A. Fay & Egan Co., the large wood working machinery manufacturers of Cincinnati, Ohio, was recently nominated for presidential elector from the second congressional district of Ohio. Mr. Egan is in no sense a politician, and his selection is therefore a tribute to his high standing in the community and among the large manufacturers of the country. Mr. Egan goes to Paris in June to visit the exposition, where his firm is making a large exhibit, having been requested by the government to represent the United States there, and he will return in time for the election.

J. A. Fay & Co., of Nos. 8 to 28 John street, Cincinnati, Ohio, the largest manufacturers of woodworking machinery in the world, have just issued a very handsome and complete illustrated catalogue of 394 pages, showing the different machines they make, and will be pleased to forward a copy to any manufacturer or foreman who is interested in that class of machinery and who will write them. A large number of the machines described have been patented in 1900, and embody the latest designs and inventions in the woodworking machinery industry. No less than twenty-eight machines have been protected by letters patent since January 1, 1900, to say nothing of a large number issued in the latter part of 1899, some

as recent as December 19. The large technical department employed by this enterprising firm, and presided over by Mr. Thos. P. Egan, president, is in the main responsible for this great number of improvements.

Mr. Geo. A. Barden, formerly superintendent of the works of the Standard Pneumatic Tool Co., of Chicago, has been appointed eastern agent of that company, with headquarters at No. 619 Washington Life Building, 141 Broadway, New York.

Mr. Sidney H. Wheelhouse, formerly sales agent for the Chicago Pneumatic Tool Co., has been appointed second vice president of the Standard Railway Equipment Co., in charge of the pneumatic tool sales department for the west, with offices at 412-414 Lincoln Trust Building, St. Louis. The appointment dates from May 1.

Wisconsin graphite was discovered in 1893 near Junction City, Wis. The prospecting showed a large vein of very clean amorphous ore, and as it came to be more developed it was found that the vein averaged over nineteen feet in thickness and was nearly vertical. In 1896 the Portage County Graphite and Mineral Paint Manufacturing Company of Stevens Point, Wis., was incorporated and came into possession of the mine. This company had several tons of the mineral reduced and began practical experiments as to its value in two of the largest lines of use, viz., paint and foundry facing. The results of these experiments have been highly gratifying, especially satisfactory results having been gained with its use as a coating for iron or steel to prevent rust. This company also owns the mineral rights in a tract of iron bearing land near by the graphite mines. This iron property is a very large deposit of iron ore which has been tested and found to produce a superior oxide or "mineral" paint, such as is used for freight cars and general outbuilding work.

Mr. T. P. Kinman, assistant mechanical superintendent of the Standard Pneumatic Tool Co., of Chicago, has sailed for Paris to exhibit and operate his company's "Little Giant" pneumatic tools and appliances at the exposition. The company will have a complete air plant in actual operation in the Champ de Mars and Park Vincennes. The New York office of the company has been removed from 95 Liberty street to 122 Liberty street, Beard Bldg.

AN EXPERIENCED railway equipment salesman and practical locomotive engineer, acquainted with ninety per cent of the railway officials in the United States and Canada, desires to make a connection with some responsible house. Address Salesman, care Master Mechanic.

WANTED—Position as master car builder, or foreman of car shops, by an experienced practical car builder. Thoroughly up to date. Accustomed for years to handling men. Address D. T. T., care of Railway Master Mechanic.

WANTED—Position as foreman locomotive repairs, by a practical man. Have had several years' experience in this kind of work. Good references furnished. Address S. E., care Railway Master Mechanic.

SITUATION WANTED—Young mechanical draftsman, twenty-nine, machinist, inspector, and thoroughly conversant with modern locomotive work; thorough, careful and accurate; can systematize work of motive power department; is open for engagement as head draftsman with railroad or system. References as to ability and character. Address, "Draftsman," care Railway Master Mechanic.

WANTED—Position as chief clerk in motive power department of a railway. Thoroughly experienced and best of references. Address Q., care Railway Master Mechanic.

SITUATION WANTED—By a capable general foreman of locomotive repairs. Address G. F., care of Railway Master Mechanic.

WANTED—Position as mechanical engineer or master mechanic by experienced mechanical engineer, now employed. Address P. R., care of Railway Master Mechanic.

POSITION WANTED by a thoroughly competent mechanical man who is experienced in directing work in a railway shop and in manufacturing establishments. Particularly well up in car work. Now employed, but wishes to make a change. Address the editor of the Railway Master Mechanic.

# RAILWAY MASTER MECHANIC

WALTER D. CROSMAN, EDITOR.

WILLIAM E. MAGRAW, MANAGER.

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No. 6.

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## Progress in Freight Car Construction and Service.

The improvement in the quality of freight cars in recent years is certainly remarkable, and the benefit to railways in having more substantial structures in a trying service will show itself directly in a reduced cost of repairs per ton-mile, and indirectly in numerous ways—the most prominent being the fewer delays to traffic by break downs.

The steel car itself is a tower of strength, and it has rapidly forced a strengthening of old wooden cars, and better design in new wooden cars.

The steel car in service has exceeded the expectation of its strongest advocates. The work of the Pressed Steel Car Co. has been, both in design and construction, so good that few material changes have been found necessary or desirable.

When designing wooden cars of 80,000 pounds capacity it has been necessary to do the work more accurately, and it has been made the subject of engineering calculations rather than the thumb rule of the carpenter, as was most of the older car design.

Taking up some of the details in modern freight cars we may note that the axles have been revised and standards adopted for car capacities up to fifty tons. Iron axles have almost gone out of use for new cars, and the steel axles now used are much stronger and more uniform in quality. The proportion of broken axles should be growing less, and if the matter could be placed on any satisfactory comparative basis we believe statistics would show gratifying progress in this direction. Journal boxes are now made of better design, and the lid and dust guards, especially, have been greatly improved.

Journal bearings have been the subject of careful scientific investigation by the microscope and also by chemical analysis, and bearings can now be obtained at moderate cost, having the most desirable anti-friction qualities combined with uniform and low rate of wear.

The whole truck has been subjected to accurate test and careful design, and there is a larger margin of strength and fewer weak points

in trucks for large capacity than in the older trucks for smaller capacity cars.

This work on the new truck has suggested many improvements which can be utilized in improving the design of the older trucks.

Attention has been called to the low elastic limit of the arch bar truck as made of bar iron. While this has answered its purpose admirably for light loads in the past, it cannot be developed into a satisfactory structure for large loads without becoming too heavy and clumsy. In order to secure large carrying capacity in a truck with minimum weight, resort must be had to the pressed steel and riveted plates which possess superior elasticity. The pressed steel and riveted plate trucks are no longer an experiment but are considered almost a necessity of modern freight car conditions.

The same thing is true of body bolsters; the superiority of pressed and riveted plates in elastic resistance, as compared with bolted bar iron structures is now appreciated, and they are seen in modern designs for heavy bolsters.

Stiffness as well as strength is a prime requisite in a body bolster, as it is desirable to keep the side bearings from contact on both sides at once, and this was the usual condition of most of the old bolted structures under the loaded car, and permanent set increased with age until, in many cases, the side bearings were in contact under empty cars.

With pressed and riveted steel body bolsters of good design, after slight permanent set has taken place under maximum load it is not likely to increase under repetition of that load, and a definite distance between side bearings can be maintained. Such a condition is another satisfactory evidence of progress in car construction.

Before leaving the truck we may mention the improvements which are noticeable in freight car lubrication. While the old method of using oil-soaked waste below the journal is retained, the manner in which the waste is packed in the box has been carefully studied and the best way of doing it arrived at. There is now a considerable amount of missionary work being done among the car oilers and packers in giving intelligent instruction with the correct methods, thus counteracting a practice that was not only bad but wasteful.

With better materials in bearings and good lubrication secured by careful packing, the number of hot boxes should be greatly reduced, and progress in this direction means more prompt and successful movement of trains.

In regard to the underframe as a whole for large capacity cars, we

may say that on page 89 of our last volume we predicted that the steel underframe for such cars must soon come into use and, before the year has gone by, we hear of a large car shop being constructed for this special business of making cars with steel underframes and wooden superstructure. The use of steel for the body of box cars does not seem necessary, as there is little advantage, if any, in weight; the cost must be much greater, and the thin metal, with such a large surface exposed, must depreciate rapidly by corrosion. The same is true, to some extent, of coal cars, and it is probably the reason why some roads prefer a steel underframe and wooden boxes for large capacity coal cars. With the general introduction of steel underframes for box, as well as coal and gondola cars, the draft rigging on wooden cars must suffer, and in the next year we expect to see an unusual development of draft gear, which will be made largely of steel, more substantial and durable and with a capability of resisting stresses almost equal to the steel cars themselves.

The whole tendency of modern freight car construction in this country is toward more expensive structures, built largely of steel, which will have a longer life and will spend less time on the repair track.

The extra expense in initial cost is well justified by increased earnings per car and reduced cost of repairs.

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## Locomotive Progress.

Our review, last June, dealt principally with the enormous growth of freight locomotives. The prominent feature in locomotive design in the past year has been the production of very large passenger engines. The Chicago & Northwestern has carried the size of 8-wheel engines almost to the maximum possible limits; the engines have 19½ x 26-inch cylinders, and 75-inch drivers. They weigh 137,000 pounds, of which 87,000 pounds are on the drivers. They have a total heating surface of 2,507 square feet.

The Alton road has had built at the Brooks Locomotive Works, a number of 8-wheel engines for its Chicago-St. Louis daylight run, which exceed the Northwestern engines in some dimensions. The cylinders of these engines are 19 x 26 inches. The weight on drivers is 90,500 pounds, and the total weight is 139,000 pounds. The heating surface is 2,177 square feet.

One of the largest passenger engines in the world is the 10-wheel Brooks engine on the Lake Shore road. It has cylinders 20 x 28 inches;

80-inch drivers; 66-inch boiler shell; a grate area of 33.6 square feet, and a total heating surface of 2,694 square feet. Another is the Delaware, Lackawanna & Western passenger engine built by the same works, with 72-inch boiler and 137,000 pounds on six drivers.

The largest 6-wheel switching engine built thus far is that for the Cambria Steel Co., by the Baldwin Locomotive Works. The cylinders of this engine are 21 x 26 inches; the wheels 50 inches in diameter; the boiler 68 inches in diameter; and the weight on drivers 137,000 pounds.

The Atlantic type of passenger engine continues to grow in favor for very high speeds, and the most notable example of this type built recently is the Pennsylvania Railroad, Class E I, with wide firebox, for the Atlantic City service. The cylinders are 20½ x 26 inches; the wheels 80 inches in diameter; the weight on drivers 101,500 pounds; the total weight of engine 173,450 pounds; the tractive power 22,000 pounds; the total heating surface 2,320 square feet; and the grate area 69 square feet.

Notwithstanding the gigantic freight engines built last year they still continue to grow larger, and for great weight the palm is now held by the Illinois Central, whose 12-wheel Brooks engine is now regarded as the largest engine in the world. The cylinders of this engine are 23 x 30 inches; the boiler shell diameter 82 inches; the weight on drivers 193,200 pounds; the total weight 232,200 pounds; and the heating surface 3,500 square feet.

Compound locomotives continue to grow in favor on a number of large roads, though their use in this country is by no means general. The suitability of the different types for special service is becoming more clearly defined. The two-cylinder compounds are doing their best work in freight service with heavy trains on nearly level roads. For high speed passenger service they have not proved successful.

The Vaucrain four-cylinder compounds are doing remarkable work in very high speed passenger service. The fastest schedules are now operated by this type of engine. The same kind of engines are also showing themselves well adapted to freight service.

The total number of compound locomotives built in the United States up to April this year was 1,900, and of these, 1,320 are Vaucrain four-cylinder engines, 250 Schenectady two-cylinder compounds, and 153 Richmond compounds. Many of the Vaucrain engines are for export, the large Russian orders being of this type. Probably not over 1,000 Vaucrain compounds are now in use in this country.

The total number of locomotives built by contracting shops in the United States in 1899 was 2,473, the largest number in a single year yet recorded. The increase over previous year is nearly 400, or about 32 per cent, and 10 per cent higher than 1890. The per cent of compounds has decreased — 340 compounds were built in 1899, or 14 per cent of total output. In 1898, 373 compounds were built, or 20 per cent of total output.

In boiler construction we have had three novelties, two of them dealing with corrugated fireboxes without staybolts; the other having a compromise firebox, with width of 72 inches. The Vanderbilt boiler, with corrugated firebox, was described in our issue of October, 1899, and the success attending it has led to the construction of a number of additional engines with similar stayless fireboxes.

The Atchison road built an experimental boiler, with a corrugated tube the whole length, and small return tubes above it. This was placed in the machinery of an old engine with small cylinders. As the heating surface was considerably reduced, as it must necessarily be by such construction, we do not expect that any successful boiler for large locomotives can be worked out on these lines, and we doubt if the experiment will be carried any further.

The wide firebox of the Prairie type locomotive on the Burlington road gives us the most encouraging evidence that there is now to be a breaking away from the old fixed practice of making fireboxes flush with the frames, 42 inches wide and no wider, regardless of the requirements of heating surface and cylinder volume. In this firebox the width is 6 feet, and the length 7 feet, giving a grate area of 42 square feet, for cylinders 19 x 24 inches. This is an increase of 40 per cent in area, as compared with the grate surface usually provided for such cylinders. The total cylinder volume is 8 cubic feet, and its ratio to grate area 5.2. On most large engines recently built this ratio is only 2½ to 3.

Boiler pressures of 210 pounds or over are now considered regular practice, and few large engines are built in the United States to carry less than 200 pounds.

Piston valves are found a necessity with high boiler pressures, and they have been developed so rapidly that while last year we recorded experiments with them on various roads, they are now a regularly established standard. There are two types, one with the main steam passage in the center, the steam ports next, and two exhaust ports, one at each end. This plan has the advantage of keeping the steam at the center of the valve chest and the exhaust next the heads, so that condensation is

reduced to a minimum. It has the disadvantage of a disturbance in the valve motion which makes it unsymmetrical for forward and back motion, but it can be adjusted so as to show a good distribution in the forward motion. The other form of piston valve is that in which the ports have the same relation to each other as in the common flat slide valve.

Steel castings have become a necessity on account of superior strength; they are used not only as a substitute for forgings, but in place of cast iron. The stresses in many details are now so great that if these details were made of cast iron they would be very clumsy and heavy. Cast steel driving centers and main frames are now a matter of large regular orders by locomotive builders, instead of experiments as in former years.

Nickel steel, also, for some parts where stresses are high, has become a real necessity. The Bethlehem Steel Co. has done a good work in distributing samples of nickel steel on fifty roads, and as this steel has received a proper heat treatment and is of known and exact composition it will serve to show the good qualities of this splendid material to much better advantage than the so-called nickel steel which was evidently the subject of the master mechanics' report last year. When the reports come in, giving the results of this later test, they will tell quite a different story, and will serve to establish nickel steel on a permanent basis as one of the prime requisites in first-class locomotive construction.

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## Locomotive Road Tests.

In June, 1899, we illustrated and described the dynamometer car built under the direction of Prof. L. P. Breckenridge, by the Big Four Railroad. The car has been used in a number of tests since that time; and auxiliary apparatus has been added so that it is adapted to numerous other tests besides the record of drawbar pull. The principal aim has been to concentrate in the car as many of the measuring and recording instruments as possible, and to remove from the locomotive all such instruments as can be made to measure accurately when readings are made in the car. Corrections for errors introduced by this transmission are, of course, made, and care is taken that results are accurate.

In this way the observers and instruments are placed in almost as favorable conditions for careful work as in shop tests of locomotives. By carrying along with the locomotive, in a special car, a complete labo-

ratory, with all necessary gauges and apparatus, it is thought that locomotive testing on the road, with engine in regular service, may be conducted with equal facility and care as if the engine were mounted on a testing plant.

The French engineers have followed this practice for many years, and very elaborate test cars have been built by French railways. They have been developed so far as to take cylinder indicator cards on the same table which records the drawbar pull, but the accuracy of such work has well been doubted.

Prof. Breckenridge has the advantage of all this preliminary work by others, as well as rather an extensive experience of his own in road testing, and it will be interesting to see how his persistent and enthusiastic work in refining and perfecting road testing will be rewarded. His paper before the Western Railway Club, in May, 1900, describes very fully how road tests should be made, and explains some future improvements which are to be made in the test car. The hydraulic dynamometer, with cupped leather packing, which he uses, has always been looked upon with some suspicion, and although fairly good results have been obtained from it, yet it will be admitted that it is not an ideal method of measuring drawbar pull. New designs have been made in which the cupped leather is eliminated and bronze pistons, carefully fitted and lapped, are to be substituted. There are three cylinders arranged tandem with one piston rod, and three pistons of different diameters, so proportioned as to answer for passenger work and light and heavy freight work. The cylinders are so piped that any one can be connected with the recording gauge, and the other two disconnected.

An attempt will also be made to measure the temperature of smoke-box gases, with a Le Chatelier pyrometer and records transmitted electrically to a recording galvanometer in the test car.

A recently perfected continuous cylinder indicator will be used in tests to be made this year, and, if successful, much of the work on individual indicator cards will be avoided. This will give an idea of the grand scale upon which Prof. Breckenridge is laying out his work, and, as he very truly remarked, in experimental work of this kind if we do not always ascertain the truth we are seeking, we incidentally discover other facts which are equally important and valuable.

It is well known that this has been found the case in the locomotive testing work at Purdue.

The discussion on Prof. Breckenridge's paper at the Club was rather confused, but interesting nevertheless. It failed to distinguish between

road testing as a regular routine work and that intended as original research, or as experimental work to find the value of new designs and devices. For this reason, some members thought the scheme laid out in the paper too elaborate, and as dealing with too many factors at one time.

The paper was intended to cover the field of road testing as completely as possible, giving instructions for conducting each particular kind of test, but it was not intended that all the measurements named should be made at one time, or in one series of tests.

The simple matter of indicating old locomotives, to test the valve and valve gear, does not require a dynamometer car, and should be regarded as ordinary routine test work.

The dynamometer car, with its elaborate battery of gauges and recorders, is only necessary for original research, and testing new locomotives, when some improvement requires a careful record of both boiler and engine performance.

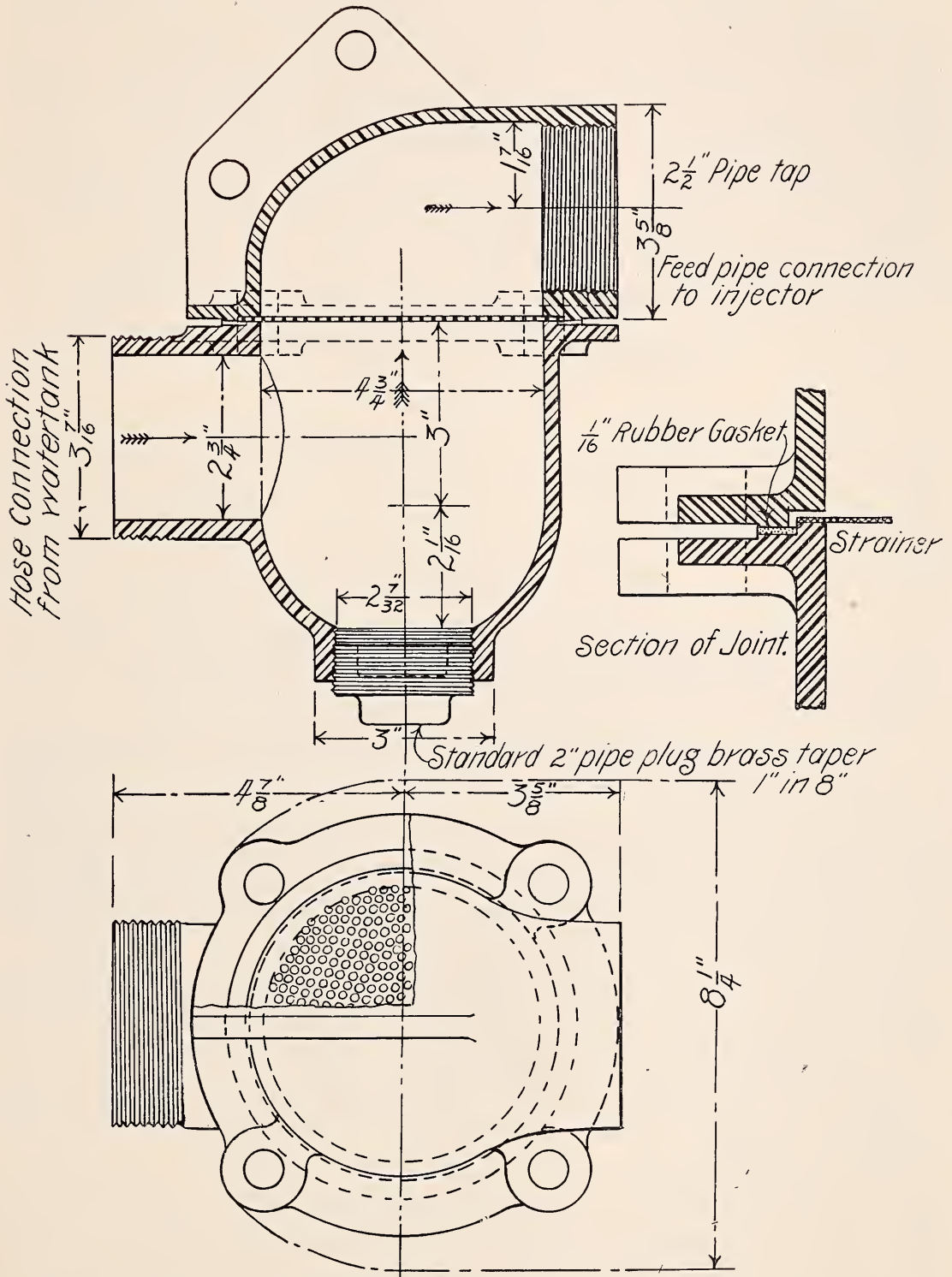
This is the purpose of the car which Prof. Breckenridge is using, and this the kind of testing which will be conducted in it. We shall be interested in following the work to be laid out for it, as it is now to be shown whether the road testing of locomotives will be as profitable and fruitful in adding to our knowledge as many valuable facts and useful data as has been contributed by those conducting locomotive tests on a fixed plant on the shop or laboratory method.

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## FEED WATER STRAINER—C., B. & Q. RY.

On the Chicago, Burlington & Quincy Railway it was some time ago decided, finally, that the old design of cone strainer in the feed water hose was a bad design, in that it reduced the flow of water to the injector. Numerous devices were tried, to meet the difficulty, including some of those sold by the injector companies, which, while satisfactory in operation, were quite expensive. Strainers in the tank and in the tank valve were also tried, but were found to be more or less unsatisfactory. Finally, the design shown herewith was adopted, the right to use same being acquired from the inventor, Mr. J. P. Hayes.

The strainer, which we are enabled to illustrate through the courtesy of Mr. F. A. Delano, superintendent of motive power and rolling stock of the Chicago, Burlington & Quincy system, is attached directly to the foot cock and is, therefore, at the front end of the hose. The water follows the path indicated by the arrows, and it will be noted that it



FEED WATER STRAINER—CHICAGO, BURLINGTON & QUINCY RY.

passes upward through the strainer. Accordingly, any mud or other foreign matter which is stopped by the strainer falls into the bottom chamber of the strainer case, whence it can be readily removed through the plug shown.

The drawings show the construction of this neat device quite clearly,

the joint carrying the strainer being shown up in larger detail in the small sketch. The strainer is made of No. 20 sheet, with holes  $\frac{1}{8}$ -inch diameter and  $\frac{3}{16}$  inch between centers. The area of the hole at the strainer is about 40 per cent in excess of the area of the pipe. The device is very cheap to make, being of ordinary gray iron. The Burlington has equipped two or three engines with this strainer and is going to equip more as rapidly as possible.

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## STOP—LOOK—LISTEN!

BY IRA C. HUBBELL.

A visitor to an institution for the feeble-minded found a man of years astride a chair, rocking to and fro with all his might, whipping the chair vigorously and at the same time commanding it to "git up," as if riding a horse. The visitor, thinking to gratify the patient, remarked in passing, "Uncle, your horse seems balky." "Horse!" said the patient, "horse!" contemptuously, "horse! this ain't no horse, this is a hobby; any darned fool can ride a horse, but it takes a smart man to ride a hobby."

Paul said: "We brought nothing into this world, and it is certain we can carry nothing out."

Our individual experiences teach us that each is dependent upon the other, whether we frankly so acknowledge or not. The man willing to confess his ignorance and avail himself of the ever present opportunities to learn, is headed toward the town of Success.

The writer likes to think of the railway as a large manufacturing plant, bending all its energies to the development of that part of the world's industries which naturally falls to its lot.

As stated in previous letters, the plant, like all other manufacturing concerns, possesses its producing and its selling departments.

In one communication, reference was made to the necessity for the sales department (the traffic department) marketing the product of the plant at a profit, or the plant must necessarily pass to the management of the courts and through sale into others' hands.

At another time, reference was made to the responsibility resting upon the producing side of the organization, as to its ability to give to the sales department just as good service to sell as the other lines are offering, and at equally as low first cost as the other lines, or the same final result follows as when the transportation is given away instead of being sold at a profit.

The responsibility as to the final result is then mutual, but in the main the producing side must necessarily carry the greater burden, and in no part of the producing side is there greater opportunity for economies that increase the year's profit than in the design and construction of equipment.

One thousand pounds of unnecessary weight in a locomotive's truck will, in the course of a year, equal 18,000 tons one mile. In 100 locomotives this takes from the earnings the equivalent of 1,800,000 tons one mile, and expressed in money at an average rate of but 5 mills per ton mile, \$9,000, or the equivalent of 5 per cent on \$180,000. The \$9,000 does not represent all that has been taken out of net earnings. So far as bare transportation expenses are concerned, it costs just as much to haul 1,000 pounds piled on the pilot of the locomotive as it does to pull the same materials loaded in a box car. Few lines, if any, can move one ton of freight one mile at less than 1 mill. Operating expenses, therefore, are necessarily increased accordingly, or \$1,800, and from net earnings a bad design is responsible for \$10,800 loss in one year.

There is food here for reflection, and a useful lesson can be had from studying designs of equipment published in our periodicals. For instance, two master mechanics each prepare specifications for 10-wheelers. One engine weighs 160,000 pounds with 46,700 pounds on the truck and but 70.81 per cent of the engine's weight on the drivers. The other engine weighs 141,400 pounds with 28,900 pounds on the truck, or 79.56 per cent of the gross weight on the drivers. The weight on the drivers in the first engine is 113,300 pounds, and in the second is 112,500 pounds, or a difference of but 800 pounds, and yet there is a difference in total weight in favor of the latter engine of 18,600 pounds. For the sake of argument, deduct from this the 800 pounds difference in weights on the drivers and it would appear that the first mentioned design is not as favorable, from the point of ultimate economy, as the latter, and by "ultimate economy" is meant the sum of the items of transportation cost assumed at 1 mill per ton per mile and lost earnings through energy consumed in handling dead weight, on a basis of 5 mills per ton per mile. Assuming the locomotive mileage at 36,000 miles per year the 17,800 pounds is equivalent to 320,400 tons one mile, or an aggregate loss to net earnings of \$1,922.40 per locomotive of this design per year.

A study of designs and light weights of cars will disclose wonderfully different opinions. For example, take two 34-foot box cars 60,000 pounds capacity, 66,000 pounds load limit, which have come under the writer's observation (the percentages are figured on load limit); one shows 70.14

per cent carrying capacity to gross load and another 65.8 per cent. In other words, one car weighs, light, 28,100 pounds, the other weighs, light, 34,300 pounds. On an average mileage of 6,000 miles per annum this difference in dead weight equals 18,600 tons one mile, and in 1,000 cars 18,600,000 tons one mile.

At railway crossings the sign is sometimes seen—

*Stop—Look—Listen!*

These figures should attract the thoughtful attention of those who represent the producing side of the railway plant.

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## THE REHABILITATION OF THE PISTON VALVE.

BY ROBERT F. HOFFMAN, M. E.

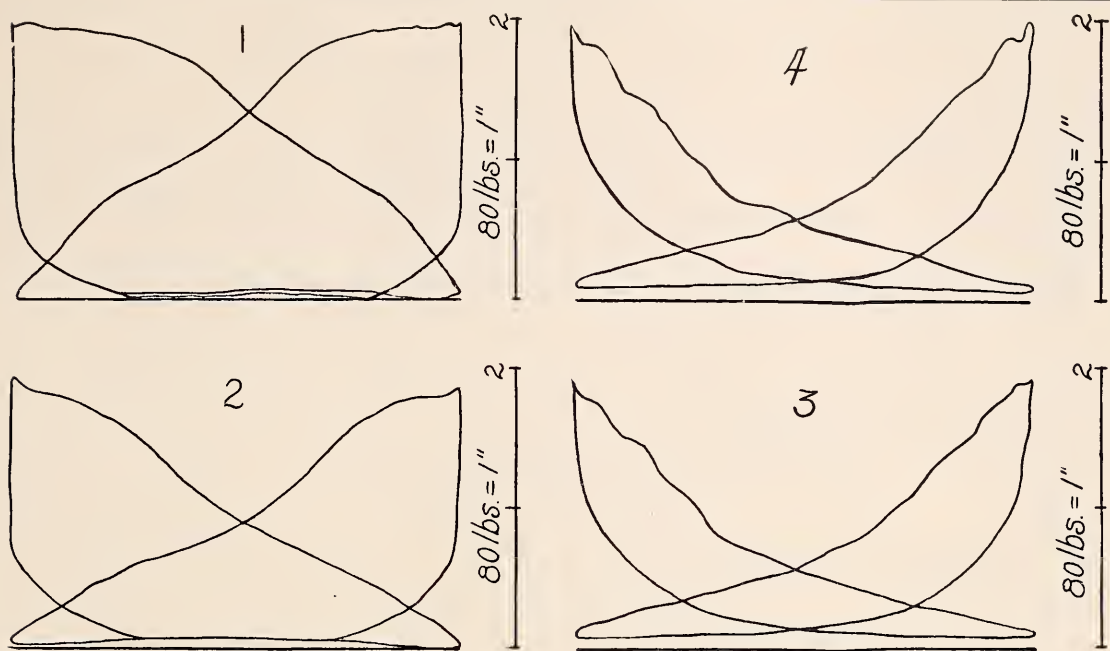
Atchison, Topeka & Santa Fe Railway.

V.

To discuss in minute detail the various adjustments that are possible in valve motion, lead, negative lead, inside clearance and inside lap, would necessitate exceeding, far, the allotted space at command. It is more expedient to assemble a few groups of cards, which, while affording no exact parallels for comparison, establish a range of operations with piston valves which seems to leave no doubt of their adaptability to any class of locomotive service today required.

In group "A" are shown four pairs of cards, taken with an 80-pound spring, upon a 17x24-inch single engine. The valves were piston, set line and line in full gear, one inch outside lap, 1-16 inch inside clearance. The range of speed is from 15.6 miles per hour, at 72 revolutions per minute, to 78 miles per hour at 360 revolutions. The distribution is good; at least fair. With the advantages that are to be had by slightly blinding valves such as these, it is clear that there exists in this distribution no lack that cannot be supplied to meet the desire of any one of several exponents of differing theories upon the subject of distribution.

In group "B" appear four double pairs of cards taken from a 4-cylinder tandem compound freight engine, 15 and 25 x 28-inch piston valves, set 1-16 inch lead in full gear,  $\frac{7}{8}$ -inch outside lap, high pressure 3-16 inch clearance inside, low pressure line and line inside. The travel in full gear was 6 inches. The travel in full gear for the single engine first mentioned was  $5\frac{1}{2}$  inches. The speed of the freight engine in the making of these diagrams was from 8 miles at 48 revolutions, in card No. 1, to 20 miles per hour at 120 revolutions per minute, in card No. 4.



GROUP A.

Card 1—M. E. P., 100 lbs.  
 I. H. P., 198.  
 Boiler pressure, 165 lbs.  
 Revolutions, 72.  
 Cut-off, 10 inches.  
 Miles per hour, 15.6.

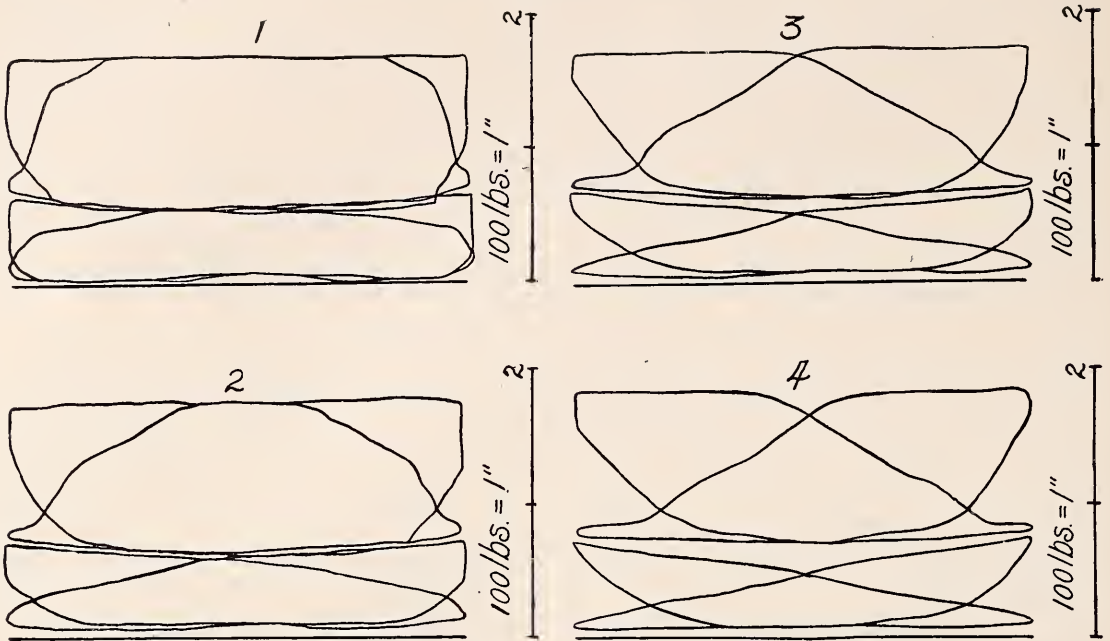
Card 2—M. E. P., 75 lbs.  
 I. H. P., 223.  
 Boiler pressure, 170 lbs.  
 Revolutions, 108.  
 Cut-off,  $7\frac{1}{2}$  inches.  
 Miles per hour, 23.4.

Card 4—M. E. P., 37 lbs.  
 I. H. P., 366.  
 Boiler pressure, 179 lbs.  
 Revolutions, 360.  
 Cut-off,  $5\frac{1}{2}$  inches.  
 Miles per hour, 78.

Card 3—M. E. P., 37 lbs.  
 I. H. P., 336.  
 Boiler pressure, 177 lbs.  
 Revolutions, 330.  
 Cut-off,  $5\frac{1}{2}$  inches.  
 Miles per hour, 71.6.

Again, the distribution is quite passable; it may fairly be called good beyond the ordinary, for engines of this type.

From such an engine as that described in the foregoing paragraph, having valves similarly proportioned and set as stated, drift cards composing group "C" were obtained. There the speed is from 22 to 30 miles per hour, these rates applying to cards 3 and 4 respectively. The diagrams were obtained from the low pressure cylinder for the purpose of testing, more severely than could be done by a simple engine, the "flexibility" of the piston valve. While these cards were taken from the low pressure cylinder, cards were simultaneously obtained from the high pressure cylinder. The very undesirable condition shown in card

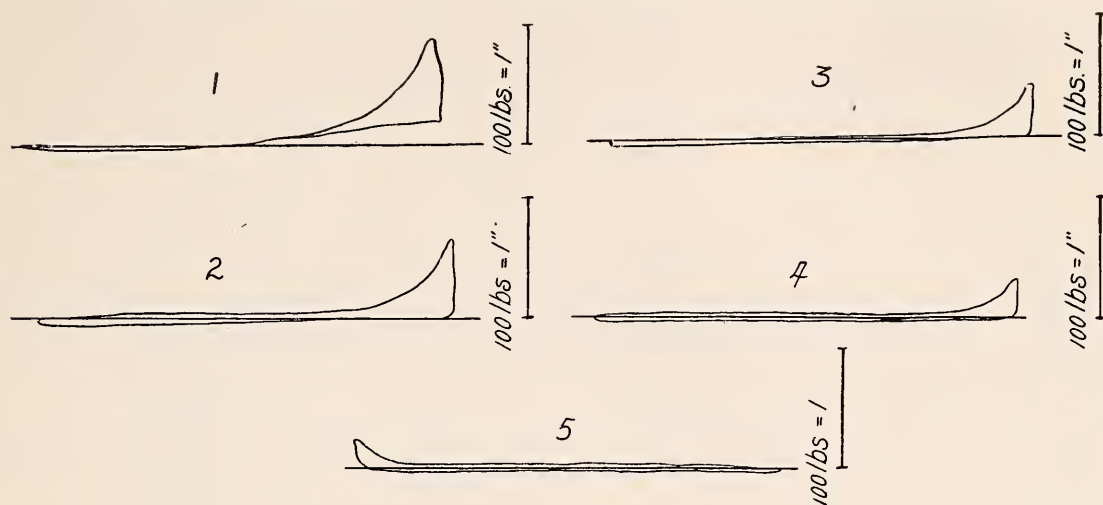


GROUP B.

	Card No. 1.	Card No. 2.	Card No. 3.	Card No. 4.
Boiler pressure.....	160	175	175	180
Revolutions per minute.....	48	84	108	120
Speed miles per hour.....	8	14	18	20
Cut-off, high pressure.....	22 1/2 in.	19 in.	16 1/4 in.	14 1/2 in.
Cut-off, low pressure.....	22 1/2 in.	19 in.	16 1/4 in.	14 1/2 in.
Av. M. E. P. high pressure cylnds	102.5	89	75.5	66.5
Av. M. E. P. low pressure cylnds..	49	42.5	34	31
I. H. P. high pressure cylinders..	120	182	199	196
I. H. P. low pressure cylinders...	160	242	249	253
Sum. of I. H. P.....	280	424	448	449

No. 1, with the cut-off at  $9\frac{3}{4}$  inches and revolutions 144, is readily reducible to the operation shown in card No. 4, cut-off  $20\frac{1}{4}$  inches and revolutions 180; and, further, through the various stages illustrated, to the harmless condition set forth in card No. 5, cut-off  $23\frac{7}{16}$  inches (lever practically in the corner) and revolutions 138.

While these diagrams were being made upon the low pressure cylinder, the diagrams taken upon the high pressure cylinder ranged upward in comparison, from five pounds about equally divided between vacuum and compression, to within five pounds of the distortion shown in card No. 1, as the lever was hooked up. Diagrams obtained by the writer, while at work upon a simple engine having balanced D valves, show that, while the compression in drifting can, upon such an engine, be reduced to a very little less than that shown in card No. 5, by dropping



GROUP C.

Card 1—	Cut-off	9 $\frac{3}{4}$	inches;	R. P. M.	144
Card 2—	“	13	“	“ “	168
Card 3—	“	17 $\frac{1}{2}$	“	“ “	132
Card 4—	“	20 $\frac{1}{4}$	“	“ “	180
Card 5—	“	23 7-16	“	“ “	138

the lever well down to the corner, yet a distortion of similar contour, and almost as great, can be produced from the D valve by hooking the lever up to short cut-off, as in the obtainment of card No. 1.

The establishment of the point is clear. Passing the slower speeds, there is not as great relief in the lifting of the D valve from its seat as has freely been assumed. Drawn up to, or left at, a relatively short cut-off at speed in drifting, the valve will certainly lift from its seat. It is not desirable practice to depend upon its doing so, however, and beyond that consideration it is also certain that, failing to drop the lever to suitably long cut-off, the compressive transaction, at any speed above 30 miles per hour, becomes too quick to be accommodated within the restricted field through which the valve may lift to its balance table.

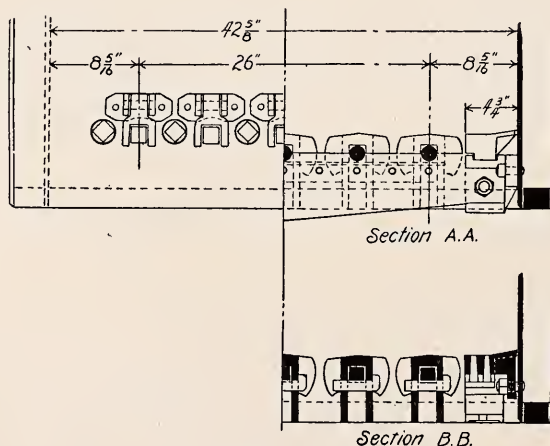
These facts, and facts they are, lead to one point finally. It is that point which has been so often stated, namely, that the reverse lever is too often left at short cut-off during drifting. It is true. Having witnessed many hard struggles of strong men with refractory reverse levers, however; having seen a strong man's eyes glaze after he had been kicked into the border land of the valley of the shadow of death, by an accident that could not well have occurred with a truly balanced valve, it is difficult to conceive one's self as doing otherwise than as men are doing—keeping out of the immediate and real danger of shifting the lever, as

long as possible. With a valve gear that is possible of running adjustment, without danger of a self-inflicted death penalty, there are few locomotive engineers today, none worthy of the name, who would fail to properly manipulate it, steam on or drifting.

In closing this series, the writer hopes, not to have provided a shop panacea for all of the disaffections to which valve gear is subject, but simply to have made clear the belief that the piston valve, in its simplest form, is a device that will richly repay careful adaptation to the field offered by locomotive operation.

## LOCOMOTIVE GRATE—PHILADELPHIA & READING RAILWAY.

The locomotive grate shown in our engravings is a design that has been in satisfactory use on the Philadelphia & Reading. The general scheme, we understand, is not new, having been originated by Mr. J. N. Weaver, formerly master mechanic of the Lehigh Valley; but he used a round pull-out bar. Mr. L. A. Shepard, while mechanical engineer of the Philadelphia & Reading, followed the same general plan, but introduced the square pull-out bar. This was done in order that burned bars might be removed without at the same time having to disturb the pull-out bar. With this feature the grate bars can be replaced by merely lifting them off the pull-out or supporting bar. This grate was designed for engines from which water bars had been removed, these latter having, we are informed, caused no end of trouble and expense from buckling and bursting.



SECTIONS OF FIG. I.

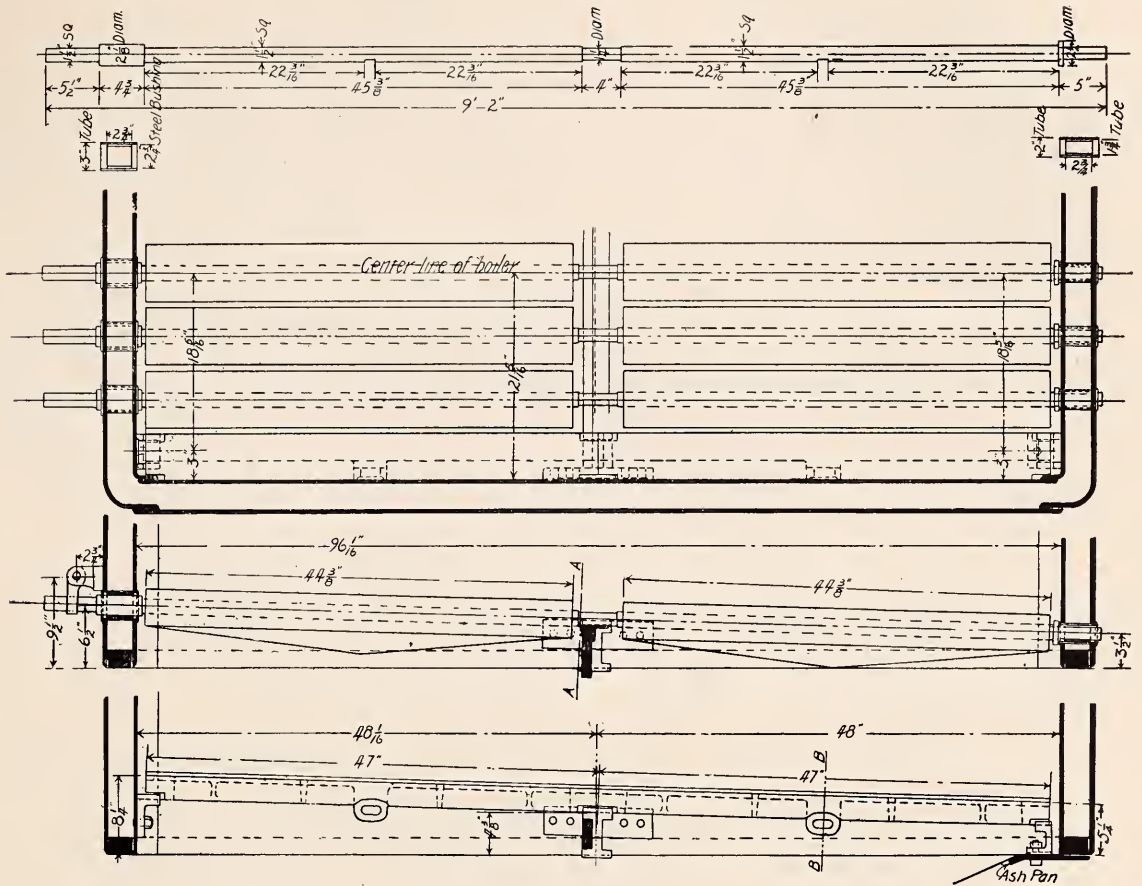


FIG. 1.

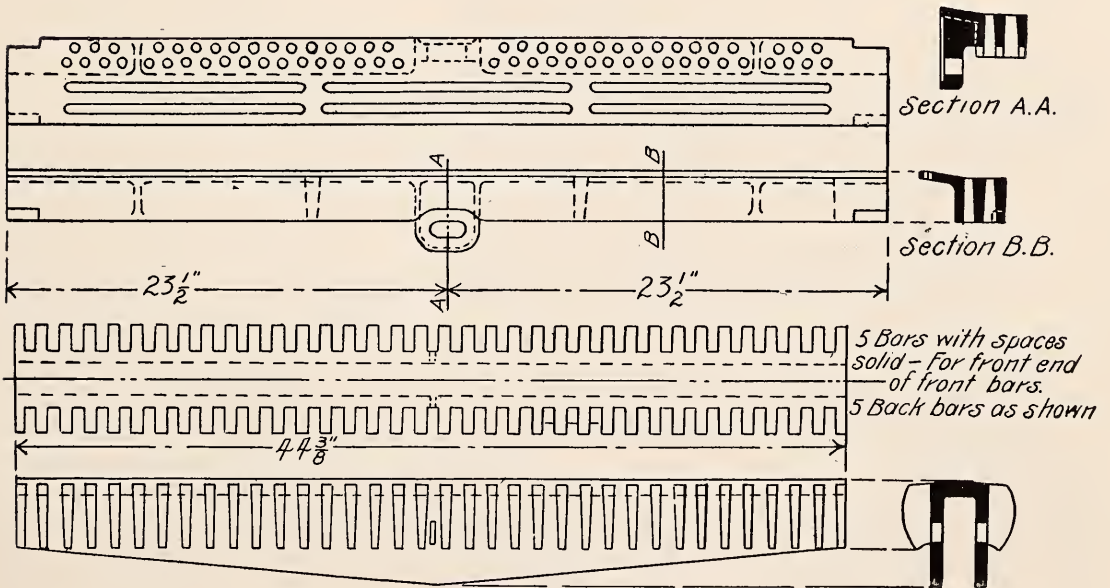


FIG. 2.

# THE MASTER CAR BUILDERS' CONVENTION.

## PROGRAM OF WORK TO BE DONE.

MONDAY, JUNE 18, 1900. LENGTH OF SESSION, 10:00 A. M. TO 1:30 P. M.

### Opening Exercises:

Prayer; Address of Welcome; President's Address.....	10:30 a. m. to 11:20 a. m.
Intermission.....	11:20 a. m. to 11:25 a. m.
Reports of Secretary and Treasurer.....	11:25 a. m. to 11:35 a. m.
Assessment and announcement of annual dues; Appointment of Committees on Resolutions and Correspondence, Nominations and Obituaries.....	11:35 a. m. to 11:40 a. m.
Election of Auditing Committee.....	11:40 a. m. to 11:45 a. m.
New Business, including reading of notices, etc.....	11:45 a. m. to 12:00 m.

### Topical Discussions:

1. When pressed steel trucks are broken on a foreign road, should not repairs be made by the manufacturer or the owners, in place of repairs being attempted by the road on which the car may be? To be opened by Mr. B. Haskell
  2. How soon after a new car is built should it be re-weighed to modify the original stencil weight; at what intervals should it be re-weighed thereafter, and what should be the minimum variation from the previous stencil weight for which change should be made? To be opened by Mr. F. A. Delano
- 12:00 m. to 1:00 p. m.
- Discussion of Report on Standards and Recommended Practice... 1:00 p. m. to 1:30 p. m.
- Adjournment.

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TUESDAY, JUNE 19, 1900. LENGTH OF SESSION, 9:00 A. M. TO 1:30 P. M.

Discussion of Report on Triple Valve Tests.....	9:00 a. m. to 9:30 a. m.
Discussion of Report on Brake Shoe Tests.....	9:30 a. m. to 9:40 a. m.
Discussion of Report of Committees: Air Brake Appliances and Specifications for Air Brake Hose.....	9:40 a. m. to 10:00 a. m.
Revision of Rules of Interchange, including reports of Committees on Arbitration, Prices in M. C. B. Rules, and Revision of Passenger Car Rules.....	10:00 a. m. to 12:00 m.

### Topical Discussions:

3. To what extent is it desirable to equip cars with permanent check chains now shown under the Recommended Practice of the Association? To be opened by Mr. R. P. C. Sanderson
  4. Should not a standard wrecking chain be adopted which can be interchanged between roads with cars, without necessitating removal? To be opened by Mr. S. F. Prince, Jr.
- Unfinished Business; Report of Committee on Nominations; Report of Auditing Committee... 12:00 m. to 1:00 p. m.
- Discussion of Report on M. C. B. Couplers..... 1:00 p. m. to 1:30 p. m.
- Adjournment.

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WEDNESDAY, JUNE 20, 1900. LENGTH OF SESSION, 9:00 A. M. TO 1:30 P. M.

### Discussion of Report of Committees:

1. Design for Wheel Circumference Measure..... 9:00 a. m. to 9:20 a. m.
2. Design for Journal Box, Bearing, Wedge and Lid for Cars of 100,000 pounds capacity; also Design for Journal Bearing and Wedge Gauges for 80,000 pound cars..... 9:20 a. m. to 9:40 a. m.
3. Revision of Rules for Loading Long Materials..... 9:40 a. m. to 10:00 a. m.
4. Revision of Recommended Practice, including Design for Springs for 100,000 pound cars..... No report.
5. Standard Center Plates..... 10:00 a. m. to 10:20 a. m.
6. Draft Gear..... 10:20 a. m. to 10:40 a. m.
7. Spread and Design for Side Bearings..... 10:40 a. m. to 11:00 a. m.
8. Uniform Section of Siding and Flooring..... 11:00 a. m. to 11:20 a. m.
9. Metal Dead Blocks; Safety Chains..... No: report.
10. Subjects..... 11:40 a. m. to 1200 m.

### Topical Discussion:

5. Good methods for terminal cleaning of passenger cars, and is it advisable to have oil in cleaning mixture? To be opened by Mr. A. M. Waitt....
  6. Is a charge against the car owner for repairs on account of truing up tapered journals correct and proper? To be opened by Mr. G. W. Rhodes.
- Unfinished Business... 12:00 m. to 1:00 p. m.
- Report of Committee on Resolutions and Correspondence..... 1:00 p. m. to 1:30 p. m.
- Election of Officers. Adjournment.

# THE MASTER MECHANICS' CONVENTION.

## PROGRAM OF WORK TO BE DONE.

THURSDAY, JUNE 21, 1900. LENGTH OF SESSION, 9:00 A. M. TO 2:00 P. M.

### Opening Exercises :

Prayer; Address of Welcome; President's Address. . . . . 9:00 a. m. to 10:00 a. m.  
Action of Minutes of last meeting . . . . . 10:00 a. m. to 10:05 a. m.  
Reports of Secretary and Treasurer. . . . . 10:05 a. m. to 10:15 a. m.  
Assessment and announcement of annual dues. . . . . 10:15 a. m. to 10:20 a. m.  
Election of Auditing Committee. . . . . 10:20 a. m. to 10:30 a. m.  
Unfinished Business . . . . . 10:30 a. m. to 10:40 a. m.

### New Business :

Appointment of Committees on Correspondence and Resolutions; Obituaries; Nominations; Such Business as may be brought up. . . . . 10:40 a. m. to 11:00 a. m.

Discussion of Report on "What Can the American Railway Master Mechanics' Association do to Increase its Usefulness?" . . . . . 11:00 a. m. to 12:00 m.

### Discussion of Topical Questions :

1. The best method for securing eccentric straps to the rods. To be opened by C. H. Quereau. 2. Nickel steel as a journal bearing. Is there any noticeable increase in friction or wear, as compared with the ordinary steel or iron? To be opened by W. H. Lewis. . . . . 12:00 m. to 1:00 p. m.

Discussion of Report of "The Extent to which the Recommendations of the Association have been put into Practice." . . . . . 1:00 p. m. to 2:00 p. m.

Adjournment.

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FRIDAY, JUNE 22, 1900. LENGTH OF SESSION, 9:00 A. M. TO 2:00 P. M.

### Discussion of Reports on :

Relative Merits of Cast Iron vs. Steel Tired Wheels . . . . . 9:00 a. m. to 9:30 a. m.  
Advantages of Ton-Mile Basis for Motive Power Statistics. . . . . 9:30 a. m. to 10:00 a. m.  
Flanged Tires. . . . . 10:00 a. m. to 10:30 a. m.  
Compound Locomotives. . . . . 10:30 a. m. to 11:30 a. m.

### New Business :

Report of Auditing Committee; Report of Committee on Nomination. . . . . 11:30 a. m. to 12:00 m.

### Discussion of Topical Questions :

3. Has the limit of length of tubes, 2 inches in diameter, been reached in locomotive practice? To be opened by S. M. Vauclain. 4. Metal vs. wooden cabs for locomotives. To be opened by J. E. Sague. 5. Strap vs. jaw, back end of main rod. To be opened by S. P. Bush. . . . . 12:00 m. to 1:00 p. m.

Discussion of Report on Journal Bearings, Cylinder Metals and Lubrication. . . . . 1:00 p. m. to 2 p. m.

Adjournment.

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SATURDAY, JUNE 23, 1900. LENGTH OF SESSION, 9:00 A. M. TO 2:00 P. M.

### Discussion of Reports on :

Piston Valves . . . . . 9:00 a. m. to 10:00 a. m.  
Power Transmission by Shafting vs. Electricity . . . . . 10:00 a. m. to 11:00 a. m.  
Best type of Stationary Boiler for Shop Purposes. . . . . 11:00 a. m. to 12:00 m.

### Discussion of Topical Questions :

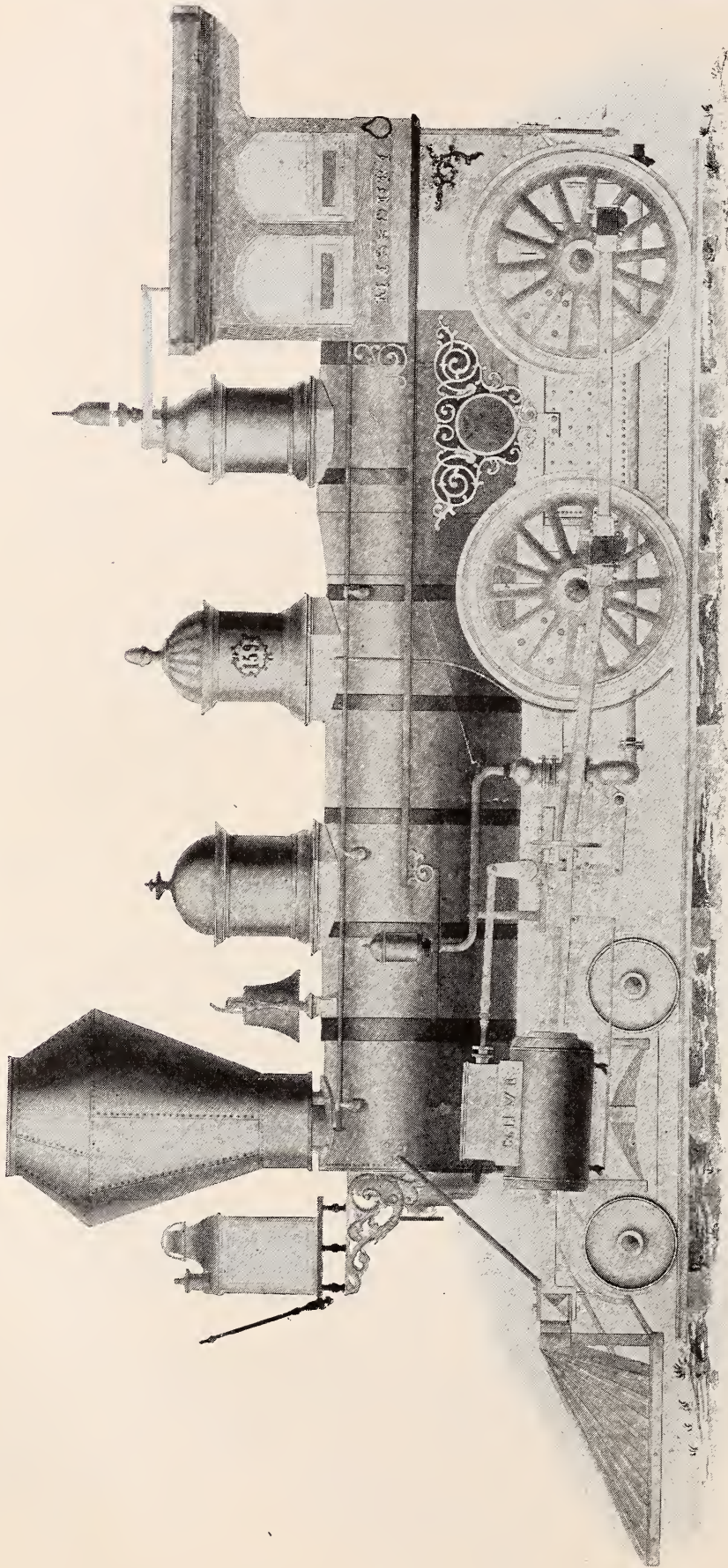
6. Graphite as a locomotive lubricant. To be opened by G. R. Henderson. 7. Advantages of increasing ratio of grate area to heating surface in locomotives burning bituminous coal. To be opened by F. A. Delano. 8. How to make pooling of locomotives a success. To be opened by G. W. Rhodes. . . . . 12:00 m. to 1:00 p. m.

Discussion of Report on Subjects. . . . . 1:00 p. m. to 1:15 p. m.

Report of Committee on Resolutions and Correspondence. . . . . 1:15 p. m. to 1:30 p. m.

Election of Officers. . . . . 1:30 p. m. to 2:00 p. m.

Adjournment.



OLD-TIME FREIGHT LOCOMOTIVE—THE "MISSOURI."

CHICAGO & NORTHWESTERN RY.

## OLD-TIME FREIGHT LOCOMOTIVE, THE "MISSOURI"—CHICAGO & NORTHWESTERN RY.

BY GEO. W. CUSHING.

Referring to the engine, "Missouri," these engines are, of course, obsolete now and the illustration given serves only to recall progress made in thirty-five years of experience with locomotives. This pattern or class, in size, weight and capacity, was thought suitable to use on the new lines of road opening out to the Chicago & Northwestern Railway system, and was largely used in Iowa in the building and operating of the roads.

The engraving of this particular engine is reproduced from a drawing, the design of the writer, who was at the time master mechanic in charge at the Chicago avenue shops of the Northwestern road. The engine was built in 1865, as were others of the same design in that and the three years following. There was also purchased, in 1866, of the Hinckley & Baldwin Works, fifty locomotives from the same specifications and drawings. Larger and much heavier engines were in use on the Chicago & Northwestern, but the Missouri was a standard for new road building generally.

The dimensions of the Missouri were: Cylinders, 15 x 24 inches; drivers, 54 inches; boiler, 46-inch diameter; firebox, 54 x 36 inches; tubes, 154 in number, 2-inch diameter, 11 feet long; steam pressure, 130 pounds. The tubes were steel, the firebox copper, the boiler iron 5-16 inch thick; the driver tires Vickers steel. The weight of the engine was 60,000 pounds. The tank was 8-wheeled, and had a capacity of 1,800 gallons of water and 5 tons of coal.

The pressure of 130 pounds indicates an increase in steam, at that time, in engines of this class; and the tank was also a large one. The ample heating surface given made a good steamer, and this was assisted by the use, at that time, of a Hunter pattern of stack, which gave excellent freedom to the waste products of combustion, and retained the sparks in circulation until made harmless, to be passed out through the proper openings. The front end was fitted with a pipe dropping below the base of the stack, of suitable diameter, much the same as are fitted to very good steamers now. It was also fitted with a petticoat pipe, skirted to attract proper circulation of gases and cinders through the upper or lower tubes as desired.

The cylinder oiling was done through tubes fitted with suitable oil cups in the cab and reaching to the steam chests; there were also on

top of the steam chests the usual hand oil cups, supplied by the fireman's can with oil. Water was supplied by cross head attached plunger pumps on either side of the engine.

Air brakes were not used, but their absence, with the absence, also, of modern sanders, injectors, self oilers, bell ringers, electric lights and other appliances, now most universally in evidence, did not decrease the engine and train crews' care or labor, but rather made it more toilsome.

The use of modern types of engines and their appliances has not increased labor of engine men, but has changed very materially the standard of intelligence necessary to successfully operate them. Nevertheless, there are old-time men yet employed, showing that the average capacity of the American enginemen advances with requirements of the service.

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## RELATIONS WITH EMPLOYES.

In the absence of a controlling statute, the supreme judicial court of Maine says that the relations between a railway company and its employes, including brakemen, and their relative duties, are the same as those between other employers and employes. The company, the court goes on to say, case of Gillin against the Patten & Sherman Railroad Company, 44 Atlantic Reporter 361, must make its track and switches reasonably safe for the careful employe, so that the employe using ordinary care may avoid injury. The company, however, need not, as toward its employe, use the highest degree of care possible and have the newest and best appliances. Things must be as strong and safe as they appear to be. There must be no weakness or want of repair that ordinary care would have detected. There must be no hidden, nor even obscure, peril attending the use of the appliances. Where all these conditions exist, and the peril of use is an obvious one, which the employe should have known, and could avoid by care, there is, in that respect, no further duty on the company to him. Things being just what they seem, peril and all, if the employe requires more he should make that requirement known. If he does not, but makes use of the appliances as they are, he practically gives the company to understand that he is satisfied with them and will take the risk, and rely upon his own carefulness to avoid injury. He cannot afterward, if injured by his own carelessness, or by accident, effectually insist that the company took the risk.

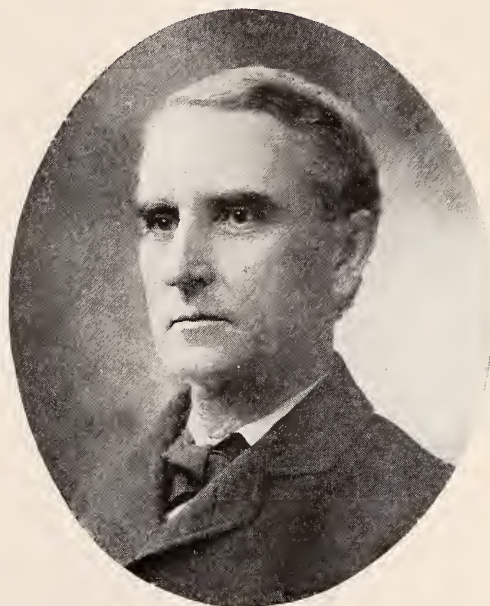
AT THE 1900 CONVENTIONS

SARATOGA, JUNE 18-23



C. A. SCHROYER

President Master Car Builders' Association



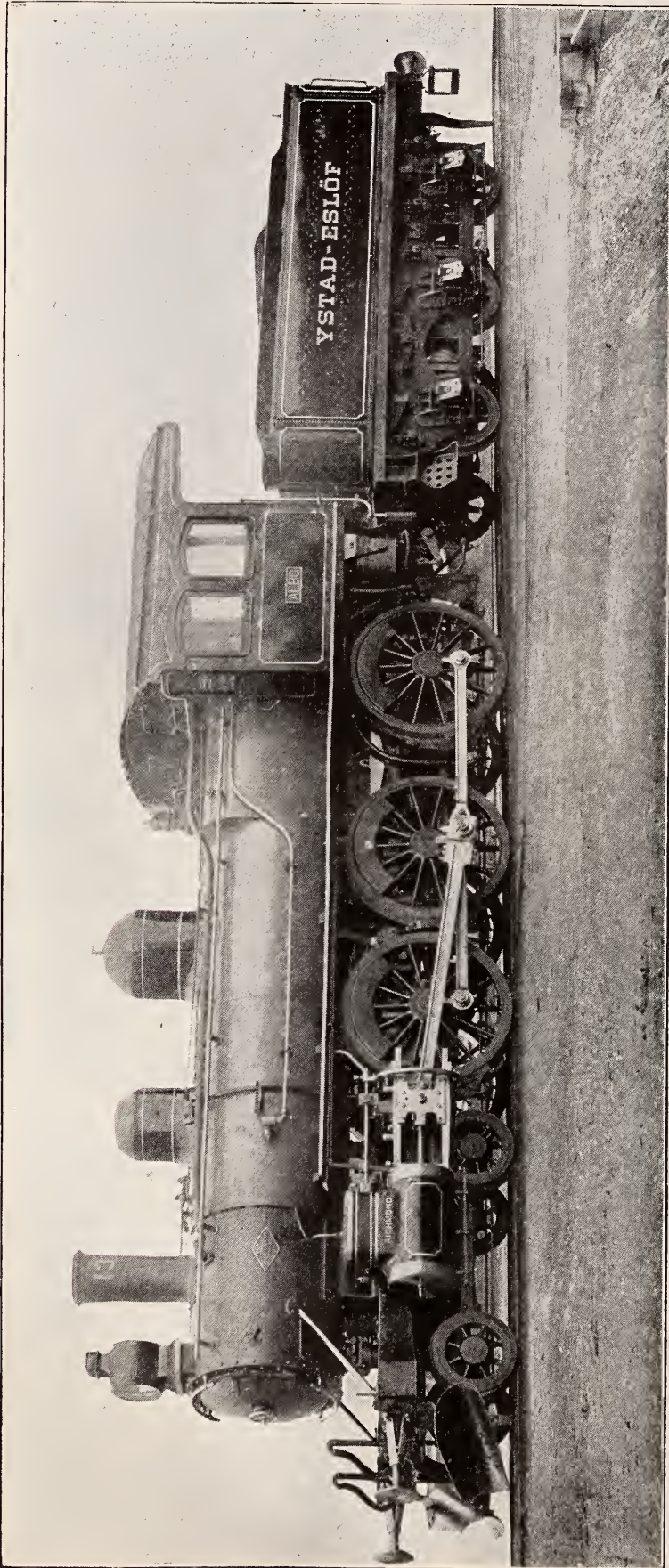
J. H. M'CONNELL

President Master Mechanics' Association



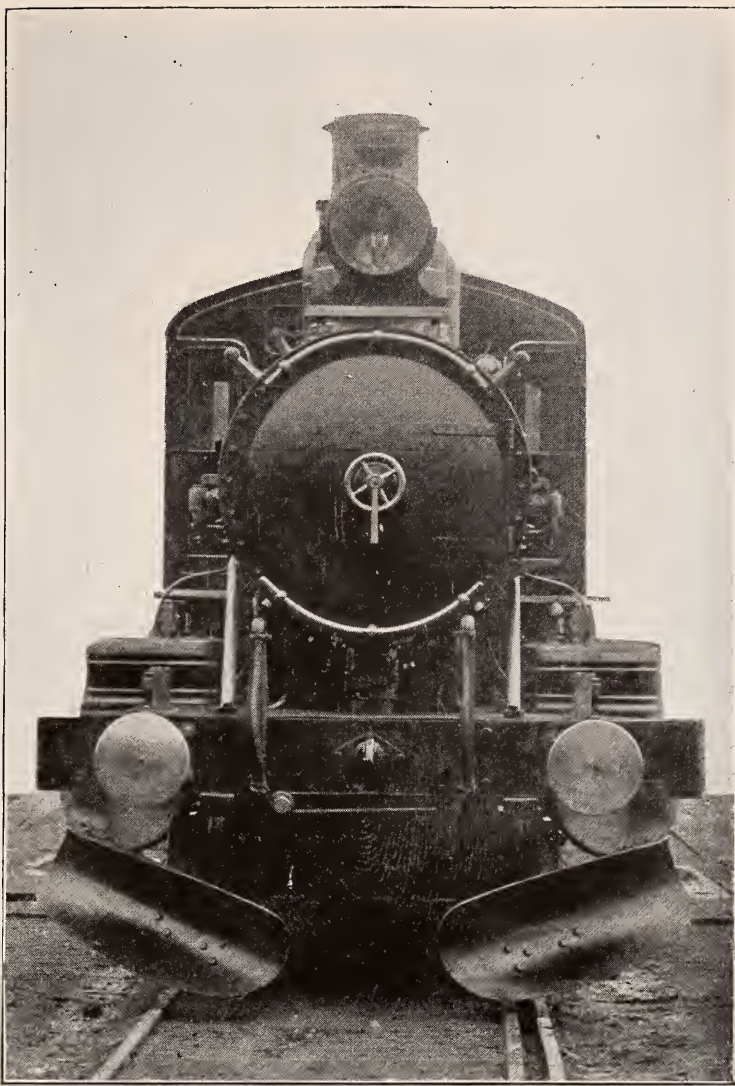
JOSEPH W. TAYLOR

Secretary Master Car Builders' and Master Mechanics Associations



RICHMOND TEN-WHEELED LOCOMOTIVE FOR SWEDEN.

Total weight—99,100 pounds; weight on drivers—72,600 pounds; cylinders— $16\frac{1}{2} \times 24$  inches; drivers— $60\frac{5}{8}$  inches; heating surface—1,262.5 square feet, of which 98.5 square feet is firebox and 1,164 square feet tube surface; grate area—17.72 square feet; fuel—coal; working steam pressure—185 pounds; boiler 51 inches; tank capacity—water 3,000 gallons; coal  $2\frac{1}{2}$  tons.



## RICHMOND TEN-WHEELED LOCOMOTIVE, FOR SWEDEN.

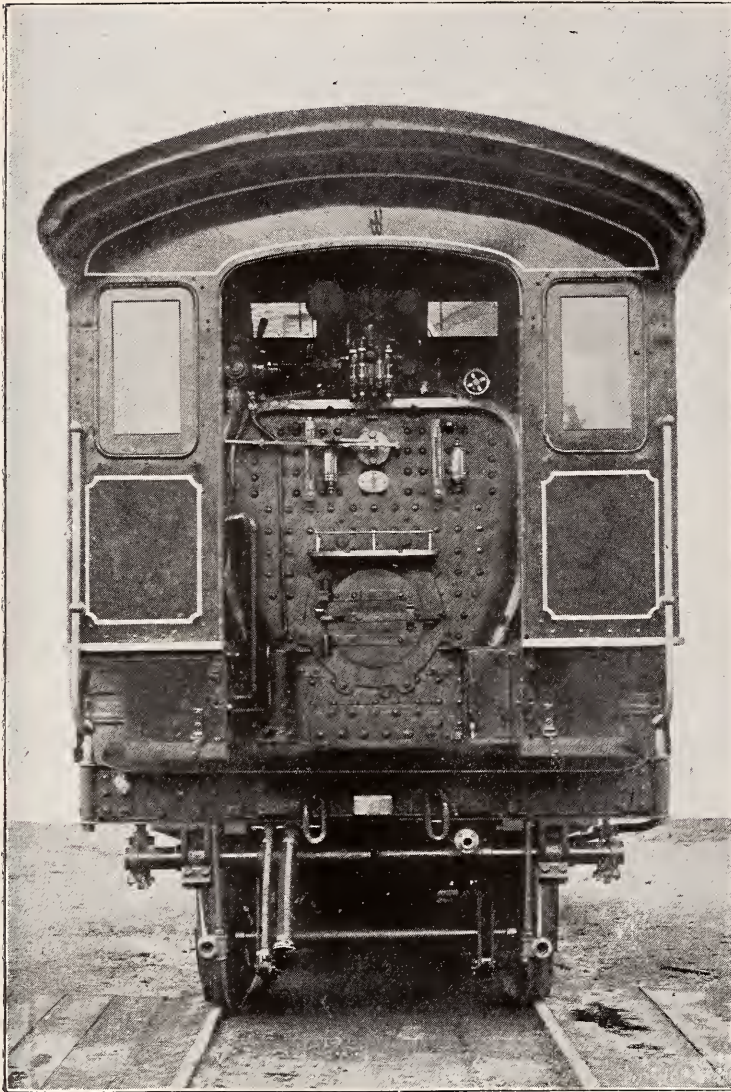
The Richmond Locomotive Works have just completed and shipped to the Ystad Eslof Railway, one of the private roads of Sweden, three  $16\frac{1}{2} \times 24$ -inch 10-wheeled locomotives with 6-wheeled tenders.

The engines were designed throughout by the Richmond Locomotive Works, and, with the exception of the smokebox door, buffers, snow plow, English vacuum brake, copper firebox and stays, and a few other minor details, are in accordance with American practice, which was the express wish of the railway company.

Three photographic views of one of the engines are shown herewith, and it is interesting to note that the engine has no bell and that the reverse and all operating levers are on the left hand side of the engine, which is the general practice in Sweden.

Mr. Dan Olson, mechanical engineer of the Ystad Eslof road, inspected the engines during their construction.

These engines weigh 99,100 pounds, of which 72,600 pounds are on



the drivers. They have  $16\frac{1}{2}$  x 24-inch cylinders;  $60\frac{5}{8}$ -inch drivers; 51-inch Bel-paire straight top boilers, designed to carry 185 pounds pressure; heating surface of 1,262.5 square feet, of which 1,164 square feet is tube and 98.5 square feet firebox surface; and a grate area of 17.72 square feet. These engines will use coal for fuel. The tanks, which have steel frame, have a capacity of 3,000 gallons of water and  $2\frac{1}{2}$  tons of coal. The special equipment includes U. S. metallic piston rod and valve stem packing, Richardson balanced valves

and Sellers injectors. The driver and truck wheel centers are cast steel, and the tubes charcoal iron; and, as before noted, the firebox is of copper and the staybolts are of 1-inch and  $1\frac{1}{8}$ -inch hollow copper.

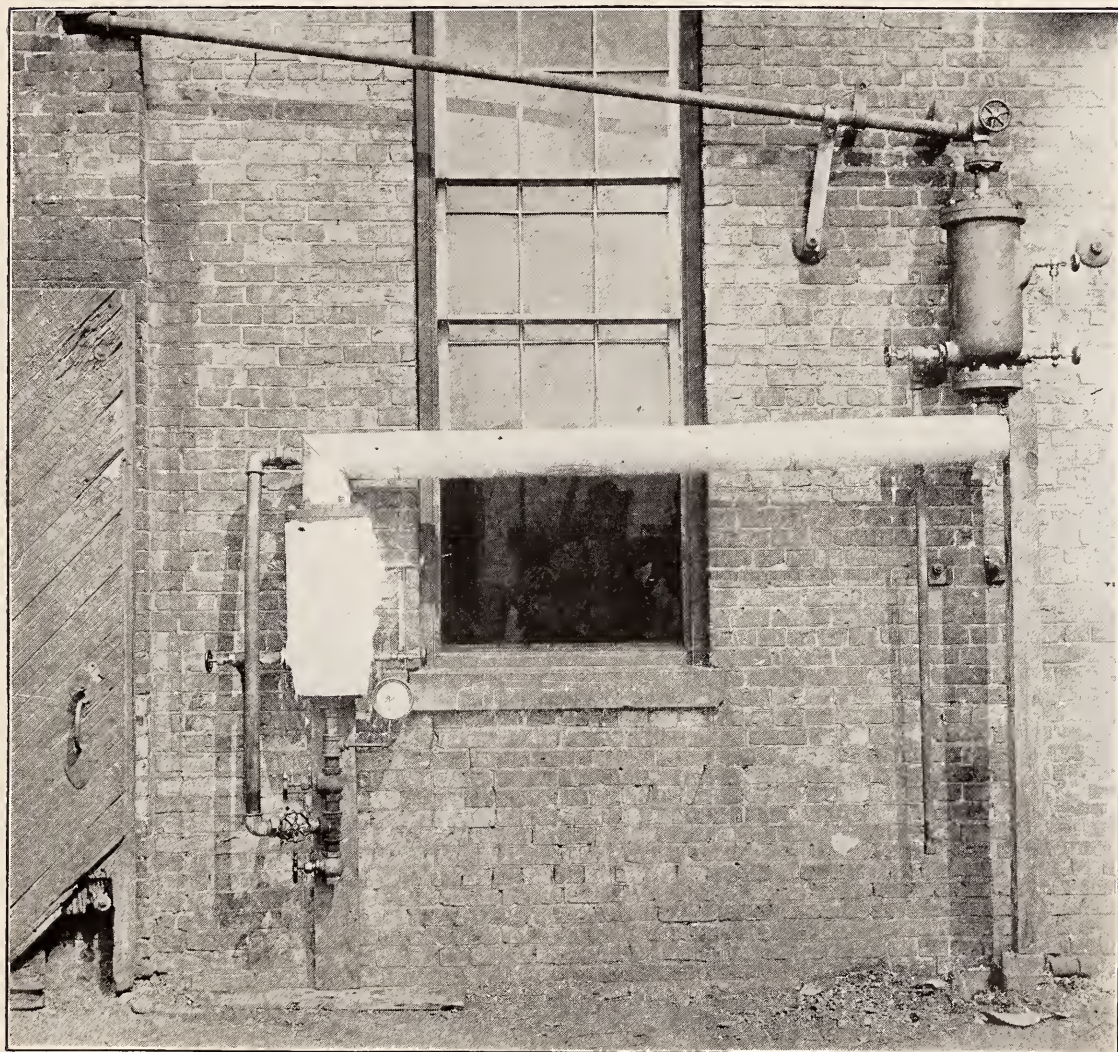
## A STEAM JACKETING TEST.

A few weeks ago a suggestive test was made at the Chicago shops of the Chicago & Northwestern road, to determine the relative radiating properties of an uncovered and a steam jacketed pipe, and Mr. G. R. Henderson, assistant superintendent of motive power and machinery of that road, courteously places the facts at our disposal.

The test was made in connection with trying to determine whether it was a benefit to use a central admission with piston valves, whereby

the exhaust passes through the valve, and also where the steam passages in the cylinder casing were protected by the exhaust steam passage instead of coming toward the ends of the cylinder next to the cold air.

In making the test, steam was led from a boiler by means of a 1 ½-inch pipe to a 3-inch Baum steam separator, thence through eight feet two inches of 1 ½-inch pipe to a second separator identical with the first



STEAM JACKETING TEST—C & N. W. RY.

as shown in our engraving. Between the second separator and its outlet valve was placed a steam gauge. The apparatus was erected in the open air in an unexposed place so as to reduce the effects of air currents to a minimum. A circulation of steam through the system was maintained by keeping the valve leading from the second separator partially opened. The apparatus was run for a sufficient length of time before starting the test, to insure a thorough warming. It was supposed that dry steam was

delivered to the pipe between the separators, whose radiation was to be tested, and that the water entrapped in the second separator was principally due to the radiation of this pipe.

In the first series this test pipe was left uncovered. In the second series a galvanized iron casing, six inches in diameter, was placed around the test pipe, covering its entire length, and the exhaust steam from the second separator was piped to one end of this casing and allowed to escape at the other end.

The following table gives the results as obtained from the tests:

*Uncovered Pipe.*

No. of Tests.	Atmospheric Temperature.	Steam Pressure.	Minutes to Run 6 Inches of Water.	Remarks.
1.	62	90	38	
2.	66	85	37½	Conditions same as No. 1
3.	79	80	38⅓	Conditions same as No. 1
Average of 1, 2, 3.	69	85	37 57-60	

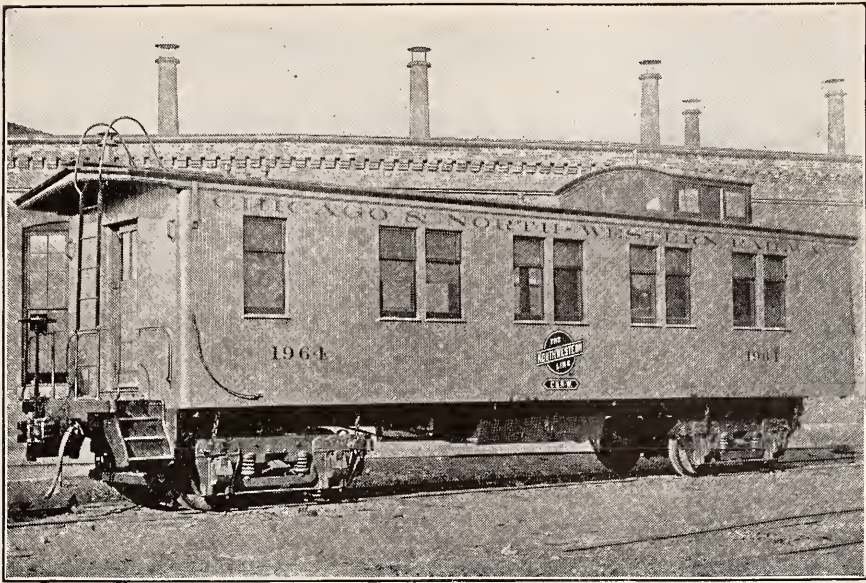
*Steam Jacketed Pipe.*

No. of Tests.	Atmospheric Temperature.	Steam Pressure.	Minutes to Run 6 Inches of Water.	Remarks.
8.	93	95	53	
9.	87	85	53½	Conditions same as No. 8
10.	87	80	44½	Valve more nearly closed.
Average of 8 and 9.	90	90	53¼	

Tests Nos. 1, 2 and 3 were run under similar conditions, Nos. 1 and 2 being continuous. Tests Nos. 4, 5, 6 and 7 were made with such varying conditions that their results are untrustworthy. Tests Nos. 8 and 9 are continuous with conditions the same. In test No. 10 the exhaust valve was more nearly closed than in tests Nos. 8 and 9, allowing only about half as much steam to flow through the casing.

These tests show conclusively that there is less radiation of heat with the steam jacket, and that the more steam blowing through the casing the less the radiation.

**I**N CAR BUILDING the next important step will be, if the signs of the times are to be relied upon, the adoption of a standard box car; and it is the opinion of some railway officials that this step would have been taken before now were it not for some individuals who insist upon showing their inventiveness in manipulating unimportant details. This is a very weighty question, and if the benefits to be derived from reducing the immense amount of material which now must be kept in stock, for repairs for our great variety of cars, to what would be necessary to keep standard cars in repair; if the economy to be gained in purchasing larger quantities of material, and if the saving to be gained in the matter of delays to cars incident to holding them out of service awaiting receipt of material for proper repairs—if these great economies are waiting on the termination of service of a few antiquated car men, then it is time for the higher officials to interest themselves in the question of a standard car.



## A NEW DYNAMOMETER CAR—CHICAGO & NORTHWESTERN RAILWAY.

A year ago this month we illustrated and described the then latest thing in dynamometer cars—that designed by Prof. L. P. Breckenridge, of the University of Illinois, and built by the Cleveland, Cincinnati, Chicago & St. Louis Railway, and fitted by the university. It will be remembered that the dynamometer proper in that car consisted of an oil cylinder. Its work was very satisfactory, and produced a fine record; but Prof. Breckenridge has designed a new cylinder arrangement, which is to go in a car for the Illinois Central, and which he expects to be an improvement.

In commenting upon dynamometer cars, in general, last June we said, in effect, that while the oil cylinder had its friends, the spring for a dynamometer had more advocates. The Chicago & Northwestern mechanical department, in designing its car, has cast its lot with those who prefer the spring. And we present in this issue rather full illustrations of the car which that road recently completed and placed in preliminary service—a car in which the spring is used in novel form and in which the transmission of drawbar pull from coupler to recording pen is even more distinctly novel.

The springs are sixteen in number, arranged eight on each side of the follower, and are put into position under a compression of 4,000 pounds each. As a movement of the drawbar and follower occurs, one set of springs is compressed and the other set released; the total capacity of each coil being 8,000 pounds. Thus a pressure on the drawbar of 10,000 pounds would compress the rear springs a certain amount, if

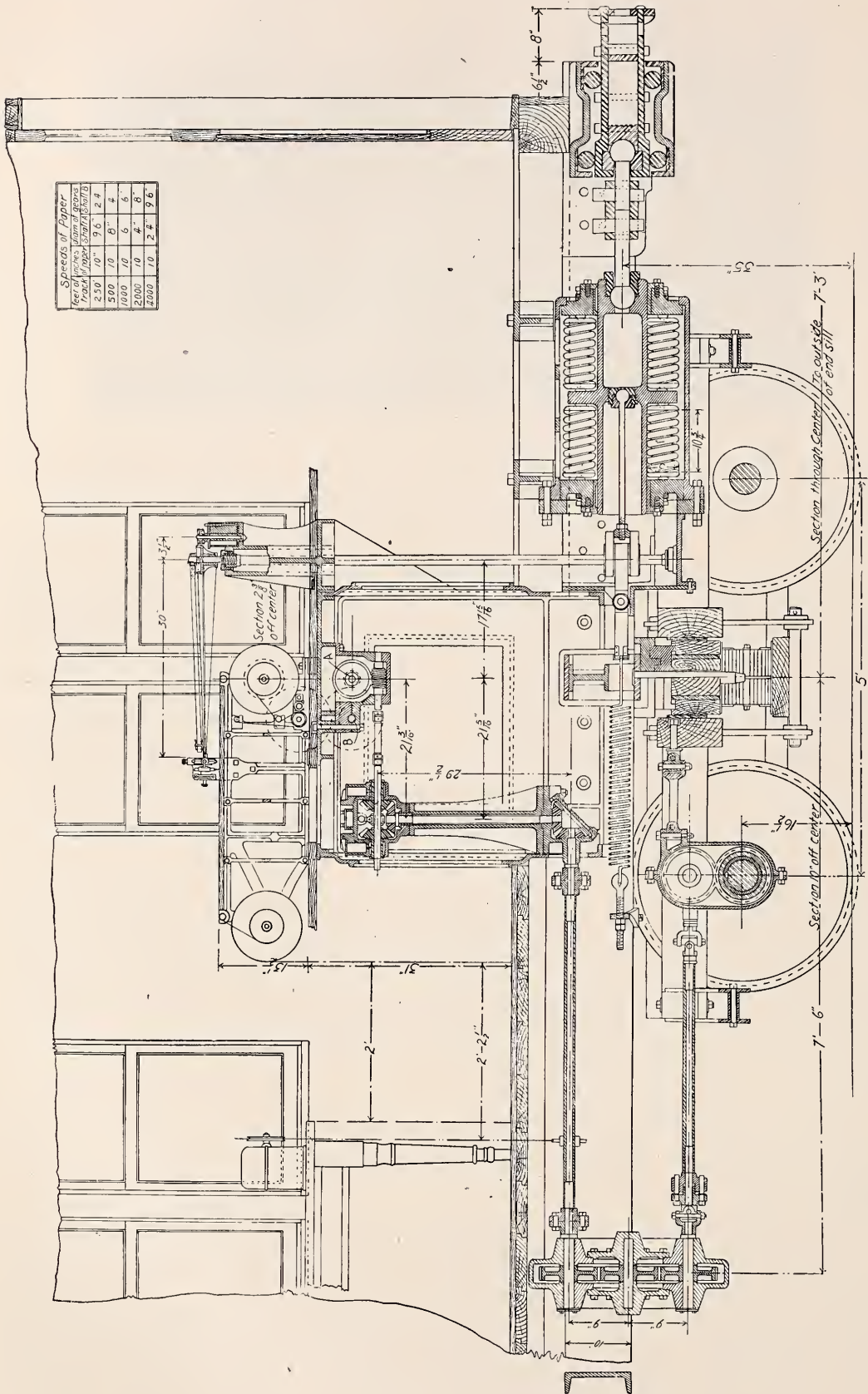


FIG. 1—DYNAMOMETER CAR—CHICAGO & NORTHWESTERN RAILWAY

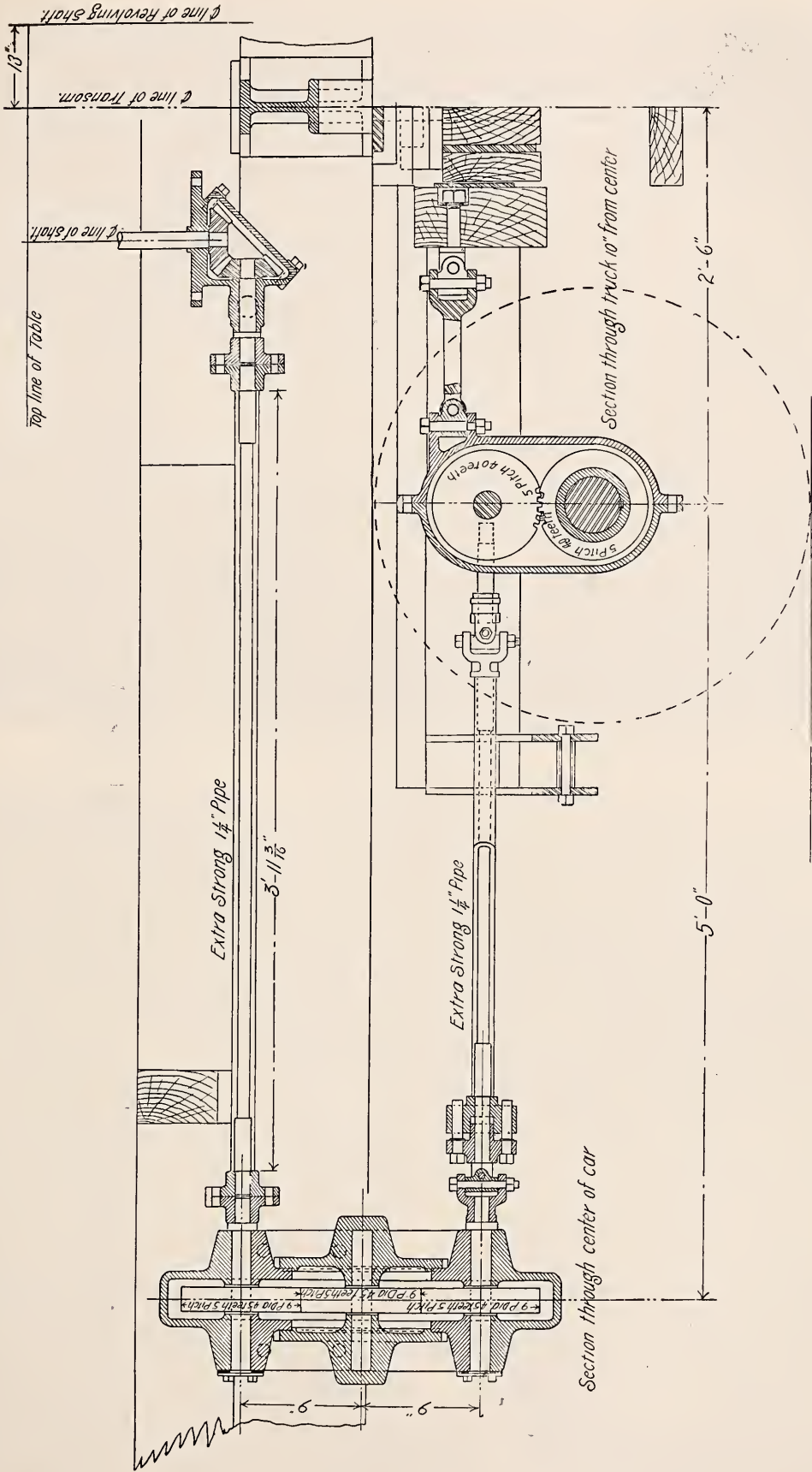
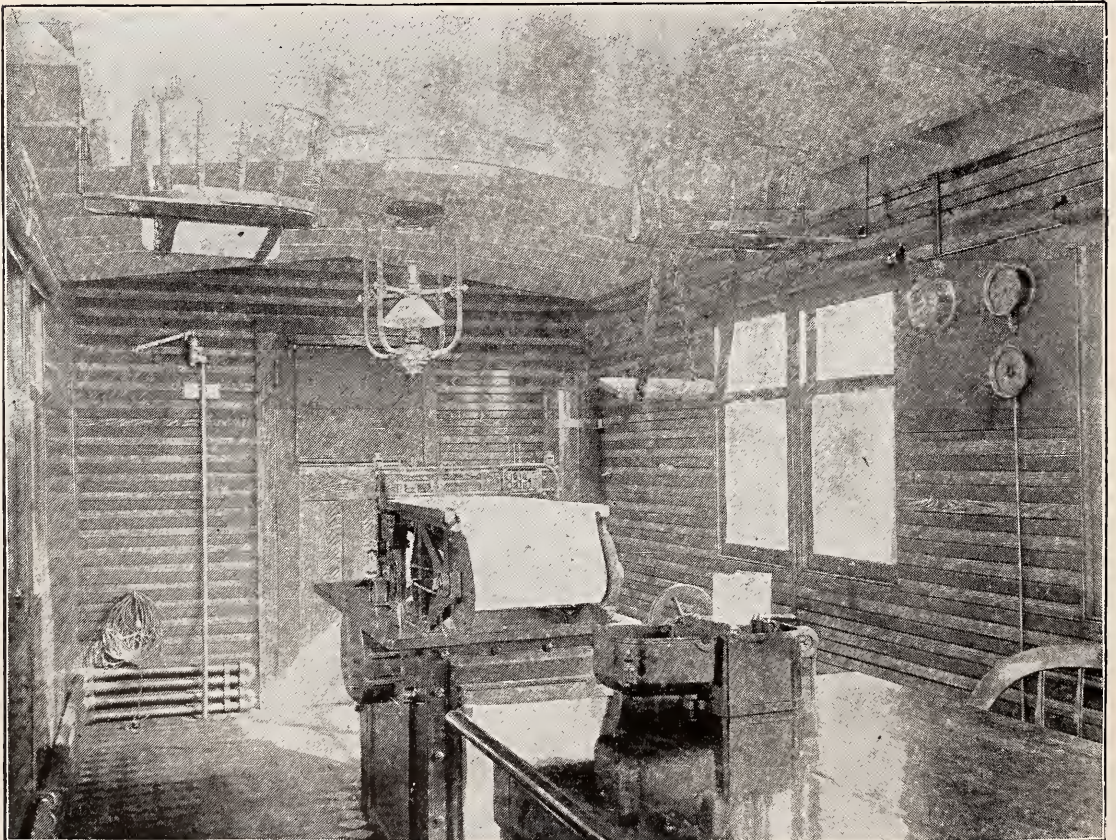
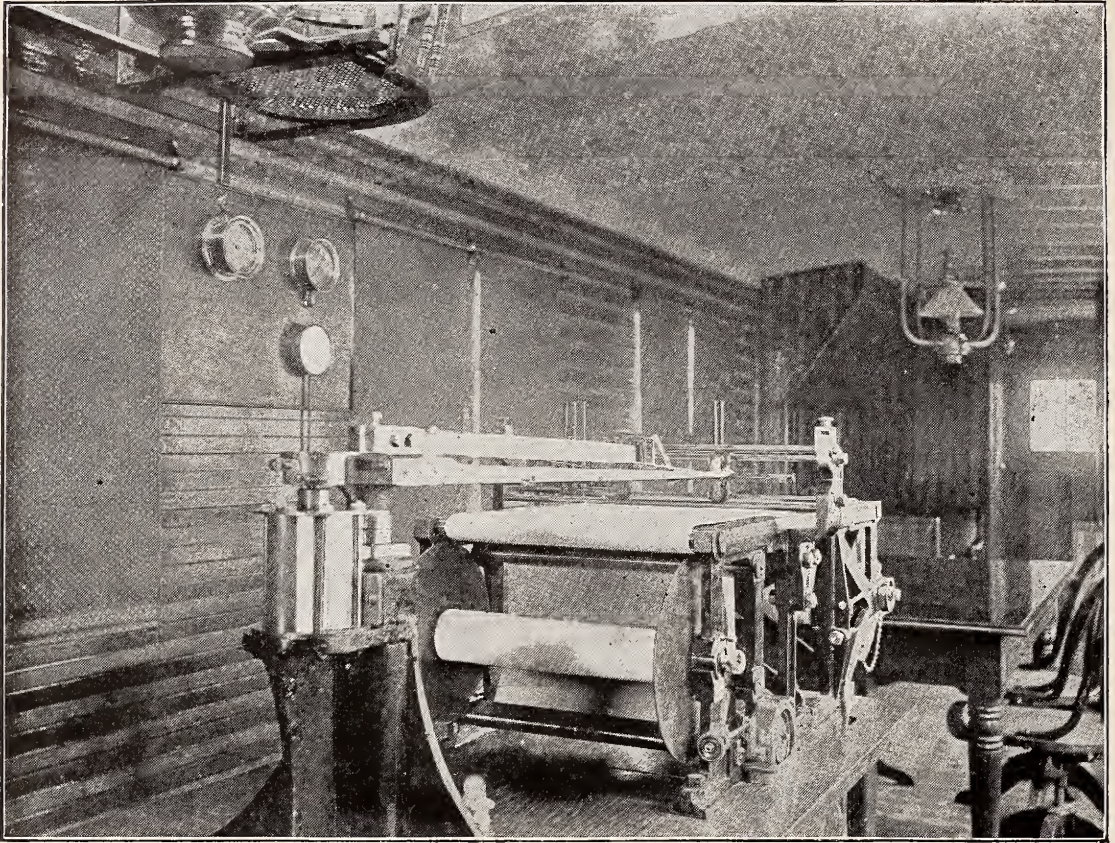


FIG. 2.—DYNAMOMETER CAR—ENLARGED DETAIL OF PAPER MOVING MECHANISM



FIGS. 3 AND 4—DYNAMOMETER CAR—RECORDING MECHANISM

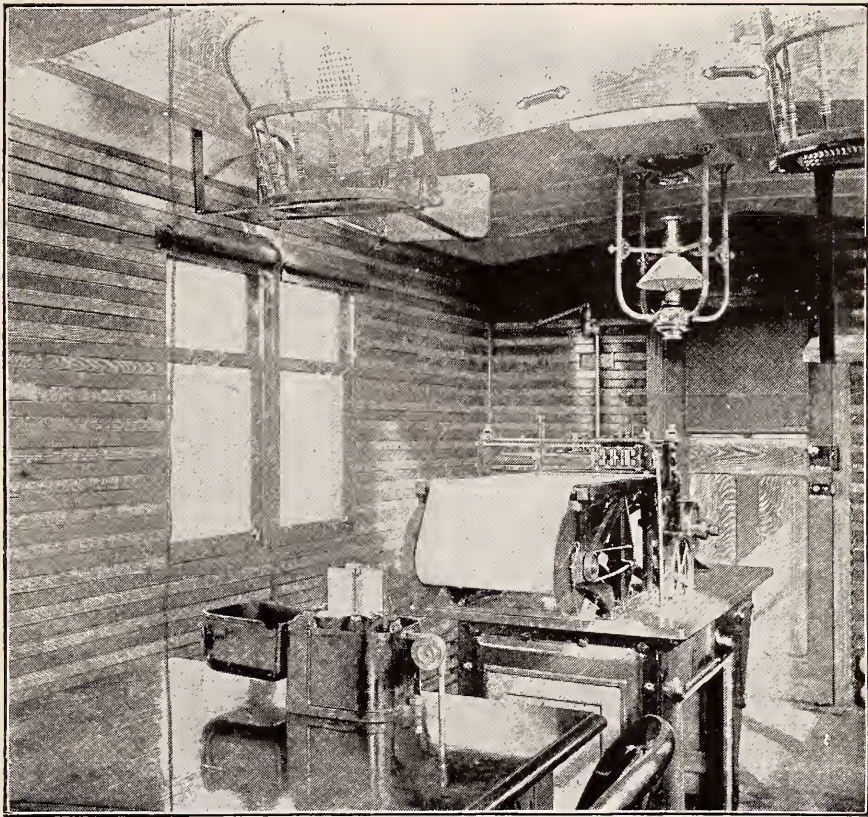


FIG. 5—DYNAMOMETER CAR

but one set were used, but as any movement of the follower releases some of the pressure of the front set of springs, the motion will only be one-half as great. The springs being compressed to one-half their ultimate deflection, the complete compression will require only the remaining half of the full load, as when solid the front springs are entirely released. The springs are carefully calibrated in their relative working positions, and it has been found that the deflections are extremely regular for different increments of load. Lost motion in the follower is thus prevented, and a steadier movement of the pencil bar obtained.

The transmission of the motion of the drawbar to the instrument is effected by means of a vertical shaft connected with the drawbar by thin steel bands wrapped around a sheave at the lower end of the shaft, the slack being taken up with a light tension spring. This arrangement is shown in Fig. 1 in connection with the whole mechanism, and in enlarged detail in Fig. 6.

At the upper end of the vertical shaft is a spring steel blade about 25 inches long, which bears at its outer end against vertical rollers secured to the pencil arm. This latter swivels around the vertical shaft, but is loose upon it, and its vibration is controlled and steadied by a

dash-pot with a rotary vane at the opposite side of the shaft, being connected to the vane by steel tapes. The pencil is carried by a frame and rollers upon guides, and is also connected to the arm by steel tapes. As the dash-pot restricts the vibration of the pencil arm to a small amount of motion on each side of the mean position, the steel blade permits the rotation of the shaft coupled to the drawbar without restriction,

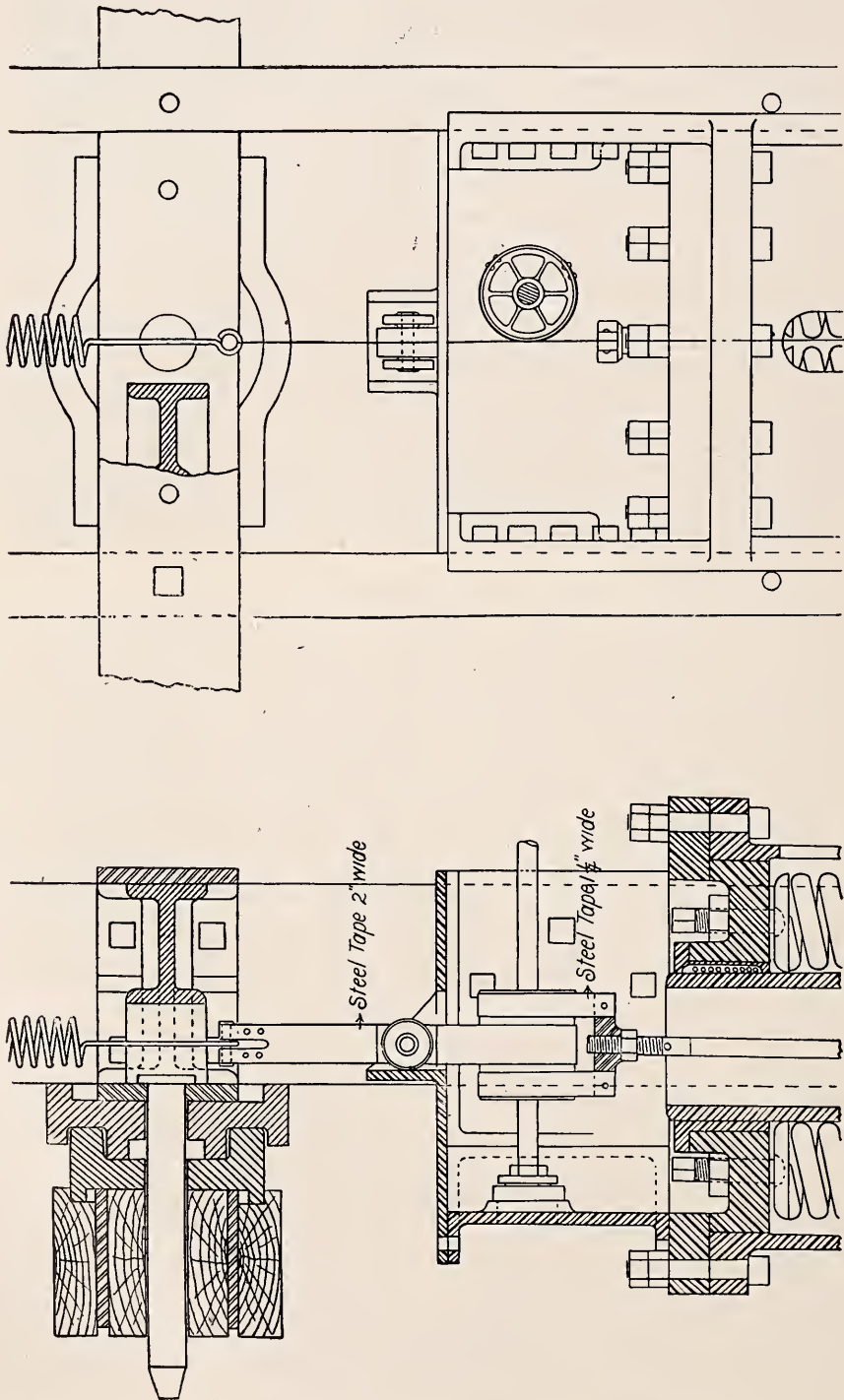


FIG. 6—ENLARGED DETAIL, TRANSMISSION OF DRAWBAR PULL

and in service the blade is continually bending to the right and left while the pencil occupies a mean position with little vibration. The amount of oscillation is regulated by a screw in the by-pass of the dash-pot. Figs. 1 and 7 give the detail of this clever arrangement, and in Fig. 2 it is shown in perspective.

The motion of the paper is derived from the axle of the truck by a telescopic universal mechanism, and five speeds are provided—25, 50, 100, 200 and 400 feet of track to the inch of paper respectively. The gearing is changed similarly to the screw gear on a lathe. Five pencils draw the following lines :

A datum line for the drawbar pull.

The curve of the pull itself.

A time record marking ten seconds intervals.

A push button record taken in the car for passing mile posts and stations, these showing on opposite sides of the same line.

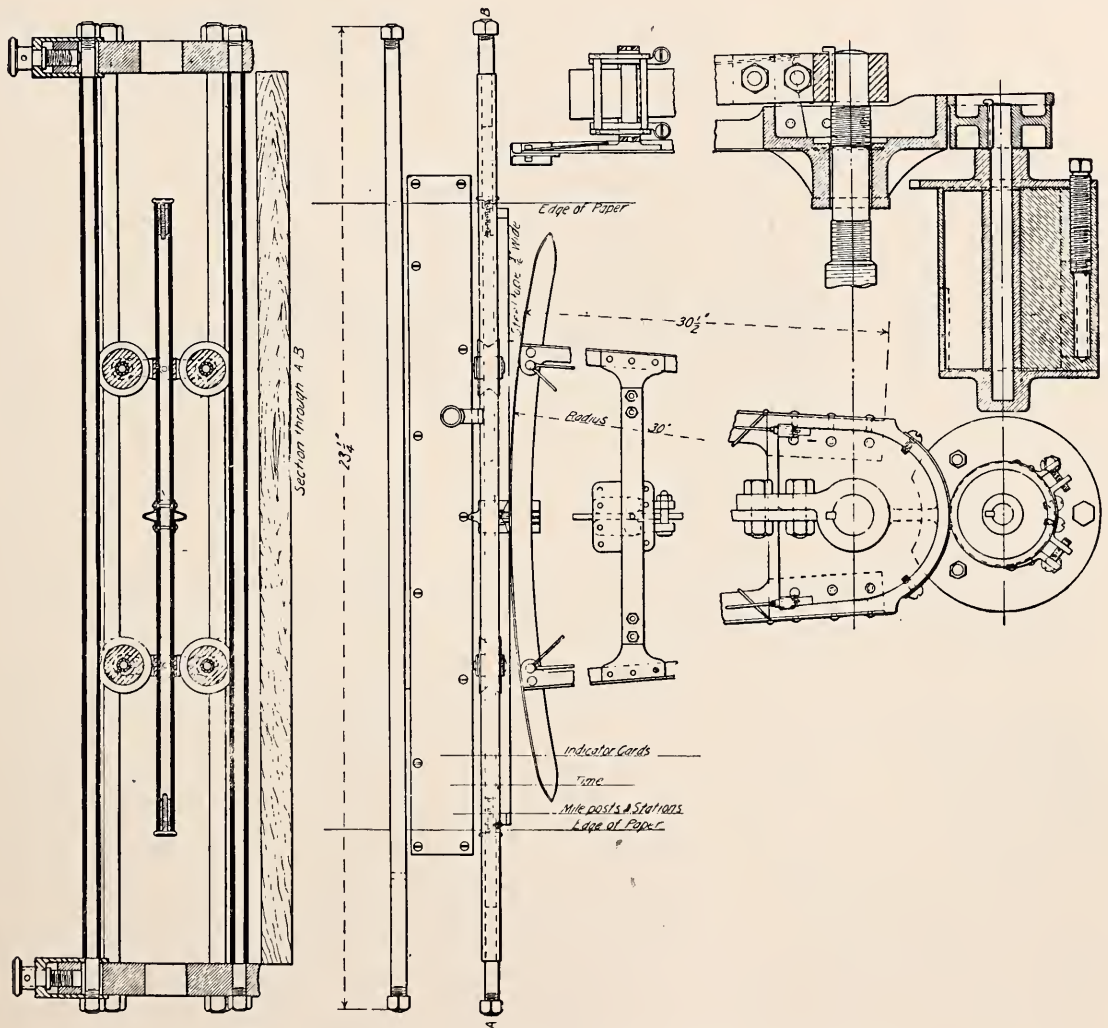


FIG. 7—ENLARGED DETAIL OF RECORDING APPARATUS

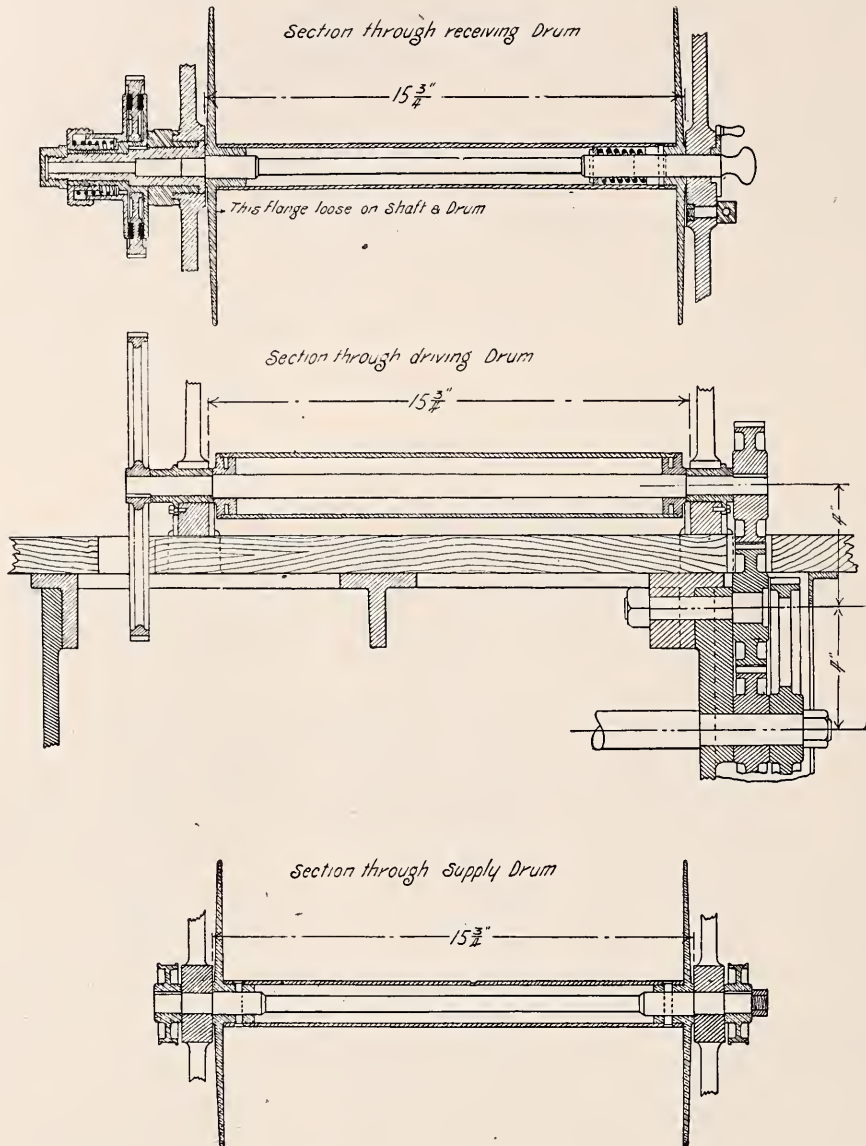


FIG. 8—THE PAPER DRUMS

A record, operated from the engine, to mark exact points where indicator diagrams are taken.

The framing and body of this car are substantially the same as the standard caboose of the road, with the substitution of steel channels as center sills, to which the draft rigging is attached. At one end is an ordinary M. C. B. coupler, but at the machine end there is a link coupler of special form connected with the follower by ball joints as shown.

The car is provided with a Boyer speed recorder and gauge, a clock and a gauge showing train pipe pressure, four berths, a table, closet, vise bench and a Baker heater. The car has just been completed, and, although not yet in service, the indications from the preliminary tests are that it will give a good account of itself.

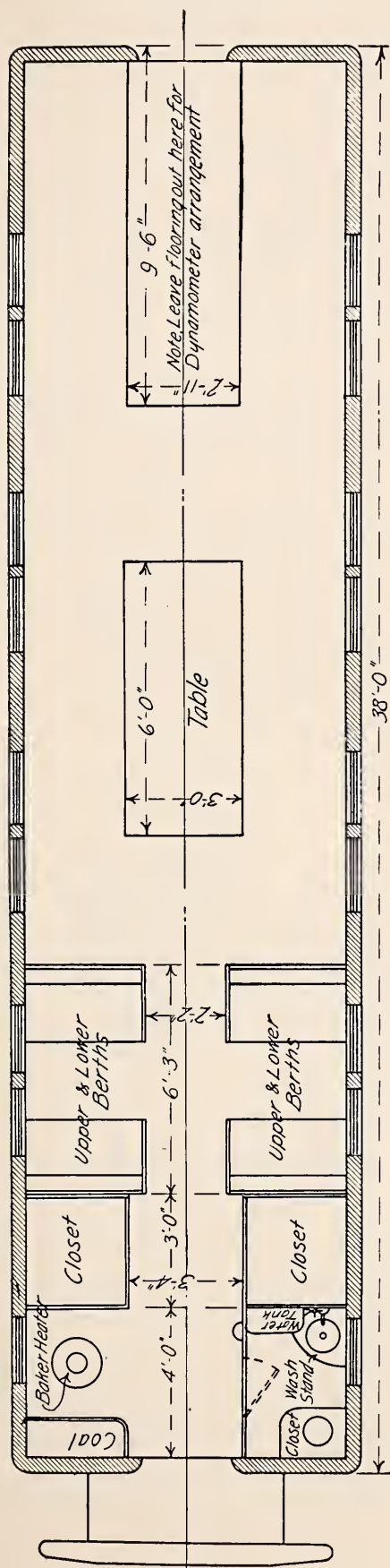


FIG. 9—DYNAMOMETER CAR, C. & N. W. RY.—FLOOR PLAN

SUPERHEATED STEAM was discussed at the recent meeting of the American Society of Mechanical Engineers, in a paper presented by Mr. E. H. Foster, of London, Eng. Tests were made of a small pumping engine of the Worthington duplex direct-acting type with triple expansion. The figures obtained led the author to the following conclusions :

1. Steam when superheated about 125 degrees Fahr. will do 16 per cent more work than when saturated.

2. With steam superheated as above, and the feed water passed through an exhaust heater, a given amount of fuel will produce from 11 to 12 per cent more work.

3. The effect of steam jacketing all the cylinders is only to produce a saving of about 4 per cent of the fuel, or 3 per cent of the feed water under the above conditions of superheated steam and feed water heated by exhaust.

4. That the use of even a small cross over exhaust pipe between the intermediate and low pressure steam cylinders, while somewhat beneficial to the running of the engine, causes an increase in steam consumption of about 5 per cent.

5. With an allowance of 2 per cent for losses due to slip and leakage, this engine shows that it can easily perform a duty of 96,000,000 or 97,000,000 foot pounds per 1,000,000 British thermal units, or of giving an effective horse power on 18.3 pounds

of superheated steam per hour, which latter corresponds to 108,200,000 foot pounds duty per 1,000 pounds of steam; certainly, a most excellent result for an engine of this class.

## THE CAR FOREMEN'S ASSOCIATION OF CHICAGO.

### MAY MEETING.

The regular meeting of the Car Foremen's Association of Chicago was held in the rooms of the Western Society of Engineers, 1741 Monadnock Bldg, Chicago, May 10, 1900.

President Morris called the meeting to order at 8:00 p. m. Among those present were:

Alderson, A. S.	Deen, Chas.	Kuhlman, H. V.	Richardson, Wm.
Brown, I. H.	Grieb, J. C.	Kramer, Wm.	Roof, C. S.
Blohm, Theo.	Guthenberg, Bruno	Krischel, M.	Saum, G. N.
Bates, G. M.	Gardner, L. S.	Kroff, F. C.	Schultz, A.
Buker, Jos.	Groobey, Geo.	Krump, M.	Schultz, F. C.
Bossert, Chas.	Goehrs, W. H.	Keebler, C. F.	Spees, W. F.
Baker, John	Hansen, A. P.	La Rue, H.	Snyder, R. H.
Bundy, C. L.	Harvey, H. H.	Miller, J. C.	Sharp, W. E.
Brown, A. B.	Hultman, Chas.	Morris, T. R.	Shaw, M.
Bourell, J. W.	Husband, E.	Marsh, Hugh	Spohnholtz, John
Barton, J. E.	Hall, W. B.	Mattes, J.	Williams, Thos.
Cook, W. C.	Jones, A. A.	Murray, D.	Wensley, W. H.
Callahan, J. A.	Julian, J. B.	Nordquist, Chas.	Wessell, W. W.
Callahan, J. P.	Johannes, A.	Norman, Frank	Weschler, H.
Constant, E. J.	Kidder, S. J.	Nightengale, H.	Wentsel, Geo.
Depue, Jas.	Kline, Aaron	Olsen, L.	
Davies, W. O.	Konze, Wm.	Prickett, Jas.	

The minutes of the previous meeting, as published in the RAILWAY MASTER MECHANIC, were approved.

Mr. Reinhard, of the committee on broken center pins and center plates, reported that the committee had done nothing as yet. The committee was given another month in which to report.

Secretary Kline reported the following list of new members:

F. R. Angell, National Malleable Castings Co.; Jacob Swenka, Thomas White and Henry McGonagel, of the P., C., C. & St. L. Railway; O. M. Stimson, Swift Refrigerator Line; M. Krischel and Mathias Schmitz, P., F. W. & C. Railway.

**PROPER CHARGE FOR BROKEN COUPLER LUGS  
AND LOST KNUCKLE.**

President Morris: The first question on our evening's program is in regard to broken lugs on a coupler and loss of knuckle—what would be a proper charge against the owner?

Mr. Grieb: It seems to me that in the case cited by the President it is but fair, before making any charge, to determine upon the condition of the articles reported as lost. It occurs to me that the principle underlying the present M. C. B. rules require that we treat one another as we would like to be treated ourselves. And in this particular instance, where there is a possibility of the coupler breaking and the knuckle and pivot pin, etc., remaining in good condition, we ought to definitely ascertain in what condition the knuckle and pin is before making any charge. A number of inquiries that I have made in connection with coupler breakages has developed the fact that the knuckles quite frequently are found to be in good condition. It, therefore, seems to me to be but right in protecting the interest of the owner of the car to determine whether the knuckle is defective or whether it is in good condition, and if you are not able to ascertain definitely whether it is not, I think it is justly due him that you give him the benefit of the doubt.

Mr. Kroff: I think case 452, May, 1897, will explain that.

(Secretary reads case.)

Mr. Bates: I think that covers this case exactly.

Mr. Grieb: I do not know whether the nature of the breakage of both couplers was alike. It seems to me that in case 452 the coupler was broken back of head, or in such location in the back portion of the coupler as must allow us to infer that the knuckle was in good condition, more than with the breakage in the lug. It might be in the case we are discussing that both the coupler and knuckle were broken. Still I think that the position I first took is right—before we charge for the knuckle as missing we must ascertain whether it was in good condition, or otherwise, and charge accordingly.

A Member: If the car came in off the road with the knuckle lost and coupler broken at lug, in that case we are not able to ascertain the condition of the knuckle. It is due the owner to give him the benefit of the doubt and charge accordingly.

Mr. Bundy: I think the proper charge would be for the coupler body, and do not think the knuckle ought to be charged. It is fair to presume, I believe, that in twenty-four cases out of twenty-five the

knuckle is not broken. I do not think it is fair to charge the owner for the knuckle.

Mr. Kehm: I think the position assumed by Mr. Grieb is proper. I do not believe arbitration case 452 covers the case in question.

Mr. Bates: I have seen several cases, in fact, a good many, where the lugs were broken off the coupler, and the knuckle and pin missing, and I invariably found that the knuckle and pin were in good order. I do not believe that it is right to charge the knuckle and pin in such a case. Where a knuckle is missing and the coupler in good order, the chances are that the knuckle became broken and was thrown out by the switchman; in a case of this kind, however, I do not think it proper to charge for the knuckle.

Mr. Kehm: We were checking bills today, and I will venture to say that in eight cases out of every ten, where the coupler was broken, the knuckle was broken also, in charges against our company. I do not think the remarks made by Mr. Bates apply to the case.

Mr. Bates: There are cases where the guard arm is broken and the knuckle broken in connection with it, but I do not believe that anybody who would charge where the head is broken off, would charge for the knuckle as well as the body of the coupler.

Mr. Roof: I think that there is a later decision—I cannot recall the number of it—something possibly within a year ago, in which, if a coupler body be broken, we cannot bill in the entirety for a knuckle and coupler, only for the body, as the difference in the cost would amount to considerable. It has been decided, I believe, and I cannot help but think that in cases where the guard arms are broken off, or the lugs that hold the knuckles, that it must be on the company's line some place, and I think we should give the car owners the advantage of the doubt and charge only for the coupler body.

Mr. Sharp: I think the position taken by Mr. Grieb is correct—that the bill should cover the coupler body only. I think in the majority of cases, if you trace it up, you will find the knuckle in good condition and it will eventually work into the storeroom of the company making the repairs.

Mr. Grieb: As a matter of information, I would like to ask you to make inquiry of the members as to what causes breakages of the lugs in a coupler. I have been trying to get information on that subject and my endeavors have not been very satisfactory.

President Morris: I think it would be interesting to find out from

the members present here this evening, what causes breakages of the coupler lugs. I would like to have the members respond freely and give their experience. There is scarcely anyone here who cannot give an intelligent opinion on this subject.

Mr. La Rue: I think in this particular case, where the lugs are broken off the coupler, that possibly they have been broken with a link in taking the slack out of the train. It is hardly possible that the lugs can be broken off by the couplers simply coming together, except in switching with the knuckles closed. In my opinion, as Mr. Grieb has stated, if the knuckle has been broken and the car handled with a link through the pin hole and the lugs broken off the coupler, then it would be consequential damage and should not be charged. That would have to be left with the company causing the damage.

Mr. Prickett: I am under the impression that you cannot charge the owner for a knuckle and coupler both, where the coupler would come in on your repair track with the lug broken off and the knuckle missing. We will have to give the owner a little of the doubt and charge for the coupler only. The knuckle, nine times out of ten, is all right, but you will find nine out of every ten that are broken in the pin hole are caused by leaving the knuckle closed in switching and striking together. The knuckles will strike and tear out the pin holes, although we do not know whether the knuckle was bent up that was lost. Speaking of lugs breaking off couplers, I am under the impression that they are broken more by taking the slack out of trains than by striking together. Last week I had to remove a coupler with the top lug broken off. In the center of the metal was a great blow hole that you could almost lay your finger down in. The break was fresh, and I think it was occasioned by a sudden jerk and the blow hole in the middle. I do not think the lugs are breaking off by striking.

Mr. Reinhard: Speaking of the lugs being broken off, some time ago we had an inspection of couplers and knuckles at our place, and among those were several that had the lugs broken off, and a good many having guard arms broken. Where the fault lies for the lugs breaking I do not know, but I believe that it is partly due to defective castings.

Mr. Prickett: Last week I removed four couplers, with both the lugs broken off at about the center of the hole.

Mr. Deen: Not long ago I saw the lugs broken off two couplers at one time, caused by the knuckles being closed; the cars striking on the knuckles broke the top lug off one coupler and the bottom lug off the

other, at about the center through the pin hole. I have seen them also broken in taking the slack out of trains; but in a great many cases where they are broken you will find it is due to faulty construction.

Mr. Marsh: I would judge that at least nine-tenths of the cases are caused by taking slack out of trains where a link and pin is used. It puts an unnatural strain on the coupler where the coupler is not able to stand the strain. In regard to charges, where the coupler is broken and knuckle missing, I believe that will have to be governed, in each particular case, by the condition the coupler is in and from the condition of the knuckle and the pin.

Mr. Davies: I am of the opinion that broken lugs are caused by striking. I have seen couplers where they are badly worn, and a sudden jerk will pull off the lug. In regard to the question before the house, I do not think it is proper to charge for the knuckle. I do not remember the case now, but there is an arbitration decision with the E. J. & E., if I remember right, in which there were two lugs broken off and the knuckle missing.

Mr. Davies: I move that it is the sense of this meeting that only the body of the coupler should be charged.

Carried.

#### **RESPONSIBILITY FOR BROKEN DRAFT TIMBERS, ETC., AND MISSING DRAWBAR.**

President Morris: We now come to question No. 2, in regard to broken draft timbers, deadwood, etc.

Mr. Kroff: I think that that would be chargeable to the car owner, if the drawbar and attachments were missing. It would answer just about the same with question No. 1, where the knuckle was missing and you bill for the coupler body. I do not see as there is any combination broken. If the drawbar was missing and the draft timbers broken we must presume that the drawbar is in good condition; they can not bill the car owner.

President Morris: Is it fair to always presume that the drawbar is in good condition, if missing?

Mr. Kroff: It surely is. You must presume that the knuckle is in good order where the lugs are broken off a coupler. There may be something broken on the pocket that would make a combination. Now, what we want to get at here is, is it always fair to consider that the drawbar and all attachments were all in good order? I think it would be; simply because labor only can be charged for replacing a missing coupler.

You may presume that the drawbar pocket was broken on the missing coupler, and bill for the drawbar pocket. I think if you are going to presume, you might presume all around.

Mr. Grieb: I can hardly agree with the position taken by Mr. Kroff. I think there is a little too much "presuming" for the good of our general health, and particularly in view of the fact that there is an arbitration case, No. 484, that covers two cases that are on precisely the same lines as the case now before us. It imposes on the line having the car in its possession, the duty of ascertaining beyond any doubt whether there was any defect in the coupler or its attachments, before they can bill for the knuckle or draft timbers or any other portion. The decision is very broad and covers two cases, and, as I remember it, one party gets the decision in one case and the other party in the other case, simply because in one case they were able to show that the coupler and attachments were in good condition, and in the other case they were not able to present such evidence, and the arbitration committee ruled that they would have to give the benefit of the doubt to the owner. If you can not prove to them that the coupler and attachments are in good order, you can not make any charge. (Secretary reads decision mentioned.)

Mr. Bates: In that case, I believe the road received the owners' car from another line that did the damage. I do not think you can call that a parallel case to this one. Now, I would like to know at what point the draft timber was broken in this case?

President Morris: I do not know that we have any information, aside from what is given here, in regard to the details of the case.

Mr. Bates: If the draft timbers were broken at the drawbar stop, the probabilities are that the coupler was lost while taking the car to the repair track, and I can not see where the combination comes in. The M. C. B. rules tell us that we cannot charge in any case for a missing coupler and its attachments. If a coupler is missing, it has to be replaced at our own expense, with the exception of labor; now, then, if a coupler is missing, or if the draft timbers were broken first and let the coupler come out, I fail to see how you can make a combination out of it. Last year the attachments were included with missing couplers; previous to that time we could charge for the attachments but could not charge for the coupler; but now, according to my understanding, we cannot charge for any of it. I think this matter is really a case of owners' defects. Simply because the coupler was pulled out, by taking the car from where it was damaged, to the shop, does not cut any figure.

Mr. Davies: I differ with Mr. Bates there. If the car comes on his repair track with broken draft timber, and he can find the drawbar and state positively that the drawbar and attachments were not broken, he can bill, but otherwise he cannot.

Mr. Bates: The rules are very plain in that respect. They say we cannot bill for a missing drawbar or a coupler, and it was understood by all of the members of the Master Car Builders' Association that when a coupler is lost it is in good order. I do not see why we cannot assume that such is the case here; if the coupler was lost, nothing can be charged besides the labor. Now, then, if we break two draft timbers and later on pull out the coupler, taking it to the shop, I fail to see any reason for looking up the old coupler to find whether it was broken or not, as the rules practically say that lost couplers are in good order and cannot be charged.

Mr. Roof: I do not see any question here for discussion at all. Knowing if a railroad company has a foreign car on its line and does this damage, and the owner's car is not offered in interchange, it matters not whether that coupler is lost or broken. It matters but little what private car owner or what foreign railway company owns that car; they expect it to bill anyhow. Even if it is missing, it is a second-hand coupler put in that car, nine times out of ten. It is the duty of the road operating that car which pulls the coupler and draft timber out, to look up the coupler to see whether it is good or not, and apply it to the car.

Mr. Grieb: I would like to say, in answer to Mr. Roof, that I think there is a grave question under consideration here. It seems to be assumed (and I do not know with what reason) that this coupler and its attachments were all in good condition. It seems to me that the arbitration decision which the secretary has just read, rules as though, instead of denying the existence of any combination of damage in order to make any bill, you have got to clear yourself of any suspicion and know the coupler is not broken. The rules define combinations very clearly, and arbitration case 484 clearly imposes the burden on the party handling the car to prove that the missing material was in good condition. I would like to hear somebody explain any reason for differing with that decision if they can.

Mr. La Rue: It has been my experience, invariably, when the draft timbers are broken and a coupler pulled out, and the coupler was brought in, that the coupler and attachments were all intact, because the breakage

of the draft timbers allows the other parts to drop out. It is not necessary for the other parts to be broken, after the draft timbers are broken, to allow them to come out.

Mr. Bundy: I believe if you get a car on the repair track with the draft timbers broken and the coupler and attachments missing, that in order to make a charge it will be necessary to look up the coupler, and if it is found that all the attachments are in good condition you would have a right to put in a new draft timber and bill, otherwise you would not.

A Member: Suppose you could not find the coupler?

Mr. Bundy: Then I would say that you would not be entitled to bill.

Mr. Kroff: I would like to hear from some of the members, if, when a loaded car came in off the road with the draft timbers broken and the drawbar missing, whether they would hold that car a week to get the drawbar and attachments in to see whether they were broken or not. If not, how were they going to make a bill? How long a time would Mr. Bundy allow the men to look up a drawbar?

President Morris: If you had a loaded car off the road, with a drawbar gone and draft timbers broken, you would consider it a combination and not hold the car.

Mr. Bundy: I would not hold the car.

Mr. Wensley: We have loaded cars coming in off the line quite often, with the draft timbers broken and the coupler missing. They are usually western road cars and we cannot hold them very long. We put in new timbers and give them a coupler and attachments, then take it up with the conductor of the train bringing the car in. He is always able to say where the coupler can be found. We bill for the draft timbers but do not think it proper to bill for the coupler.

Mr. Davies: If Mr. Wensley does that, he is working directly against the rules. It has always been my practice, when I was on the road, if a car came in with the draft timbers broken to consider it impossible to bill for it unless you can prove that the coupler and attachments were all right.

Mr. Prickett: Now, on our line if they pull a coupler or drawbar out, the trainmen have to load it up and bring it in. If they do not bring it in, the superintendent gets after them immediately. We have got a "No. 1 G. B." that has got to be made out on the arrival of train bringing car in with coupler missing. If the coupler is not on they have got to send in this report. If the conductors do not bring

the coupler in they hear from it very strongly. I think in this case all you can bill on would be the draft timbers and labor of applying coupler. The coupler evidently was pulled out on the line and it will naturally come into the storeroom of the parties that pull it out. Now, as I understand this case, the draft bolts are broken, evidently, as the timbers have spread out and allowed the followers to come out of the pocket, and that pulls on the carry iron until it pulled off, and the timbers were damaged in handling car on chain. I think that the road making the repairs would be perfectly safe in billing for the new draft timbers providing the coupler is all right—replacing the draft timbers and charging two hours.

Mr. Wensley: There is no labor for applying the coupler when the draft timbers are down. As to the rules we have on our road, in regard to handling couplers, where the conductor pulls a coupler out in his train he has to put it on the platform of his caboose and bring it in. In that way we can very soon ascertain whether it was in good condition or not.

Mr. Bundy: I will state that on the road I was recently employed on, the conductor makes out a card and hands it to the car inspector at the end of the run; if he pulls out a coupler on the road he loads that coupler on the platform of his caboose, or in an empty car, and takes it to the terminal station.

President Morris: This seems to be a very important question—as to whether the owners are responsible or are not responsible. There is quite a difference involved and there seems to be a difference of opinion here also. I believe that this ought to be sifted down and gone into very thoroughly, and a decision arrived at so that there will be a uniform way of handling it, and I think we either ought to carry this thing over to another meeting or else go into it more thoroughly tonight and have it settled. As for the C., M. & St. P., we do not charge the owners for replacing the draft timbers if the coupler is lost on our line, unless we are positive that the coupler is all right. If we cannot locate it, we take it for granted that it is a combination and stand it ourselves.

Mr. Cardwell: The fact of the coupler being missing makes it one of the items which form a combination denoting unfair usage, taking them with draft timbers broken and the carry iron broken. I think if you are unable to locate the coupler it is improper to charge.

Mr. Callahan: The way this question reads—draft timbers, draft timber bolts, and carry iron broken—how would the coupler help but be missing? I can tell within an hour or two whether the coupler is in good condition. I think the proper charge for that, if the coupler is in good condition, would be to bill for the broken part.

Mr. Bates: I have looked up quite a number of similar cases and found that in every case the coupler and its attachments were intact, and I believe it was for that reason that Section 4 of Rule 5 was put in the rules: "A coupler cannot be missing and broken at the same time." I would suggest that we hold this question over, and that every man act as a committee of one to obtain all the information possible so that we will be prepared to talk more intelligently on this subject at our next meeting.

Upon motion, the question was carried over to the next meeting.

### THE CAUSES OF SLID FLAT WHEELS.

President Morris: We now come to question No. 3, which relates to slid wheels. This is a question that covers a good deal of ground, and we would like to have a very full discussion on it.

Mr. Bundy: I will state that there are several reasons for slid wheels. I have made the matter quite a study in my time, and find various reasons for sliding wheels. I believe it is partly due to the engineer not handling the air properly. If you have a train of cars with only a few air brake cars, the engineer, carrying 90 pounds in his main reservoir and 70 pounds in the train line, by placing the handle of the engineer's valve in full release position, will get to exceed 70 pounds train line pressure, and as freight cars are figured to brake 70 per cent light weight of car, the result is he will probably slide the wheels. Again, I believe wheels are slid by setting brakes, going down long grades, and when the train slows up the engineer brings the handle of his valve back into running position; in this way the train line is recharged slowly and, with a leaky triple piston ring, the air passes by the ring into the brake cylinder, charging it up to train line pressure, thereby sliding the wheels. And again, I believe some wheels are slid by the train brakeman setting the hand brake at the same time air brakes are applied, and the two brakes applied at the same time slide the wheels. I think, again, a great deal is due to the condition of the weather. You will find most of our slid wheels—that is my observation, at least,—in the coldest weather we have. I have found slid wheels on cars that I figured the brake leverage on, and found that we were braking the right percentage. I could find no defects in the triple valve or in the brakes. Sometimes you will find the levers braking too high.

Mr. Marsh: We all know, of course, that when a wheel slides there is too much leverage. It might be caused from an improper division of the lever, or by an unusual pressure in the train pipe. I believe that it

is generally due to the engineer, who will get too much pressure in the train pipe. He overcomes the percentage on which the leverage is figured, and in that case will slide all the wheels on that car. That would show four pair of flat wheels. Now, if the car would show two pair of flat wheels at one end of the car, I believe that it would be fair to presume that the wrong lever has been used. Somebody, in making repairs, has not had a lever of proper proportion and put in one with too much leverage. If it is one pair of wheels, I believe it will be fair to presume that the boring mill that bored these wheels is out of order. If the wheel is not bored absolutely in the center, you will find that when the brake is applied it will set fast to the short side of the wheel, and, when it comes around to the long side, I do not believe there is any pair of wheels that has obtained centrifugal force sufficient to shove that piston rod back into the cylinder and allow the wheels to go on. I believe many wheels are slid by reason of this defect.

Mr. Sharp: I have heard brakemen say that they would take up the slack; especially a man going out on a long train would go out on the train and screw up the brakes so they would hold tightly, in order that he would not have to get out any time to assist the engineer. A great many claim that the brakes are not properly taken care of. I heard a very lengthy argument yesterday, where a man did not want to pay for a slid wheel, claiming that the brakes were out of order.

Mr. Brown: One of the greatest questions we have on that point relates to dirt accumulating where the train pipe connects to the triple valve. There is a strainer there, and dirt accumulating therein prevents the actual flow of air that should act upon the triple valve properly and consequently there has been a great deal of trouble. It is a small feature, but I am almost certain that that point has been overlooked a great deal. I have had questions come up to me, in the air brake car on the Plant system, at the places where I have examined engineers, and when the replies came in on the reports to me I simply asked them if they examined that one point. Almost invariably they said "No." I said: "Please go back to your car and examine that point," and they found that my criticism was well taken. But as to sliding wheels. I have had a little experience in car building, and I have found a great deal of that due to the ordinary cast iron brake shoe. I have seen men in the yards walk along between the tracks with a hammer in their hands and actually knock the brake shoe from the wheel.

Mr. Brown (W. A. B. Co.): Some of the gentlemen have covered very good points in regard to the leverage and in regard to the wheels

not being bored central; but still there are a great many more that enter into the question. With passenger trains, especially, at muddy road crossings, next to station platforms where they are making the stop, the wheels will lock themselves just as they strike the crossing, and it may be possible that after they are locked the engineer, finding that he is not making the proper stop, will open the sand cock. It may be the wheels will lock, or the engineer will lock them, and run on somebody else's sand. In a good many cases you will find wheels where only one wheel is slid flat, the opposite wheel not being slid at all or only showing a mark. That slid wheel can be traced to the sand question and curves. Overcharging the train pipe will also do the same thing. Using hand brakes in connection with the air brakes causes these troubles. Another great source for slid flat wheels is the fact that the cars are not all braking equally; they are making the strong braking car stop the one that is braking weak.

Mr. Kidder: A few of the reasons which contribute to the sliding of wheels (a number of which have been covered by the gentlemen who have already spoken) are:

1. Wheels slightly out of round.
2. Loss of friction between wheels and rails when curving.
3. Hand brakes applied.
4. Variation of metal in tires and brake shoes.
5. Shoes plain or of the Ross-Meehan pattern.
6. Angularity of brake beam hangers.
7. Brake beam levers not of equal proportions.
8. Variation in weight of opposite ends of the car.
9. Tilting of the trucks when brakes are applied.
10. Short piston travel when brake slack is taken up on a loaded car.
11. Utilizing a portion only of the air brake cars in a train.
12. Six-wheel trucks and four wheels braked.
13. Excessive air pressure in train line.
14. Lack of care or judgment in handling the brakes.

It has already been explained what has been the result in having wheels out of round.

“Loss of friction between wheels and rails when curving.” This, I presume, is plain to all of you. Of course, in rounding a curve, one or the other of the wheels on the axle has got to slip, to keep up or back with the other one, and in so doing there is a certain amount of adhesion between the rails and the wheels that is lost.

“Hand brakes applied.” How this would apply has already been stated.

“Variation of metal in tires and brake shoes.” The question of

metal in brake shoes and in wheels cuts a very material figure. It is generally understood that the soft gray cast iron shoe will give a better adhesion between the wheel and the shoe than any other metal that can be used. The Westinghouse Air Brake Company has always advocated gray iron, as it thinks it the best for the purpose, and it is with that kind of a shoe in mind that that company has for years advocated a certain amount of braking power. Now, with the braking power so adjusted, the using of a harder shoe renders the brake power obtained less efficient than that realized from the gray iron shoe. If you take a cast iron shoe of the common style, you will find that you can use a higher per cent of braking power without skidding wheels than with the Ross-Meehan form of shoe. The wedging effect of the Ross-Meehan shoe very perceptibly increases the friction between the shoe and wheels. I do not know of any experiments that have been made to determine this difference, but in my estimation it will be at least 20 or 25 per cent. In other words, if I were using Ross-Meehan shoes, I should feel justified in employing 70 instead of 90 per cent braking power on passenger equipment cars.

“Angularity of brake beam hangers.” This is a thing that is, I suppose, about as little considered in the hanging of brakes on cars as anything that has been brought up. Properly speaking, the center line of the brake beam hanger should be as near as possible at right angles to a line drawn through the center of axle and brake beam.

“Brake beam levers not of equal proportion.” That has already been covered.

“Variation of weights at opposite ends of cars.” That is another thing, particularly in passenger equipment cars, that is overlooked. You will find passenger equipment cars several tons heavier on one end than on the other; at the same time, no provision is made in the brake gear to allow for the varying weights of the ends of the car.

“Tilting of the trucks when the brakes are applied.” This applies particularly to passenger equipment cars, because the brakes are usually hung from the trucks. When the brakes are applied the retarding force is at the points where the wheels come in contact with the rails. The momentum of the car body, carried far above, must be overcome from these points where the wheels on the rails are hanging back; the consequence is that a certain amount of the weight that should be on the rear pair of wheels of the truck is transmitted to the front wheels. In other words, we have a good deal heavier weight on the front wheels of the truck than on the rear wheels. The consequence is that there is a very good opening for the picking up of the rear wheels.

“Short piston travel when brake slack is taken up on a loaded car.” I have seen a good many cases of this kind where the slack has been taken up on a loaded freight car. Now, there are times when we find some pretty light springs under cars, which cause the car body to rise when empty. The consequence is, particularly if the brakes are hung somewhat low, that when the car is empty the brake shoe slack is exhausted, and the shoes being held against the wheel, sliding is the possible result.

“Utilizing a portion only of the air brake cars in a train.” Some roads use all the air brakes in a freight train; others do not. If we have in use all the brakes in a train, it is comparatively light work for each brake to stop that train; but where we have a train and utilize but a few air brake cars, and undertake to make the same kind of a stop as if we had a large number of air brake cars, the consequence is we are necessarily using a high braking power on the braked cars, and it is apparent that the higher the brake force the more liable the wheels are to slide, particularly if the engineer is a little careless in handling the brakes.

“Six-wheel trucks — four wheels braked.” I have seen trains where 37 per cent only of the total weight of the train could be utilized for braking power, and much of this loss of braking force was due to employing 6-wheel trucks with 4-wheel brakes. This state of affairs was on the fastest trains of the road I have in mind. If we had a train of 6-wheel truck cars, with 4-wheel brakes under those cars, for every stop that is made the braked wheels must do  $33\frac{1}{3}$  per cent more work than they would have to do providing every wheel was properly braked. Years ago, an idea to some extent prevailed that 6-wheel trucks, as compared with 4-wheel trucks, lessened the danger from broken wheels and axles. As a consequence, a good many passenger cars were equipped with 6-wheel trucks. The 6-wheel trucks are, as a rule, still in service, and, unfortunately, the trucks will not permit the employment of beams on the center wheels, and the trucks have got to be worn out before modern brake gear can be utilized. We have 6-wheel brakes on the Pullman cars, simply through pure luck on the part of both the Pullman and Wagner companies. The trucks were originally designed for 42-inch wheels, and when they afterward changed the wheels to 38 inches, it made provision for the third brake beam.

“Excessive air pressure in train line.” This, perhaps, causes flat wheels about as often as most any one thing in connection with air brakes. Engineers do not realize, as a rule, what a few pounds of air

does. Every man who runs an engine knows what five or ten pounds increase of steam pressure in the boiler will do, especially when trying to climb a hill. A great many engineers seem to look upon the air brake from the same standpoint. If we increase the train line and the auxiliary pressure from 70 up to 75 pounds, we have wiped out the 10 per cent of safety; in other words, with a full brake application we have a braking force equal to the weight of the wheels on the rails; if we increase to 80 pounds we have then a braking power considerably higher on the wheels than the weight of the wheels on the rails, and there is but one thing to be expected, and that is, locking and sliding the wheels.

“Lack of care and judgment in handling the brakes.” We can do all we please to try to get the brakes in proper condition and maintain them in that condition, but just so long as there is neglect or carelessness in handling the brakes, just so long will we have slid wheels. Of course, we all realize that the more perfect the brakes are kept in condition, the less liable they are to cause trouble, but you may maintain the brakes in the most perfect condition, and if you can not get the engineers to use care and judgment in handling them and observe the condition at every stop he makes, just so long will the sliding of wheels continue.

Are we braking too high a percentage for safety? I do not think that we are. The matter of the percentage of braking power was gone into years ago very carefully and it was concluded, beyond any question, that 90 per cent was a perfectly safe basis to work on for passenger cars, and 70 per cent for freight cars. With the quick action triple valve on passenger cars, we only get about 71 or 72 per cent braking power with the full service application; and 90 per cent on emergency application. Now, I believe any of you that closely look into the matter will agree with me that where one pair of wheels is slid in the emergency application, there are nine, at least, slid flat in making the ordinary station stops. That would go to show us that these station stops, with only a possible 70 per cent, are sliding the wheels where with 90 per cent we very seldom have slid wheels. Can we attribute it to the parties handling the air? As has been stated here by some of the gentlemen, and by myself, we can attribute a good deal of it to the handling of the brakes. Is it due to the condition of the weather, or from any mechanical defect? Both those subjects have been pretty well covered, but to a certain extent it is a result of the condition of the weather and a mechanical defect. The point has already been brought up here in regard to packing rings that leak.

Mr. Sharp: I believe that Mr. Kidder stated that the common gray iron shoe had been used in all the tests and I did not just catch his argument that a harder shoe was a cause for a slid flat wheel.

Mr. Kidder: If I gave the impression that a hard shoe would be more apt to slide a wheel than a soft one, I gave a wrong one. Perhaps it might be interesting here to state a little incident that occurred in the very early days in connection with quick action air brakes. On the first two passenger trains that we ever equipped with the quick action brakes, I personally looked after the application of the brakes, and prided myself that I had done a pretty nice job. Those brakes worked elegantly for over two months. One day I happened to be at the train and the engineer said: "What is the matter with these brakes?" I said: "I do not know." Then he remarked: "They do not hold half as good as they used to." I looked over that train as well as I could and could not see that any change had been made, and I went to the headquarters of the road and had a conference with the superintendent of motive power and the superintendent of air brakes, and they both told me that there had been no changes made on the cars. Finally, we went to dinner, and on my return, in walking about the yard, I found a lot of scrap shoes and among others several steel ones. When the superintendent of motive power came around I asked him if he had made any change in brake shoes. "Yes, I took off those brake shoes and put on some steel ones." I said: "What did you do that for?" "Well, those shoes wore so much longer than the old ones that we felt justified in using the steel shoe." The loss of holding power was explained to him and the result of it all was, orders were issued that a sufficient number of iron brake shoes be sent to the two terminals on the road and put back on the trains the next Sunday. After that was done, the brakes resumed their original work. This is simply an illustration of what the different metal in the brake shoes will do.

Mr. Brown: I would like to ask some of the gentlemen here what kind of a test they subject their triple piston packing rings to, to determine when they ought to be replaced with new ones. I do not know of anything that contributes more to slid flat wheels than defective packing rings.

Mr. Bundy: It has been our practice in testing triple valves to test them by re-charging the train line very slowly. If you have a leaky train you will catch it that way; and, invariably, in making repairs to the triple valve I always tell our air man to test the triples that way, no matter whether we renew the piston ring or not.

Mr. Kidder: I would like to ask Mr. Bundy what his method is in testing—as to what length of pipe he would feed to get a slow flow of air and also whether he would fully apply the brake or partially apply it, to test the packing rings?

Mr. Bundy: We have got our shop equipped with a 1 ½-inch pipe and an engineers D valve and we draw off about ten pounds pressure in service application, and then we charge up the train line, slowing by bringing the handle back on the release position—not on full release, but just opening the port slightly. Even if the brake sets and releases all right, we probably try it in the emergency and release in the same way.

Mr. Kidder: In making this slow feeding-off test for the purpose of determining whether the piston packing ring is in good condition, the brake should never be fully applied, but with a train pipe reduction of five to ten pounds.

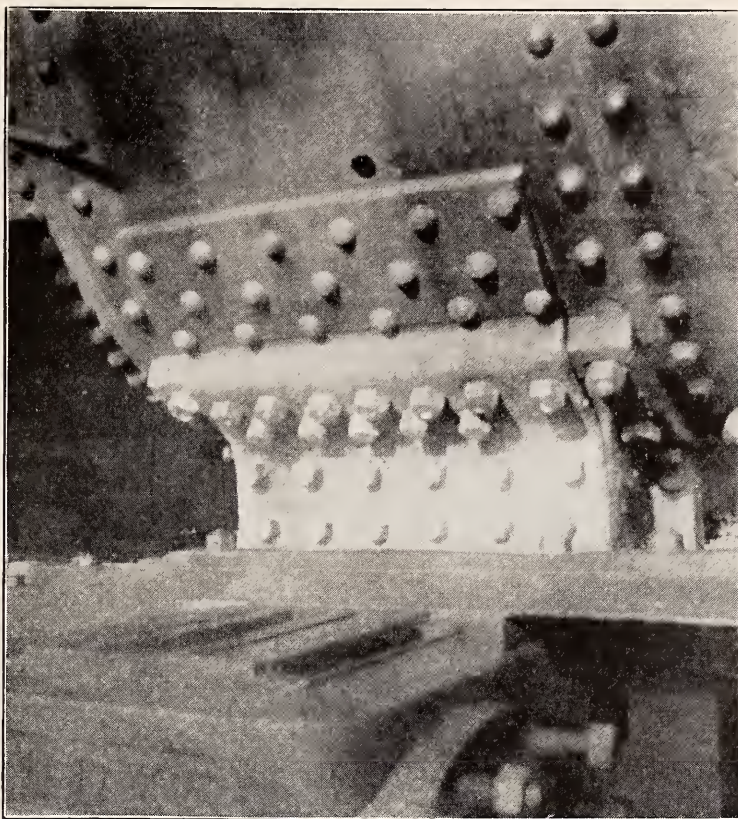
The discussion here closed and the association adjourned. The program for the next meeting, to be held June 14, is as follows:

1. Discussion continued on the subject of responsibility for broken draft timbers, head block, timber bolts, carry iron, etc., in connection with a missing coupler.
2. How much labor should be charged for the removal and replacement of one brake head or one brake fork on metal brake beams, in cases where they are riveted on?
3. In case of renewal of a broken coupler and a broken carry iron at same end of car, what is a proper labor charge?
4. In case of a truck hanger breaking, allowing sand plank to break also, what would be a proper charge; it being impossible to take measures to prevent the breakage of additional parts.

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## PATCHING LOCOMOTIVE SADDLES—AU SABLE & NORTHWESTERN RAILWAY.

Our engraving is reproduced from a photograph, of a form of patch that is being put on some of the engines of the Au Sable & Northwestern Railway by Mr. W. M. Kummer, master mechanic of that road. Mr. Kummer informs us that the saddle was broken on top row of bolts, the flange being broken entirely off on both sides. As a consequence, the engine was laid up for new cylinders and saddles. On looking the engine over, Mr. Kummer found that by putting in a good liner on the inside of the smoke arch and a good heavy patch, as shown on the print, he could still use the engine. The patch is made of 5/8-inch flange steel,



SADDLE PATCH—AU SABLE &amp; NORTHWESTERN RY.

22 inches by 22 inches, with seven 1-inch reamed bolts, seventeen  $\frac{3}{4}$ -inch rivets and seventeen 1-inch top bolts, steam tight in saddle, and made to just fill the holes. These have been found to be all doing well and are not working any.

Mr. Kummer has now three engines running on the road with these patches, pulling trains of 30 cars over a very rough track, and they are apparently as good as ever they were; and they are not bad looking after the steam chest is in place. The engines are Brooks mogul, with 15x18-inch cylinders, weigh about 28 tons, and have 32-inch wheel centers. They all have a run of about 75 miles per day, each way, making in all 150 miles, on  $4\frac{1}{2}$  tons of coal per trip.

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## COMMUNICATION.

### LUBRICATING AIR BRAKE PUMPS.

CLEVELAND, OHIO, May 21, 1900.

*To the Editor of the Railway Master Mechanic:*

Referring to the rules formulated by the Air Brake Association, at Jacksonville, I wish to suggest that if the lubricator pipe is attached to

the highest point of the steam cylinder of the pump, instead of to the steam pipe, it will be found that five drops of oil for the first minute and one drop of oil every two minutes thereafter will be found sufficient.

This refers particularly to the 9½-inch Westinghouse pump, as in it is a D valve which calls for oil quite frequently but which, with the lubricator pipe attached to the steam pipe and that to the air pump, at least ten inches below the valve, receives it, if at all, very irregularly.

This method has been in use on the Norfolk & Western Railway for over a year, and is, also, giving very satisfactory results on the Nashville, Chattanooga & St. Louis Railway. It applies only when the triple feed lubricator is used; with the independent or small lubricator, part of the oil will be siphoned out each time the governor stops the pump.

J. F. WALSH.

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## A MODERN WATER STATION.

The Chicago & Alton Railway has, since its reorganization, been actively engaged in perfecting its system of water stations; and of the many model plants which it has installed we select that at Sag Bridge, at the Desplaines river near Lemont, Ill., as being representative of the modern methods employed. There is nothing remarkable about this station in the way of a difficult situation, or anything of that sort; it simply typifies the present advanced methods of handling water for railway purposes.

In Fig. 1 we give a general view of the yard. In the foreground is a large 12-inch crane, and 300 feet beyond the station end is a second 12-inch crane. Beyond are the tank and the pump house. These cranes are fed from the tank by a 14-inch supply pipe. This pipe is protected at the tank end with a 14-inch Halladay outlet valve, which is held open, or closed in a second, by any operator outside the tank. This valve has the advantage of being protected from all frost by being within the body of water itself. Moreover, it is very much cheaper than a 14-inch gate valve, and has the further advantage of being operated instantly.

The pumping machinery consists of one Otto gasoline engine of 10 horse-power, and lifts water into the tank at a fuel expense of ½ cent per thousand gallons. The total lift is 50 feet. The pump is triplex, of a capacity of about 9,000 gallons per hour. There is no expense for attendance involved for the pumping plant, as the engine is operated by the station agent, only about 15 minutes per day of his attention being required. This plant has been in operation for the past six months, without any call for repairs or report of breakage.



FIG. 1.—A MODERN WATER STATION—CHICAGO & ALTON RAILWAY

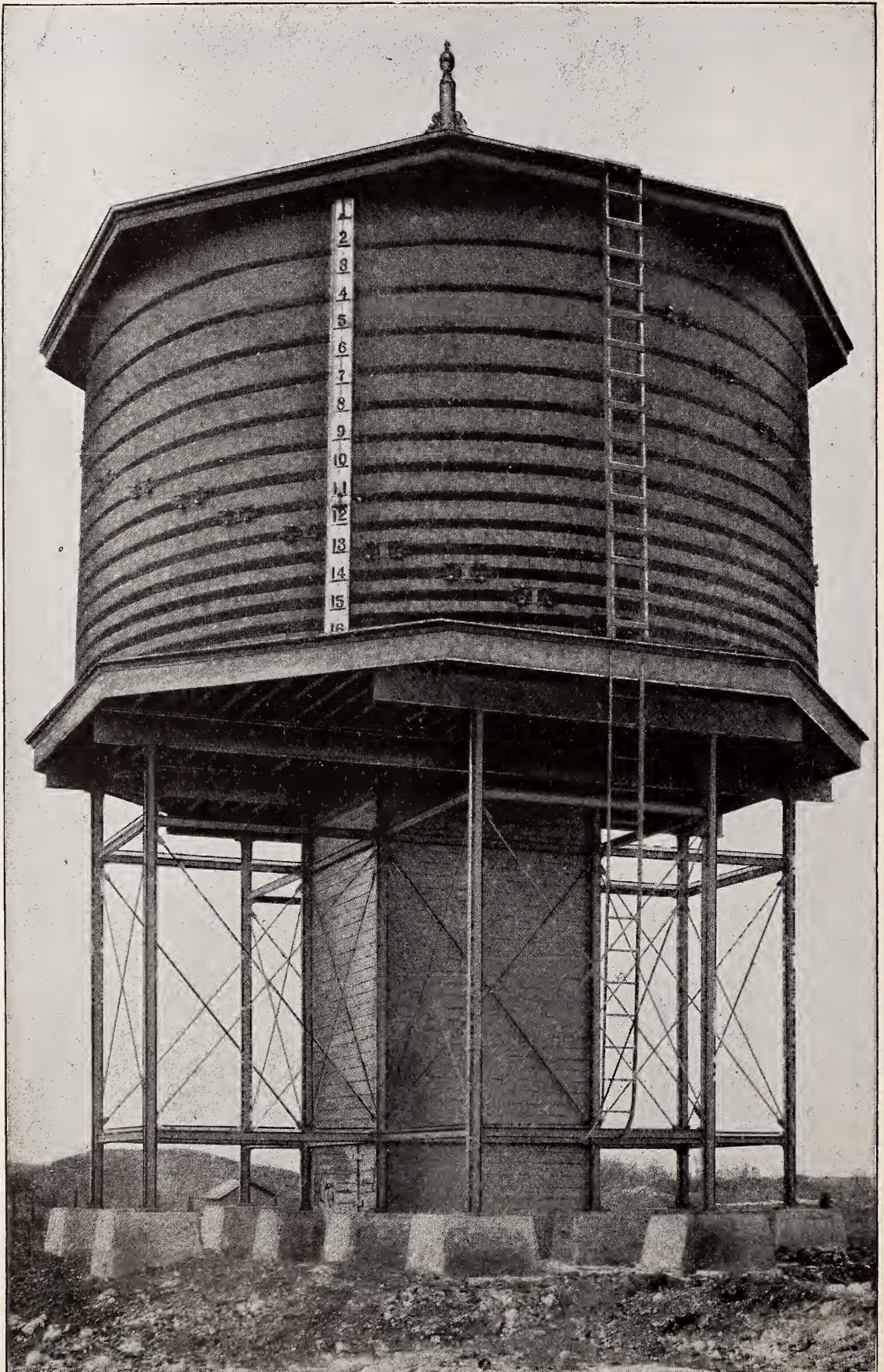


FIG. 2—A MODERN WATER STATION—CHICAGO & ALTON RAILWAY

In Fig. 2 we give a view of the tank. Its capacity is 90,000 gallons. It is elevated on a steel tower 20 feet above the rail. It has the usual frost proofing, after the manner of the Burnham patent. A slate roof removes the usual possibility of burning down from sparks catching in the shingles—of which disaster there are numerous instances on record.

The principles sought for in laying out this station were to keep the tank as low as possible, so as to reduce the cost of pumping into the tank, and to make the supply pipes as large as possible, so as to insure a speedy delivery of water to the engine tank. These cranes feed locomotive tenders at the rate of 5,000 gallons per minute. The average tender is filled in about 45 seconds. The object lesson, then, of this model plant is that, by the proper assembling of a water station, expense is cut off at both ends, viz.: first, the pumping cost is reduced to a minimum; and, second, the time of delivery is cut down amazingly. We believe that this rate of delivery to the tender is not exceeded on any other road in the country.



## A NEW IDEA IN BRAKE SHOES—THE “U” SHOE.

The design in the invention of the “U” shoe is to provide a brake shoe of great durability, which has a constant and uniform action throughout its life, without injurious effect on the wheel, and to secure this extra endurance at as little expense of the holding power as possible.

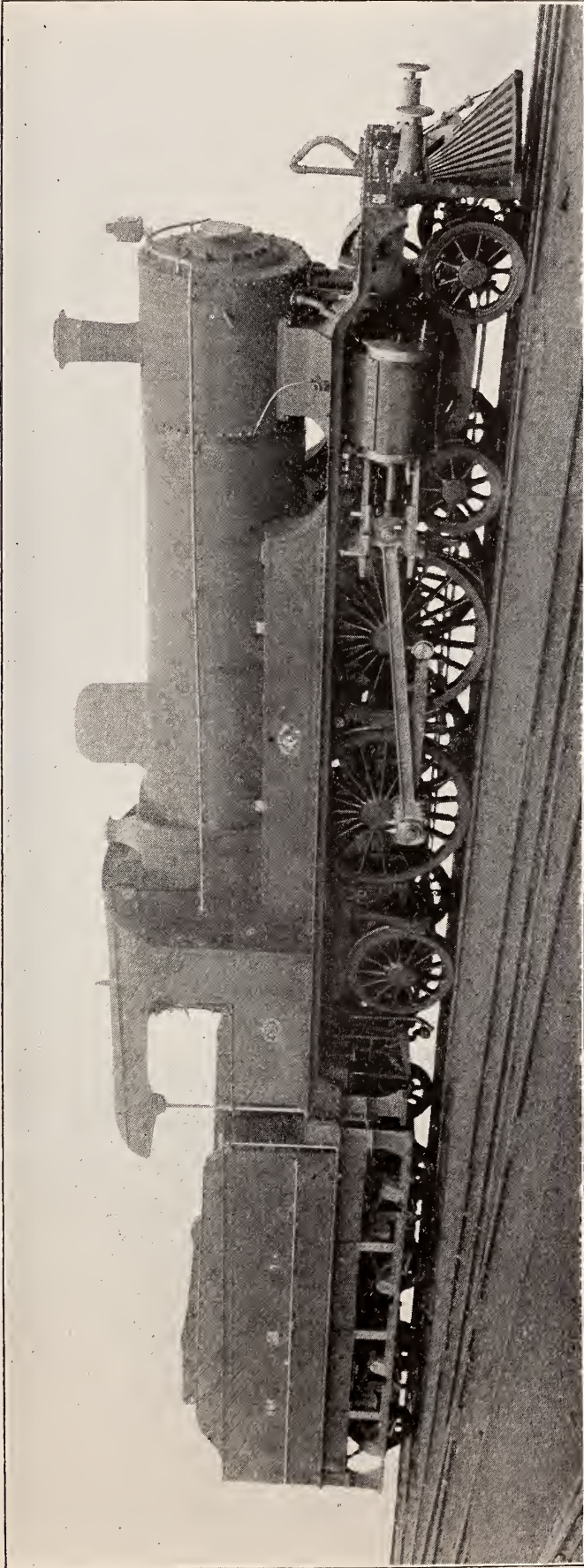
The idea is to take a soft cast iron brake shoe and add metal to the ends beyond the limits of the ordinary shoe, hardening these ends from the back in such a manner that the chilled or hardened portion merges into the softer iron before reaching the surface of the shoe exposed to wear against the wheel in commencing service.

At the start, practically the entire area of contact between the shoe face and the wheel is of soft cast iron and is equal to the bearing face of the M. C. B. standard shoe. The prolongation beyond the point of the ordinary shoe, extends on the line of the tangent to the curve of the shoe face, so that the hardened ends project about  $\frac{3}{16}$  of an inch from the wheel upon the application of the new shoe.

As the shoe wears down, the hardened ends come into play to increase the life of the shoe. These hardened ends, while delaying the rapid wear of the soft cast iron, increase the bearing surface of the shoe so that the holding power is but slightly reduced, and, as the shoe diminishes in thickness, the hardened ends decrease in area, and when the shoe is nearly worn out it is practically the same as the ordinary standard shoe in its holding effect.

The location of the hardened ends of the "U" shoe is outside of the limits of the ordinary standard M. C. B. shoe, and these ends in no wise, it is claimed, diminish the strength of the shoe. The ordinary type of chilled brake shoe is very liable to break in service on account of the strained condition of metal in the body of the shoe. This strained condition is claimed to be entirely removed in the construction of the "U" shoe, which, in addition, is made of a special grade of metal much stronger and tougher than the ordinary cast iron, which permits the shoe to be worn down considerably thinner than is possible with the ordinary cast iron of every day use. Service tests have, it is claimed, clearly demonstrated that the "U" shoe has holding power and endurance superior to all other forms of chilled cast iron shoes, and for this reason the "U" shoe is strongly recommended by its makers for use on coach and car wheels where great durability is desired.

The "U" brake shoe is manufactured and sold by The Sargent Company, of Chicago, who brought out this type of brake shoe to meet the wishes of those who require extreme durability rather than high frictional effect. Where the maximum retarding power is required they offer the Diamond S shoe, which, in their opinion, is the proper shoe to use where the most efficient train control is desired. There is, however, a considerable demand for brake shoes of greater durability than the Diamond S, and to meet this demand the "U" shoe has been designed.

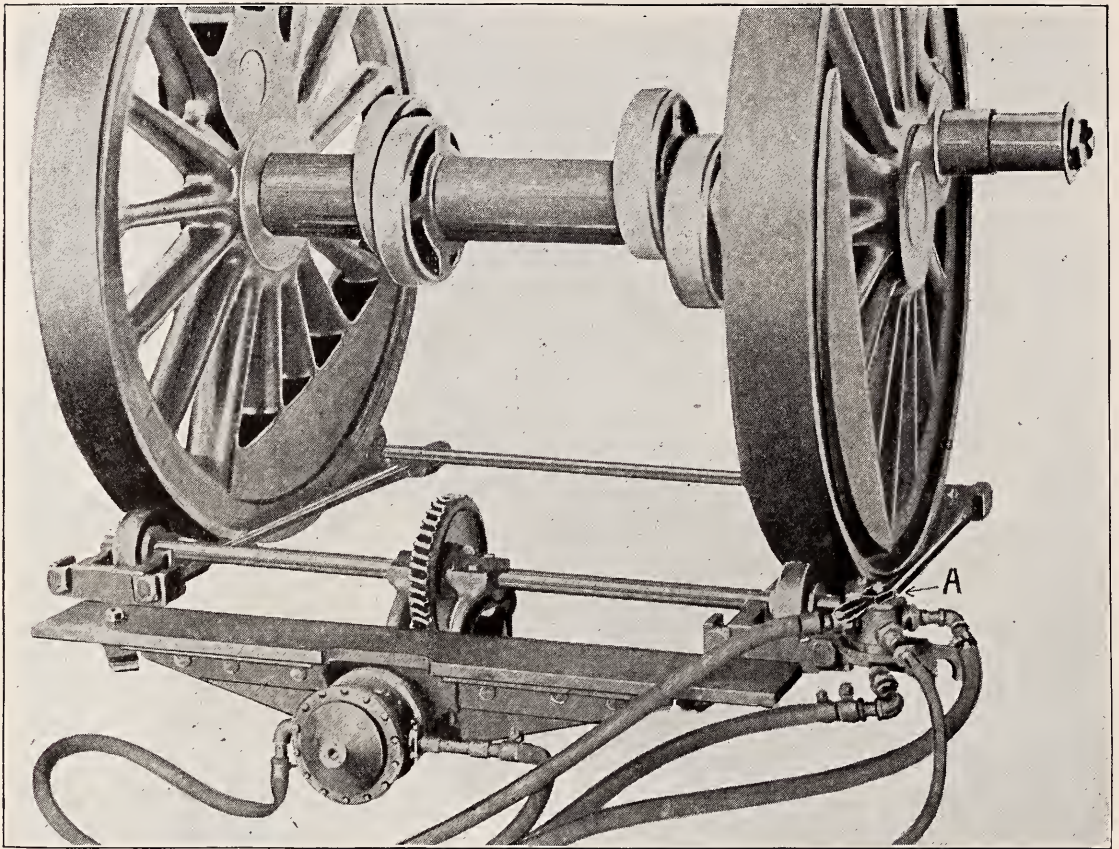


BROOKS LOCOMOTIVE FOR THE EGYPTIAN STATE RAILWAY.

Total weight—150,000 pounds, of which 83,000 pounds are on the drivers, 37,000 pounds on the front truck, and 30,000 pounds on the trailing truck; cylinders—20 x 26 inches; drivers—78 inches in diameter; boiler—60 inches in diameter, designed to carry 180 pounds pressure; firebox—97 x

42 inches; flues—260 in number, 2 inches in diameter and 15 feet,

1  $\frac{1}{8}$  inches in length; fuel—Welsh coal.



### VALVE SETTING MACHINE—C., B. & Q. RY.

A very clever machine for revolving the wheels of a locomotive while setting the valves has been designed and placed in service at the West Burlington shops of the Chicago, Burlington & Quincy Railroad. Through the courtesy of Mr. J. F. Deems, assistant superintendent of motive power of that road, we are enabled to present two photographic views of this machine in position. The rollers used are the same as those formerly used when the wheels were rotated by hand, the shaft being cut off and the lever and ratchet being dispensed with.

With the new arrangement a small air motor is used for rotating the wheels, working through the medium of a worm gear, which is shown more clearly in Fig. 2. The valve, at A, is operated by the man who holds the tram, catching the centers by keeping his foot on the valve handle, moving it back and forth. Thus he rotates the wheel in either direction, as occasion may require. We understand that the refinement and rapidity of adjustment are greatly increased by the use of this neat

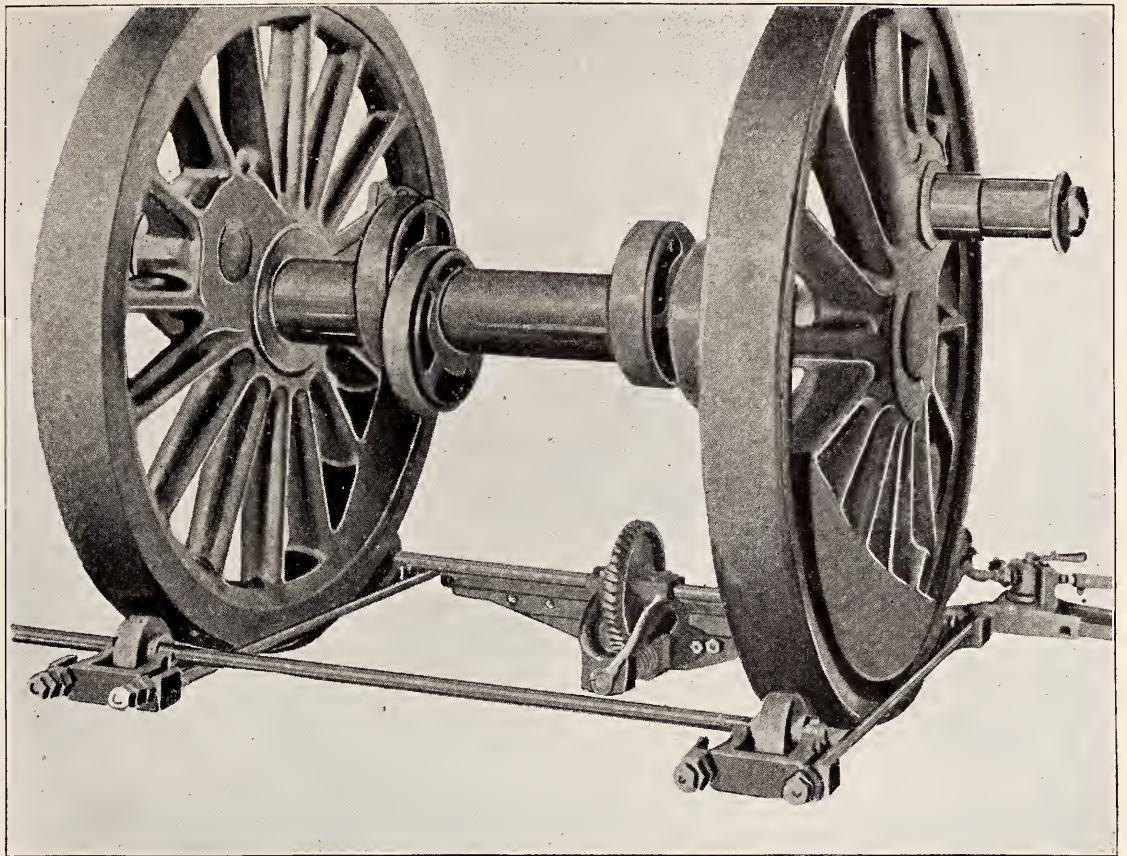


FIG. 2

device. Moreover, the work of two helpers is dispensed with as compared with the old-time method. Other details of the device are fully revealed in our two views.

## LOCOMOTIVE WATER SUPPLY.

BY THEODORE W. SNOW.

In handling water for locomotive supply there are two important divisions in assembling each station, viz.: First, lifting the water into a proper receptacle or storage vat; second, discharging the water into the tank.

In the first division it is usually necessary to employ an engine and pumping machine of a more or less complicated character with great range of detail, according to the source of water supply.

We have, therefore, in the first division to ascertain, frequently at great cost, from what water bearing strata of sand, or gravel, or rock, a

sufficient supply of suitable boiler water can be obtained, before any estimate of cost of machinery can be made.

In the second division we have known quantities to deal with, and a close estimate of cost can always be made.

In assembling a water station there are two prime objects in view, viz.: Division 1, the cost of elevating water per unit of 1,000 gallons; division 2, the time of delivery per unit of 1,000 gallons. Secondary

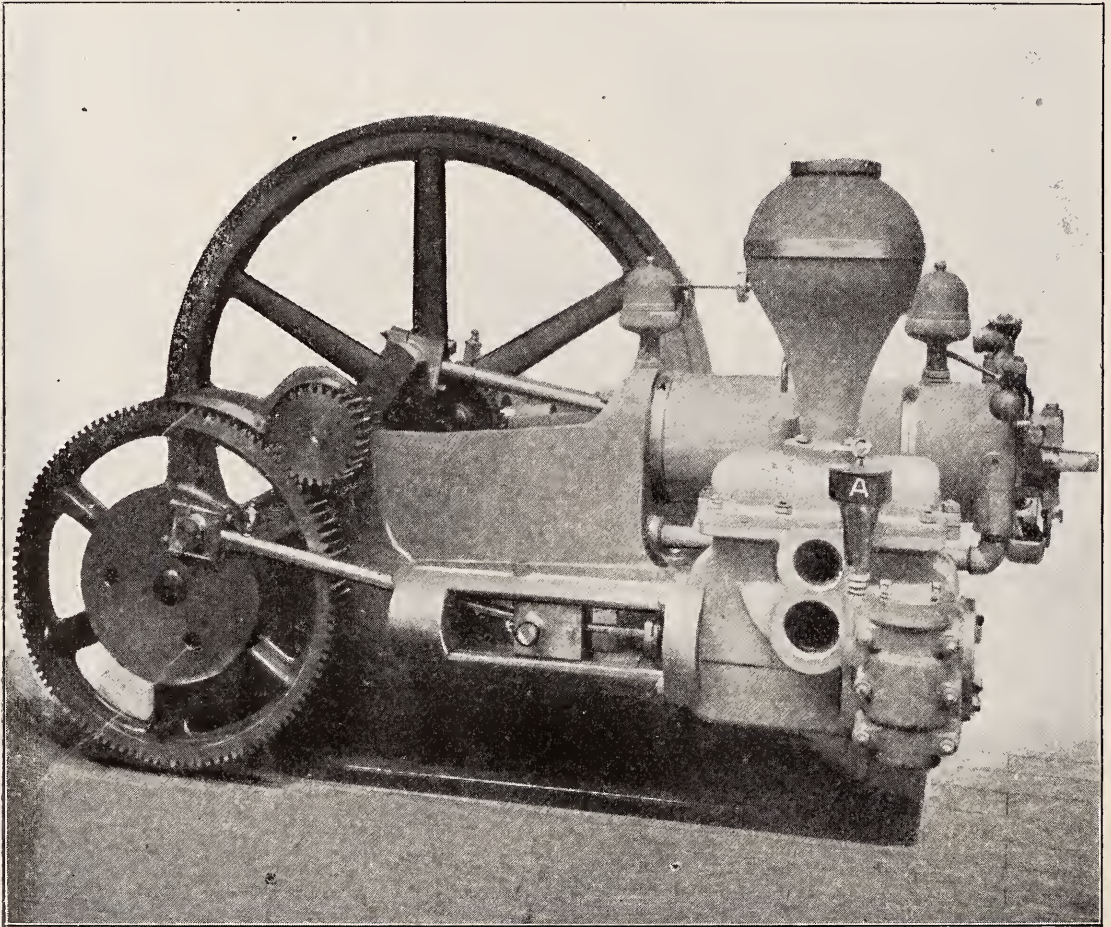


FIG. 1.—LOCOMOTIVE WATER SUPPLY

to these two prime objects are the items of first cost, durability, freedom from frost, cost of repair, etc., etc.

The two prime objects are the only ones to be considered in this article, as they involve nine-tenths of the abuses of the railway water service. In the coming era of railway economics these abuses will come up for attention and will result in the larger railways at least establishing a separate water department, supervised by a technical man of mechanical and hydraulic training. Such a department will cost the large railways nothing; on the contrary, it will result in a direct saving of many

thousand dollars per annum and an indirect saving of many thousands additional. The need of such a change is already felt, as witnessed by the present effort to provide *parts* of the necessary equipment, such as larger and more efficient pumping engines—engines that burn less fuel, engines that require less cost in attendance, repairs, etc. All this is laudable as far as it goes, but it is not enough. The water question on a large railroad is a big one and should be treated in a broad and liberal manner. If the railway management will expand the water service in exact proportion to the development in rolling stock, bridges, weight of rail, and in fact every other department, we will find the locomotive tender with a capacity of from six to eight thousand gallons, we will find every other water station abolished, we will find a class of pumping machinery adapted to the low service needs of the railroads, and we will find all supply and discharge pipes of a size sufficient to permit the enlarged flow of water without entailing more fuel cost for pipe friction than the whole fuel duty of lifting the water to the requisite head.

The railways in the past four years, and especially in the past two years, have been buying gas and gasoline engines for pumping purposes in large numbers. Why? Chiefly on account of saving in the item of labor and in attendance. In this land of cheap coal, the cost of steam pumping is but little more than the cost of gasoline pumping, so far as fuel cost is concerned. Six gallons of 74° gasoline is about equal to one ton of good steaming coal, and most of our large roads are coal miners or intimately connected with coal mines, and such coal will not average a cost of more than 60 cents to \$1.00 per ton.

In every other comparison the internal combustion motor has the best of it, and effects savings in labor, wear and tear, etc., of from \$30.00 to \$60.00 per month for small (and a majority of the) stations.

So far, so good.

But it is not good enough; there are other savings to be made as important.

The pump to be used with this engine is, in nine cases out of ten, designed for an entirely different purpose. It is a most common occurrence to see a pump designed and guaranteed by the manufacturer to work against a head of 300 feet, at work in a railway pump house lifting water 50 or 75 feet. Here is a waste in first cost.

Again, nearly all pumps attached to the gas or gasoline engine are of the reciprocating type, whether they be single, double or triple acting.

In all such pumps a crank or crank plate with pitman connects to

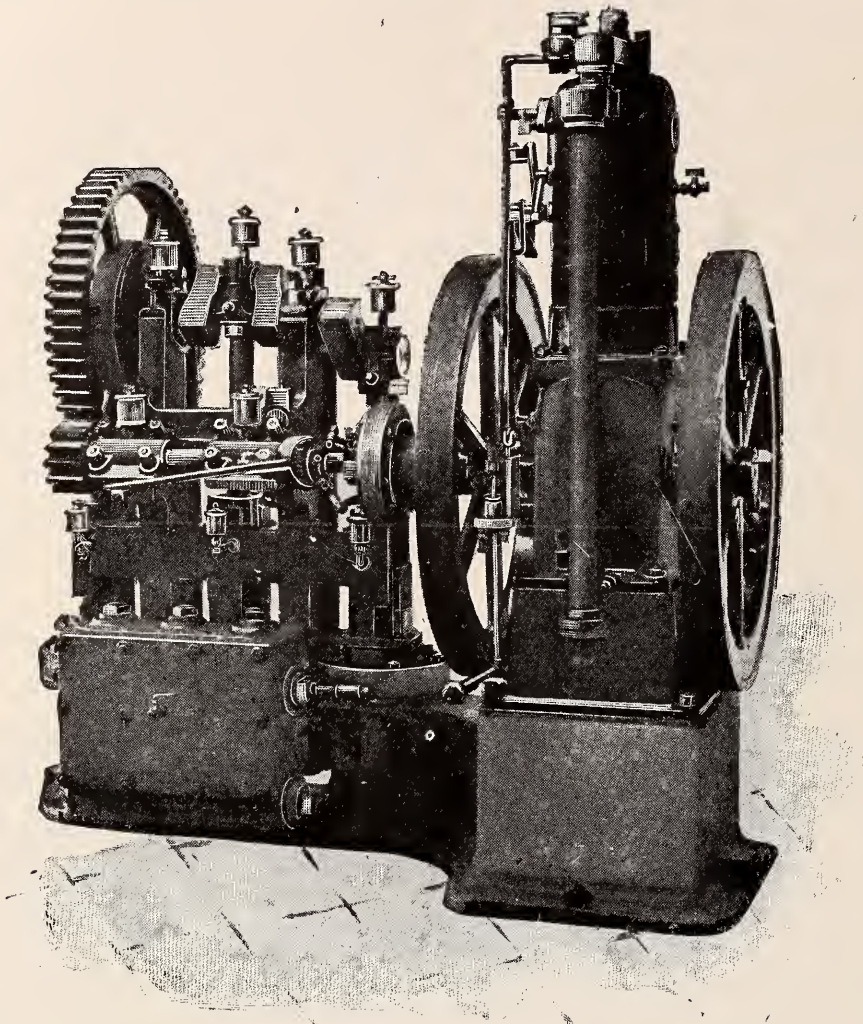


FIG. 2—LOCOMOTIVE WATER SUPPLY

the pump plunger. A safe rule in mechanical engineering is, that such pitman should be six times the length of the stroke, and longer even better, when possible.

Another very safe rule is to keep the piston speed down to 100 feet per minute, or *less*. Cut No. 1 shows a pump that was designed some fifteen years ago to meet a certain trade, in connection with passenger elevator service for city trade, where space for machinery was the *most* important item.

In the railway service we find half a dozen manufacturers copying this type for a service entirely different. In making such a pump and engine self-contained (on one base) the pitman or connecting rod between pump and engine is so short that a large percentage of the power of the engine is wasted in useless friction upon the guides of the pump.

Cut No. 2 illustrates another type of pump much better adapted to

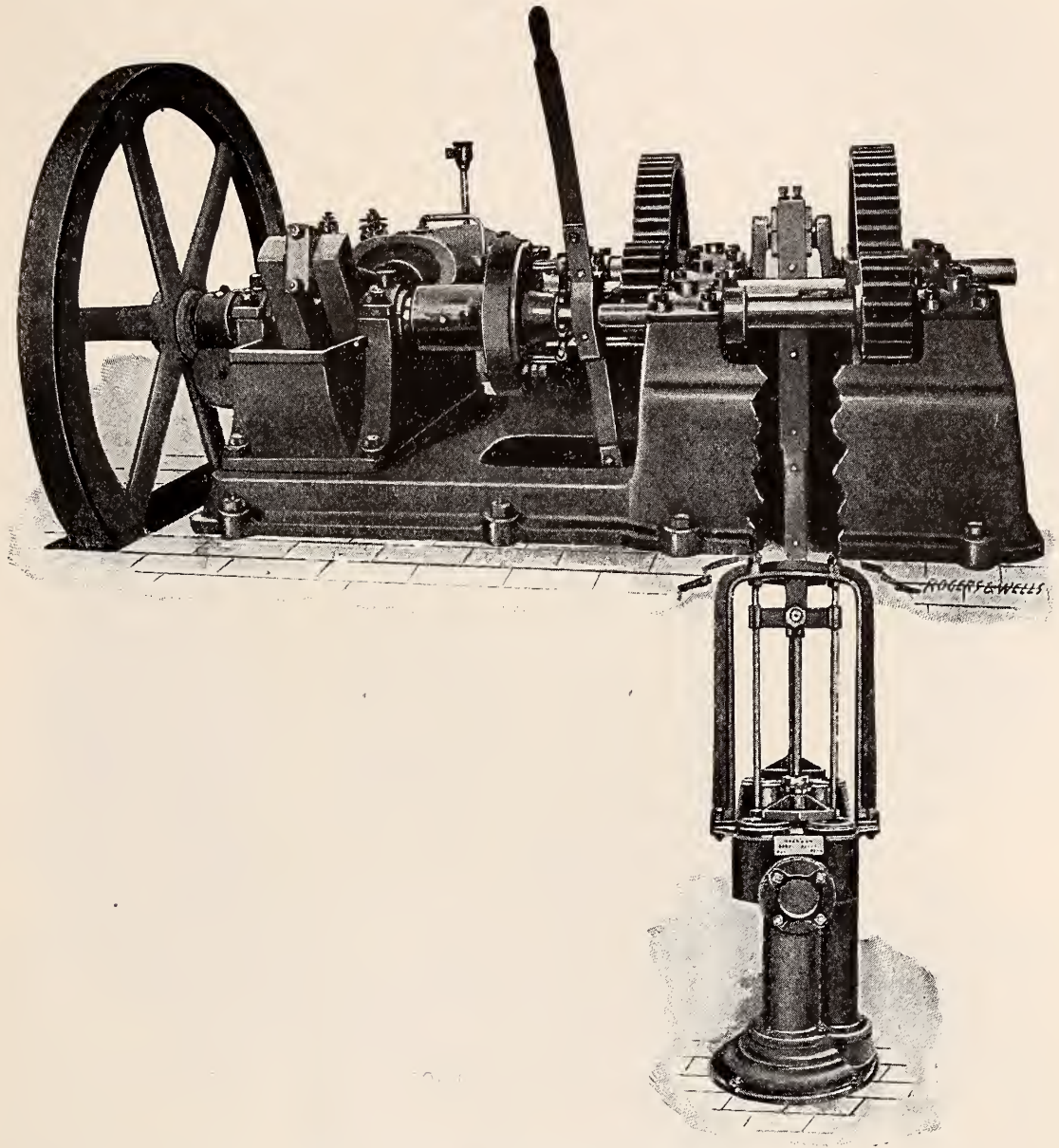


FIG. 3—LOCOMOTIVE WATER SUPPLY

railway service, and much more efficient. This style of pump was not designed for the gas engine nor for the low service necessary at most railway pumping stations. For heavier duty it is an admirable adaptation. Such instances are, however, infrequent.

Cut No. 3 illustrates another type of pump that has been adapted to this service. Designed for railway service, it is much cheaper in first cost, and is comparatively free from oil cups and other appendages requiring frequent attention.

The greater merit of this combination is that the pump can be placed below the frost line; it is always primed and the pump house can be

left safely without a heating stove. Thus very considerable economy is effected in fuel, and particularly in attendance. In all isolated pump houses there is liability of the fire burning out during cold winter nights, and consequent freezing and bursting of machinery, with expensive repairs and costly delays for water. If no provision is made for a stove in the pump house this danger can be almost entirely eliminated. The engine can be drained automatically and the pump can be placed beyond the reach of frost.

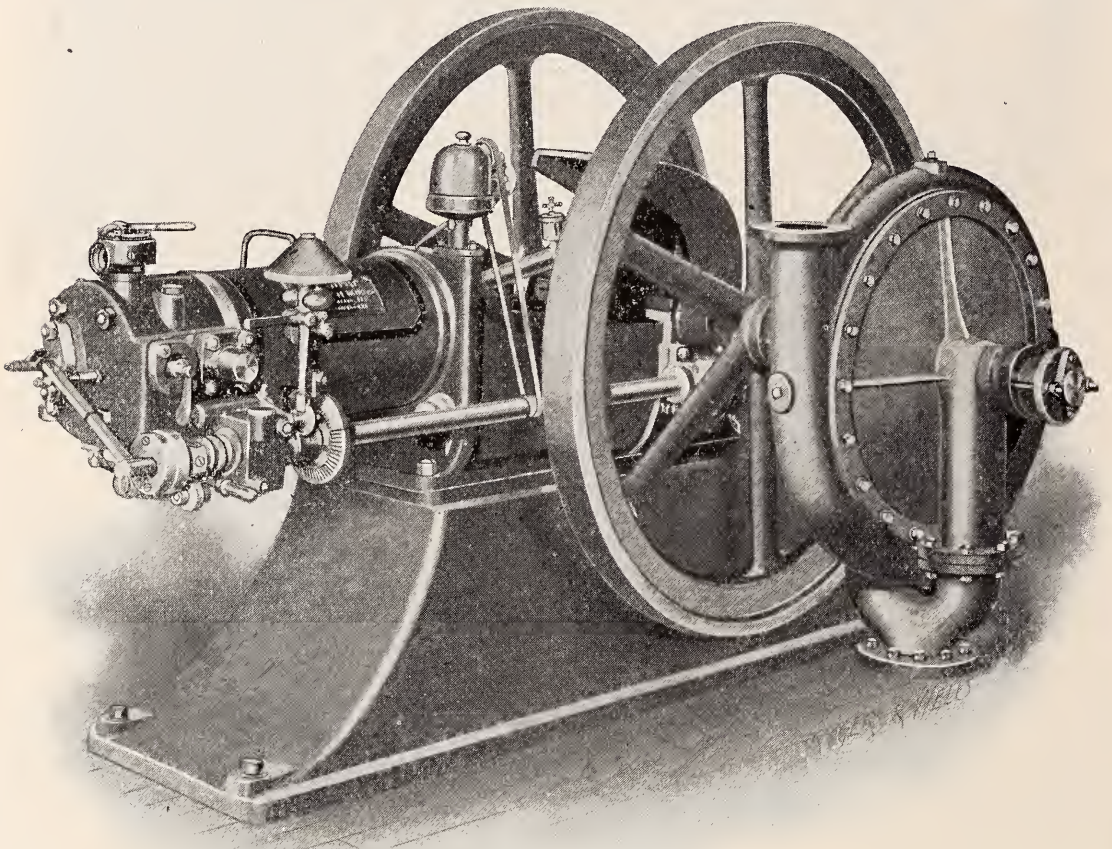


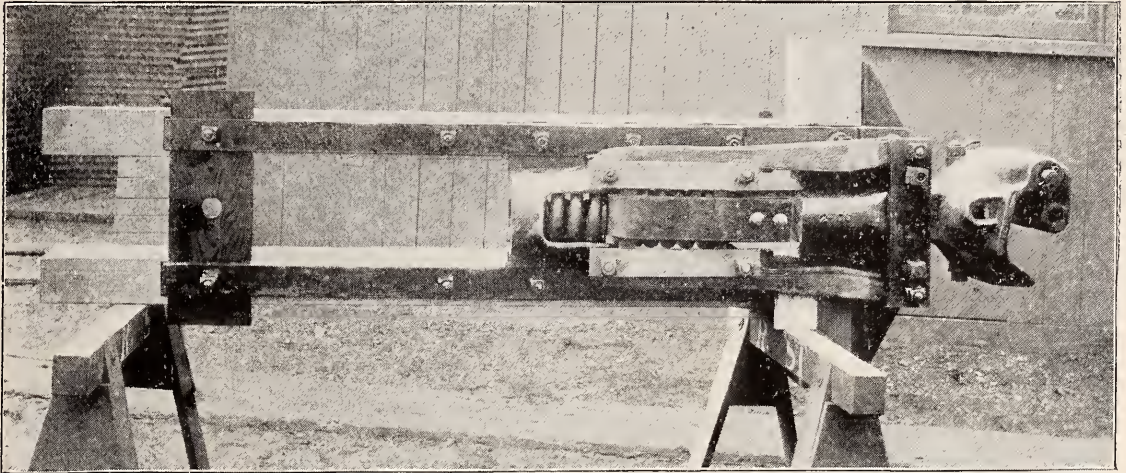
FIG. 4—LOCOMOTIVE WATER SUPPLY

Fig. 4 illustrates a design for low service work that will undoubtedly win its way to favor wherever tried. It will be readily recognized as a "rotary" pump. As shown here, it is directly connected to the engine shaft, though it is better to connect with belt and use higher speed for economical reasons.

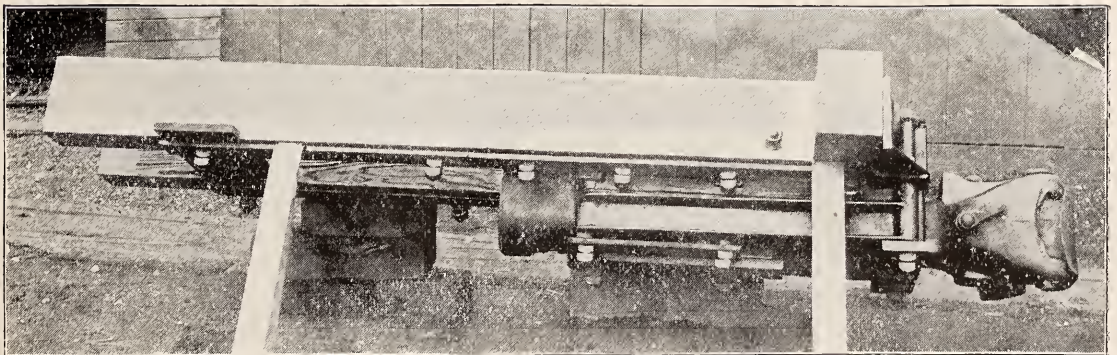
This pump (designed by Mr. John Saltar, Jr.) in a recent trial showed an efficiency of 76 per cent when working against a head of sixty feet. It will be seen at once that to transmit the full power of the

engine to the pump without starting and stopping the discharge column of water two or more times per revolution will be an ideal application. Not only will the first cost of the plant be greatly reduced, but the wear and tear, time in attendance, lubrication, etc., etc., will be greatly simplified.

Further details of construction of this pump will appear in a subsequent article.



BOTTOM VIEW



SIDE VIEW

## A ONE-PIECE METAL DRAFT RIGGING.

The Hien one-piece metal draft rigging, and metal deadwood, cast in steel or malleable, is made so as to bolt to the floor sills and end sill. The advantages of the one-piece draft rigging are that it does away with innumerable loose parts, and is all metal and not a combination of wood and iron, the usual wooden draft sill being dispensed with. It gives two springs to buff on and one to pull on, and is not limited as to the capacity

of the springs used. It only requires two followers and no specially fitted up coupler, but any M. C. B. pocket coupler can be used.

The top line of the one-piece draft rigging has two offsets or steps, one extending up about one inch behind the end sill, and the second, or one nearest the end, extending up about one inch behind the metal deadwood. The latter is bolted to the draft rigging, but it will be readily understood that the pull is taken on the offset and not on the bolts. As the trusses are carried through the metal deadwood the combination makes virtually a continuous draft rigging.

It will be noted that the rigging is tied to the transom by a 4 x 1 strap, which is bolted to and lipped over the transom and securely bolted to the floor sills and draft rigging.

One of the advantages of a metal deadwood and metal draft rigging of this construction is that where a coupler is broken on the road and the car has to be chained up, the coupler on the opposite car does not chew the end sill and draft timbers up before the car gets to its destination. It is claimed in the above construction that no damage can occur to the car.

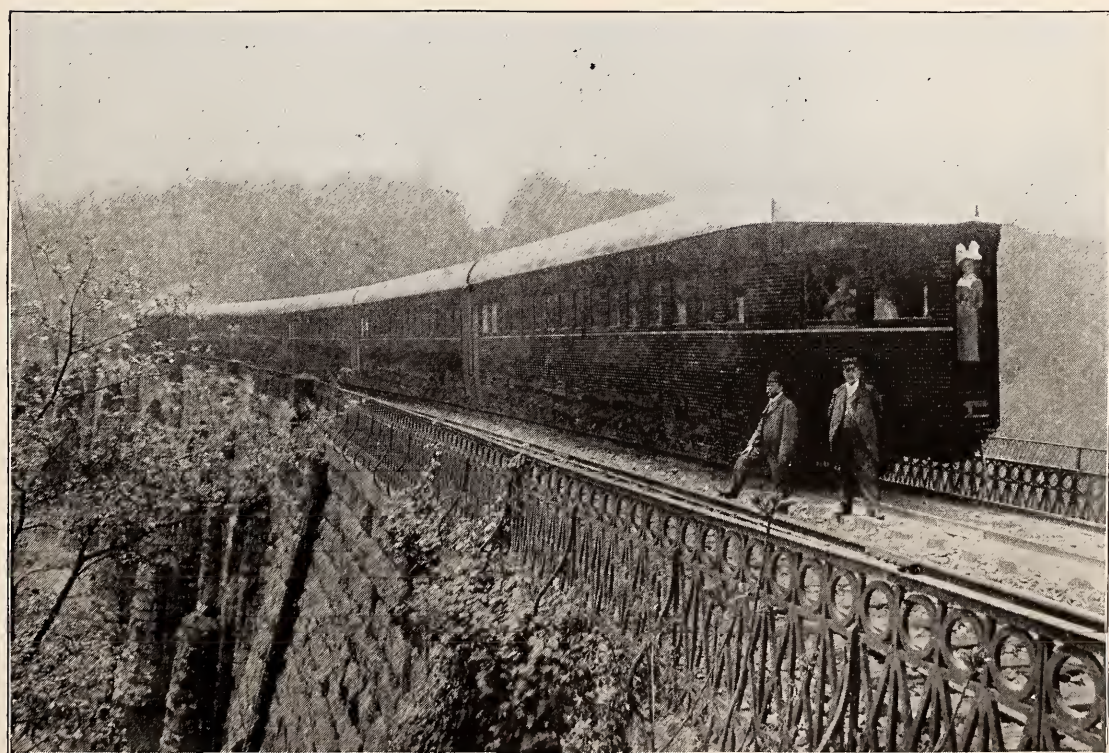
This whole application consists of a one-piece draft rigging (comprising integrally the draft sills) weighing about 215 pounds. This arrangement, the invention of Mr. Philip Hien, is offered by the Railroad Supply Co., Bedford Bldg., Chicago, and will be displayed in full size, fitted to the sills, at the Saratoga conventions

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## THE "WIND-SPLITTER" ON THE BALTIMORE & OHIO.

Some years ago Mr. Frederick U. Adams, then of Chicago, but now of Baltimore, advanced his theories as to the effects of atmospheric resistance upon railway trains. He has recently constructed a train which embodies the essential ideas which he holds should govern car construction in order that this air resistance shall be minimized, and we give herewith two views of his train with which experiments are now being made on the Baltimore & Ohio Railroad.

The theory of the Adams system of passenger car construction is that bodies so shaped as to offer the least resistance to the medium through which they pass can be propelled the more swiftly with a given expenditure of power. He contends that as much attention should be paid to the surface of a car body as to the hull of a yacht or steamship. He, accordingly, as will be seen, adopts for the whole train something of



THE "WIND-SPLITTER" ON THE BALTIMORE & OHIO

a cigar shape. In following somewhat after this shape he claims that it is practical to eliminate from 80 to 90 per cent of these resisting surfaces. Under his plans he claims that ten cars offer but little more air resisting surface than one car. The tender is built up to the height of the car so that there is no break between the engine cab and the baggage car. The windows set flush with the sides of the car. The siding runs lengthwise the car, instead of perpendicular as in the present construction. The panels are removed. The sides of the car extend down so as to nearly enclose the trucks and to prevent the air from impinging against them. The platform doors extend to the bottom of the steps, and are flush with the sides. The spaces between the cars are closed with flexible connections which accommodate themselves to all curves and the various complex motions of a train at high speed. The roof is arched and is perfectly smooth. The rear car tapers to a point. To follow out this idea logically the engine should, of course, be pointed and made as smooth as possible; but in the train now being tested nothing has been done to the engine, as Mr. Adams desires to show that the cars are the greatest violators of the laws of speed.

Another feature of Mr. Adams' system is the ventilating scheme. All the air for ventilation is admitted from the front end of the tender, where there is an absence of smoke and dust. It is carried along passages in the roofs, which connect when the cars are coupled. From these ducts the fresh air is distributed through the train. The value of such a system, if it proves operative, is apparent at a glance. One of the most difficult problems in railroading is to provide pure fresh air to the occupants of a train. It cannot be done so long as the opening of windows is permitted. Mr. Adams is confident that he has solved this problem.

For the experimental train six old coaches have been remodeled. The trucks are of the old-fashioned 4-wheel type with small journals, and the running gear is far below the best standards. Yet for purposes of comparison it is considered to be as good as if built regardless of expense.

Mr. Adams wishes it to be understood that the present train is purely one for experimental purposes, and is not intended to represent his ideal of one for regular use. It will be put to the severest tests, and altered from time to time, so as to ascertain the exact effect on speed of various plans of external construction. We are told that the Baltimore & Ohio Company did not enter upon these tests without a careful study of Mr. Adams' plans, and that their officials are much pleased with the results thus far obtained. The train was constructed at the Mount Clare shops of the Baltimore & Ohio Railroad Company at Baltimore.

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The following report has been furnished us by Mr. Adams of a record breaking performance made by this train between Baltimore and Washington, forty miles:

For two miles out of Baltimore and two miles into Washington slow speeds are necessary by reason of switches, freight yards, and a compliance with municipal ordinances. At Relay, nine miles from Baltimore, the train was slackened to a speed of twenty miles an hour, so as to safely pass the curved viaduct. In spite of all these handicaps the Adams train covered the distance in thirty-seven minutes and thirty seconds, from a standing start in the Camden depot to a full stop in the Washington depot. The train consisted of six cars hauled by Engine No. 857, a locomotive weighing fifty-seven tons and carrying one hundred and sixty-five pounds of steam, with 20x24 cylinders, and four 78-inch drive wheels. A full head of steam was carried the entire distance.

From Annapolis Junction to Muirkirk there is a steady up grade, and from there to Trinidad the track is level or down grade. The total distance from Annapolis Junction to Trinidad is 19.4 miles, and was made in fifteen minutes and twenty seconds, an average speed of seventy-six miles an hour. The following are some sample runs between these points:

Annapolis Junction to Muirkirk, up grade, seven miles in six minutes and seven seconds, a speed of sixty-nine miles an hour.

Muirkirk to Belville, 2.2 miles, in one minute and forty-eight seconds, a speed of seventy-three miles an hour.

Muirkirk to College, 6.6 miles, in four minutes and fifty-eight seconds, a speed of eighty miles an hour.

Muirkirk to Trinidad, 12.4 miles, in nine minutes and thirteen seconds, a speed of eighty-one miles an hour.

Alexander Junction to Trinidad, 4.3 miles, in two minutes and fifty-five seconds, a speed of eighty-nine miles an hour. All of these runs are the record for trains of six cars or more.

The excellence of the record made by the Adams train is found in the fact that it was made with a heavy train and a light engine on a crooked track, with frequent and heavy grades. All previous records have been made under far different conditions.

Tests of this train are, we understand, to continue for some months, with the purpose of positively determining the part played by the atmosphere in limiting the speed of railway trains.

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Fishermen who for years have known what the Fox Lake country (in Northern Illinois) not only promises but gives them in the way of sport, will be pleased to know of the new line which the Chicago, Milwaukee & St. Paul Railway has opened up to that section. That road is now operating passenger service on the new line leaving Chicago for Gray's Lake, Long Lake, Fox Lake and Nippersink at 8:30 a. m. daily, 1:30 p. m. except Sunday, 3:10 p. m. daily, and 5:20 p. m. except Sunday. Returning trains will leave Nippersink 7:15 a. m. except Sunday, 7:20 a. m. daily, 1:00 p. m. except Sunday, 7:30 p. m. except Sunday, and Sundays only at 8:30 p. m. Parlor cars are run from Chicago at 5:20 p. m., and from Nippersink at 7:15 a. m. For tickets, time tables and further information apply at 95 Adams street, or Union Passenger Station, Canal, Adams and Madison streets.

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## SYSTEMS AND EFFICIENCY OF ELECTRIC TRANSMISSION IN FACTORIES AND MILLS.\*

BY WILLIAM S. ALDRICH.

The recent progress in the use of electricity for the transmission of power over short distances has developed a new industry. It bids fair to rival in magnitude and usefulness the field of long-distance transmission, much earlier developed, and now almost exclusively held by electricity. As applied to factories and mills, electricity is simply a means to an end, which is primarily the transmission of power over quite short distances, from 50 to 500 feet, and within one building or a group of buildings. Upon entering this new field it has had to contest every inch of its progress in competition with long-established usage, in order to displace the unwieldy and unsightly power transmissions by shafting, belting, and rope drives. In almost all cases of new manufacturing plants, however, the features of electric transmission have received thorough consideration, resulting in many factory installations in which this system is exclusively used.

Each year more and more machinery is thrown into the scrap heap to make room for new and improved types, yet antiquated and costly methods of transmitting power are left in service. Modern methods of workshop production, in which machine tools are worked up to the power limit, are seen to be sought after, side by side with belted transmission of power, which makes it quite impossible to realize fully the value of the new method, by not giving the operator the utmost freedom of speed control of machine and tool. Electric motor drives provide suitable and quickly adjusted speed ranges under all of the ordinary starting loads of workshop appliances. This has resulted in increasing the output from 10 to 80 per cent, compared with the old and fixed speed conditions with belts and gears.

Electric measuring instruments, such as ammeters or wattmeters, used in connection with the motors operating each machine or a small group of machines, have shown this method of transmission to result in a saving of from 20 to 30 per cent of the power required by the old method. The electric motor is in operation and consuming energy only when needed. It is ready for instant service under any change of conditions of speed or power required by the work. It will meet easily 50

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\* Abstract of paper presented at the Cincinnati meeting (May, 1900) of the American Society of Mechanical Engineers.

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per cent overload, and maintain it for half a day or till the whistle blows. It admits of readiest expansion of workshop facilities, and machines so driven may be placed anywhere to best advantage.

*Electric, Steam, Compressed Air, and Hydraulic Transmission.*

The system of electric transmission for a manufacturing establishment is the only one which admits of economically centralizing the so-called "mechanical plant" supplying light, heat and power. It is a great advantage to be able to locate the power house near coal and water supplies. In some cases it thereby allows the use of condensing engines instead of non-condensing. By adopting electric transmission the engine may be located at any convenient distance from the machines, while shafting transmission imperatively requires that it be located as near by as possible.

If steam power is converted into electricity for all of the mechanical operations of a manufacturing establishment, it admits of a subdivision of the generating plant into duplicate and interchangeable units, the advantages of which will be apparent. The generating plant may be operated at all times in such a manner that each engine is loaded to its normal capacity. One or more units may be held in reserve for rush work and heavy orders. Night shifts can be supplied with power in units suited to their work, rather than requiring the usual single large engine to be operated as in the ordinary day shift. Nearly uniform loads may be maintained on the engines, both day and night, the electric-light load, at night, offsetting additional electric motor service during the day.

In some cases it may be found necessary or desirable to have a mixed system of steam and electric distribution, but it can be obviated, with increased economy, by judicious installation. The use of small steam engines about an establishment, for any purpose whatever, is to be deprecated. The maximum economy today is to be obtained by centralized power generation.

There are, of course, certain operations in manufacturing work best performed by compressed air, while others are best performed by hydraulic pressure. Electricity does not enter these special fields. Compressed air and hydraulic pressure provide means for performing work by the more or less direct application of the energy distributed by these fluids. They would not be seriously considered as suitable systems for general power transmission for such short distances as are required in factories and mills.

For all manufacturing operations (except the very lightest) requiring rotary motion, continuous or intermittent, uniform or variable, and reversible or otherwise, electric motors provide the readiest facilities. For certain very definite reciprocating movements, with fixed time or distance limits, hydraulic mechanisms are best suited, though electric-motor driven hydraulic mechanisms with hydraulic control have proven admirably adapted to this class of work. For reciprocating movements requiring a cushioning effect, compressed air is best adapted. But for efficient service in any case, compressed air requires to be reheated and used expansively in a cylinder with all parts and mechanisms practically the same as in the steam engine. Electric transmission is equally adapted for all of the so-called auxiliary machinery of a manufacturing establishment, the non-productive machinery, pumps, compressors, fans, blowers, cranes, hoists, lifts, etc.

The introduction of electric transmission has been greatly facilitated by the recent standardization of electrical machinery and especially that required for power purposes. This, furthermore, facilitates repairs and renewals, if it were necessary to advance this as an argument in favor of electricity. Fortunately, electric machinery as made today requires the simplest moving parts and the fewest repairs and renewals. Many motors have been in constant service for over six months and have required only a supply of oil. Others have been in service for years, with renewals of brushes only required.

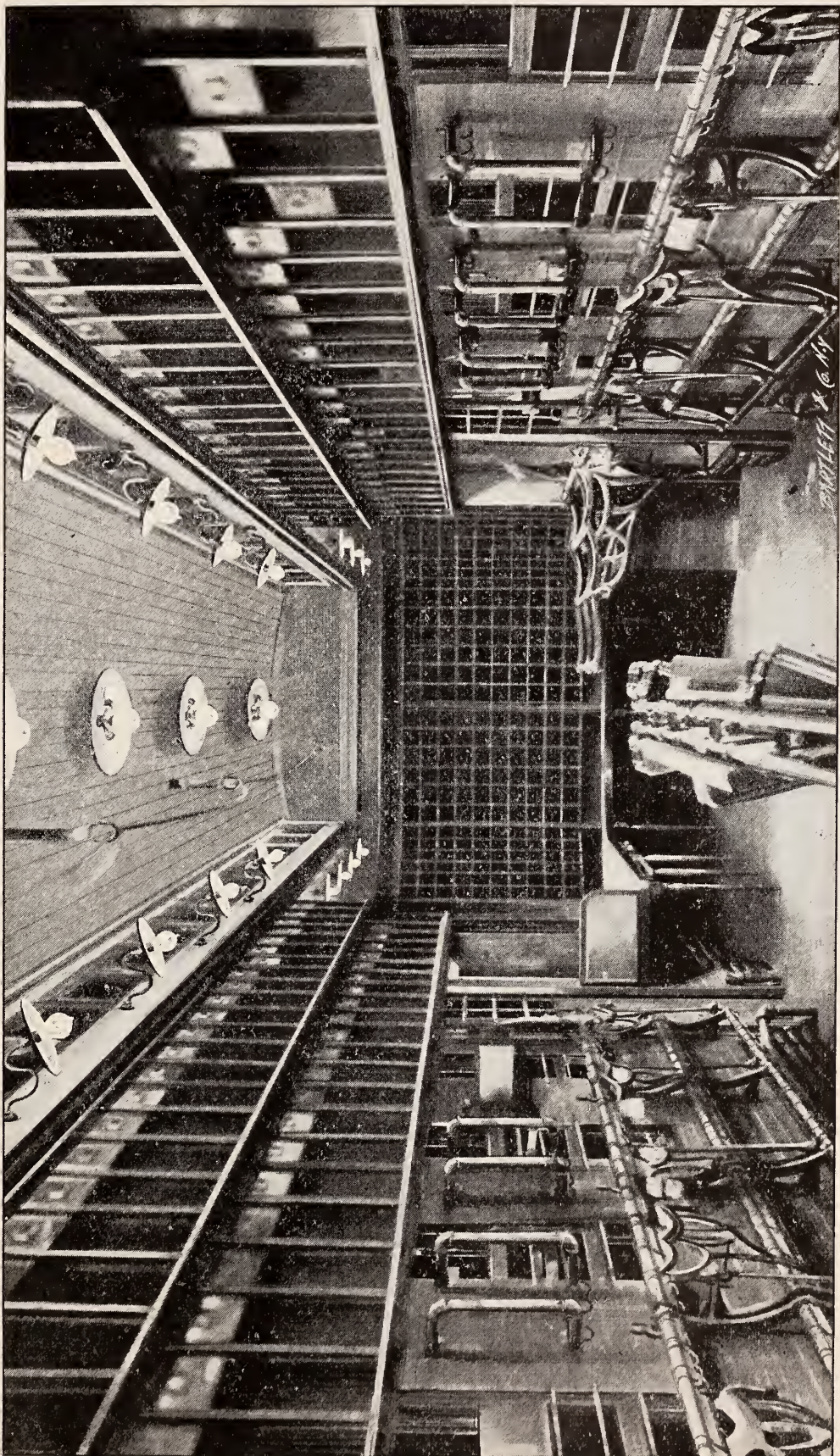
*(To be continued.)*

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### ELECTRIC CAR LIGHTING.

In few branches of passenger car equipment has there been such marked improvement in the past few years as in car lighting. Oil lamps for passenger coaches have long since been superseded by gas on all the leading railways of the country, and now electricity is bidding for favor. After many years of experimenting, a system of electric car lighting was finally evolved and put into practical use by several different companies. This system is known as the "axle light" system, which embodies a simple, independent and complete electric car lighting equipment for each car. An illustration of the distribution of this light in use in United States postal cars is herewith reproduced, showing that the system is an ideal one for these cars, as well as for passenger coaches and Pullman cars. The electricity that illuminates the incandescent lights in the car is generated from the car axle while the car is in motion, and is supplied from a storage battery beneath the car when the car is stationary. It is not the purpose of this article to enter into a technical description of the mechanism of this system of electric car lighting equipment, but rather to bring to the attention of our readers the rapid progress that has recently been made in the introduction and successful operation of this system of car lighting on the passenger coaches of leading railway lines.

The various companies that have for several years been engaged in the manufacture and sale of electric car lighting equipment have, in the past few months, been merged into



DISTRIBUTION OF AXLE ELECTRIC LIGHT IN USE IN U. S. POSTAL CARS

the Consolidated Railway Electric Lighting and Equipment Company, with offices at 100 Broadway, New York city, and with factories in New York and Connecticut. This company is capitalized for sixteen million dollars and has among its stockholders many of the largest and most influential financiers in New York City. Its vice-president and general manager, Mr. Jno. N. Abbott, is widely known among railway officials, having been for many years the general passenger agent of the Erie railroad, and subsequently, for several years, chairman of the Western Passenger Association in Chicago. This consolidated company is now equipping passenger coaches of several leading railways with its system of electric car lighting, and in every instance the system is, it is claimed, giving entire satisfaction to the management of these railways. The system is self-regulating. In other words, it is automatic. The cost of maintenance per car per annum is said to be comparatively slight, while the superiority of incandescent electric lights is universally conceded.

This company will have one of its complete electric car lighting equipments (including the use of electric fans) applied to a passenger coach or private car on exhibition at Saratoga during the June meeting of the Master Car Builders' and the Master Mechanics' Associations, and the members of the associations are cordially invited to visit the car and make a thorough inspection and test of the equipment.

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## PERSONAL MENTION.

On the Lake Shore & Michigan Southern, further reorganization of the mechanical department has been effected. Superintendent of Motive Power Marshall's staff of master mechanics is now as follows: S. K. Dickerson, master mechanic at Cleveland, Ohio; T. E. Graham, assistant master mechanic, at Norwalk, Ohio; J. O. Bradeen, master mechanic, at Elkhart, Ind. His staff on the Lake Erie & Western and Northern Ohio is as follows; Wm. White, master mechanic, at Lima, Ohio; J. W. Kurtz, division master mechanic, at Peru, Ind.; J. W. Mittru, division master mechanic, at Fort Wayne, Ind.; David Anderson, division master mechanic, at Delphos, Ohio.

Mr. D. E. Bloxsom has been appointed master car builder of the Houston & Texas Central, with headquarters at Houston, Tex., vice James McGee, deceased.

Mr. H. A. Ferguson has been appointed assistant engineer of motive power of the Philadelphia & Erie and Northern Central, vice D. M. Perine, transferred.

Mr. John B. Watson has been appointed master car builder of the Nelson Morris & Co. Refrigerator Line, at Chicago, vice Wm. Miller, who, as previously noted, has become master car builder of the Erie & Wyoming Valley.

Mr. John Forster has resigned as superintendent of motive power of the Colorado & Southern.

Mr. James Bruce, superintendent of terminals of the Wabash at Chicago, has been appointed to his former position as chief inspector of fuel and locomotives of the same road, with headquarters at St. Louis, Mo.

Mr. William Mullendorf has been appointed general master car painter of the Illinois Central, vice H. G. McMasters, resigned to go into other business.

Mr. James A. Townsend has been appointed car foreman on the Omaha, Kansas City & Eastern, with headquarters at Stanberry, Mo. Mr. Townsend has hitherto been foreman of car and locomotive repairs on the Chicago & Alton, at Kansas City, Mo.

Mr. W. S. Hancock, division master mechanic of the Santa Fe Pacific, at Winslow, has resigned, with the purpose, we understand, of looking into mining matters at Cape Nome.

Mr. G. W. Jennings, heretofore division master mechanic on the Mexican Central,

has been promoted to the newly-created position of assistant superintendent of motive power and machinery on the same road, with headquarters in the City of Mexico.

Mr. W. T. Reed, mechanical superintendent of the Seaboard Air Line Railway, with headquarters at Portsmouth, Va., has had his jurisdiction extended over all divisions of the Florida Central & Peninsular.

Mr. H. E. Clucas, who has been master mechanic on the Atchison, Topeka & Santa Fe, at La Junta, will, it is reported, be returned to Pueblo as general foreman.

Mr. R. N. Durborrow, master mechanic of the West Philadelphia shops of the Pennsylvania Railroad, has been appointed superintendent of motive power of the Philadelphia, Wilmington & Baltimore, to succeed C. M. Mendenhall, who, as elsewhere noted, resigned to become superintendent of motive power of the Chicago & Alton Railway.

Mr. W. D. Lowrey, heretofore in the car department of the Missouri Pacific, at Fort Scott, has been promoted to be general foreman car department of the same road, at St. Louis, vice Thos. Eubanks, resigned.

Mr. John Higginson, formerly master car builder of the Canadian Pacific, died at his home in Detroit, May 25.

Mr. C. J. Clifford, who has of late been road foreman of engines on the New York Central & Hudson River, was on May 1 appointed general foreman of the Rensselaer shops, East Albany, N. Y., on the same road.

Mr. W. C. Squire, engineer of tests on the Atchison, Topeka & Santa Fe, has resigned to become mechanical engineer of the St. Louis & San Francisco.

Mr. James M. Shackford, mechanical engineer of the Chicago & Alton, has resigned.

Mr. Edward Grafstrom has been appointed mechanical engineer of the Atchison, Topeka & Santa Fe, with office at Topeka, Kan. He was chief draftsman of the Pennsylvania Lines at Columbus for many years until, recently, he was made mechanical engineer of the Illinois Central.

Mr. John Dixey has been appointed master car builder of the Ohio Southern, in charge of car shops and car equipment, vice Wm. Madison, resigned, and all car builders and inspectors will report to him. His headquarters are at Springfield, Ohio, and he reports to the superintendent.

Mr. D. J. Timlin has been appointed general foreman of the Baltimore & Ohio, at Newark, Ohio.

Mr. T. O'Brien has been appointed master mechanic of the Pacific Coast Railway, at San Luis Obispo, Cal., vice Mr. E. F. Lundholm, resigned.

Mr. M. T. Conlon has been appointed master mechanic of the Southern Railway, Charleston and Columbia divisions, vice Mr. James Meehan, resigned.

Mr. C. H. Welch has been appointed master mechanic of the Choctaw, Oklahoma & Gulf, with headquarters at Little Rock, Ark., vice C. Robkin, resigned.

Mr. C. W. Whiting has been appointed mechanical engineer of the Chicago, Milwaukee & St. Paul. Mr. Whiting is a graduate of Stevens and his practical work has been as engineer of tests and mechanical engineer of the Philadelphia & Reading Coal & Iron Co., and later as mechanical engineer with the E. P. Allis Co.

Mr. S. T. Park has been appointed division master mechanic of the Santa Fe Pacific, with headquarters at Winslow, Ariz., vice W. S. Hancock, resigned.

Mr. J. E. Battye, master mechanic of the Norfolk & Western, at Roanoke, Va., died May 17, after a brief illness.

Mr. Alexander Kearney, assistant engineer of motive power on the Pennsylvania, at Altoona, Pa., has been appointed master mechanic of the Pennsylvania Railroad shops,

at West Philadelphia, vice R. N. Duborrow, promoted to be superintendent of motive power of the Philadelphia, Wilmington & Baltimore.

Mr. A. L. Humphrey has been appointed superintendent of motive power of the Colorado & Southern, vice Mr. John Forster, resigned. Mr. Humphrey has been superintendent of motive power of the Colorado Midland for the past seven years, and was for five years previous thereto master mechanic on the same road.

Mr. James McGee, master car builder of the Houston & Texas Central, at Houston, Tex., died early in May. Mr. McGee was born in Ohio in 1833. He first entered railway service in 1861, on the old Pittsburgh, Columbus & Cincinnati, as journeyman carpenter, and on this road he subsequently rose to be master car builder, at Steubenville. In 1874 he became master car builder of the Houston & Texas Central, with which road he had since continuously remained.

Mr. O. M. Stimson has been appointed master car builder of the Swift Refrigerator Lines.

Mr. James Meehan, having resigned the position of master mechanic of the Southern Railway, at Charleston, S. C., was on May 7 presented by the locomotive engineers of the Charleston & Columbia division with a loving cup as a mark of their esteem. Mr. Meehan had held the position for six years.—*Railway Age*.

On the Atchison, Topeka & Santa Fe, the local mechanical department administrations of the New Mexico division and western division have been consolidated under one division master mechanic, who has his headquarters at La Junta, Colo. C. H. Taylor, hitherto division master mechanic at Raton, N. M., has assumed charge of both divisions. All reports and communications heretofore addressed to Division Master Mechanic H. E. Clucas, at La Junta, are now addressed to Mr. Taylor, division master mechanic of both divisions, at that point.

Mr. John Reed, of the drafting department of the Rhode Island Locomotive Works, has been appointed machine shop foreman of the Delaware, Lackawanna & Western, at Scranton, Pa. Mr. Reed served his time in the Rhode Island Locomotive Works, as machinist and draftsman. He then began railway work on the Maine Central and was general foreman at Waterville, Me., for four years. He went from there to the drafting department of the Pittsburg Locomotive Works and back again to the drafting department of the Rhode Island Locomotive Works.—*Railroad Gazette*.

Mr. C. M. Mendenhall, for the past five years superintendent of motive power of the Philadelphia, Wilmington & Baltimore, has been appointed superintendent of machinery of the Chicago & Alton. Mr. Mendenhall entered railway service in 1882 as an apprentice in the Pennsylvania shops at Altoona. He was in the physical test department from 1884 to 1888, and from 1888 to 1890 he served as assistant road foreman of engines on the New York division. In 1891 he was made assistant master mechanic at the Meadows shops, in which position he remained until 1894, when he became assistant engineer of motive power on the same division. He was promoted to superintendent of motive power of the Philadelphia, Wilmington & Baltimore in 1895.

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## SUPPLY TRADE NOTES.

The Hayden & Derby Manufacturing Co., 85, 87 and 89 Liberty street, New York, with factories located at Bridgeport, Conn., have just issued a new catalogue, standard size, 9x12, of 28 pages, illustrating the Metropolitan 1898 locomotive injectors for locomotive service. The catalogue is very complete, showing the various types which they manufacture; also plates showing the specifications as to sizes of pipe connections, and

details as to repair parts. This catalogue also illustrates in detail the H. D. locomotive strainer and H. D. combined stop and check valve, the H. D. swing, intermediate and line check valves, main steam valves and main boiler check valves, all as applied to locomotives. Many of the other products for ejectors and injectors for stationary boilers and locomotives are illustrated in detail. In addition to the usual price list, showing pipe connections, this new catalogue shows the detail tables of capacities with various temperatures of feed water, the range of capacity with various steam pressures and various temperatures of feed water, which is especially interesting to railways and railway men, now that the subject of heating the feed water is being so generally discussed and advocated. The Hayden & Derby Manufacturing Co. will be pleased to mail this catalogue to those interested upon application.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company, and also president of the New York Air Compressor Company, who has just returned from Europe, brought with him an order for twelve air compressors for European shipment. The New York Air Compressor Co. has also received an order for one of their compressors to be shipped to Yokohama, Japan.

A large duplex air compressor has been ordered of the New York Air Compressor Co. to be used in connection with the Standard Railway Signal Co.'s installation on the New York Central & Hudson River Railroad. This machine is the first of two to be located in the handsome engine room of the Grand Central station.

The Ingersoll-Sergeant Drill Co., of New York, had all its air compressors at the Paris Exposition erected and ready to run on the opening day, being the first American exhibitor to operate and the first exhibitor from any country to run its exhibit by steam. Mr. John J. Swann, late associate editor of the *Engineering News*, is in charge of this exhibit.

The Sterlingworth Company's new rolling mill at Easton has just been put in operation. Its capacity is about fifty tons per day, and it will employ about one hundred men.

The New York Air Compressor Co. has received, through the Chicago Pneumatic Tool Co., an order for a compound steam-driven compressor to furnish 1,500 cubic feet of air per minute for the motive power department of the New York Central & Hudson River Railroad. The Compressor Company is also building a large compressor to be placed in the Grand Central station for the operation of pneumatic signals.

The great woodworking machine company, J. A. Fay & Co., of Cincinnati, Ohio, and also The Egan Co., are making a great display of woodworking machinery at the Paris Exposition. They will illustrate and show in operation complete equipments on the American plan for car shops, railway shops, arsenals, shipyards, furniture factories, chair factories, joinery shops, saw and planing mills, and in fact all machines for working wood, complete and in the most improved American state of the art. Competent parties are in charge to illustrate and show what each machine will do. They also have a complete band saw mill, which will cut timber on the most advanced and improved principle, and will cut quarter oak and also short wood to the very best advantage. We advise all our mechanical friends interested in this branch of the business to see both of these firms exhibit at Paris.

The improved Michigan locomotive lubricator, with automatic steam chest plugs, has forged ahead so rapidly that the Michigan Lubricator Co. have found it necessary to enlarge their plant five times within the last three years. The question of overcoming "hold up" of oil in the tallow pipe having been solved in this device, it has been adopted and is in extensive use by many of the largest lines in this country and also in Europe. The auto-positive check valves, the first of their kind, and the new auxiliaries, to operate whether the locomotive throttle is open or closed, having proven, with the automatic steam chest plugs, extremely satisfactory, many large orders having been received unsolicited, evinces the fact that the improved Michigan lubricator speaks for itself. It is manufactured by the Michigan Lubricator Co., whose address is 661 to 671 Beaubien street, Detroit, Mich.

The Safety Appliance-Equipment Co., of Boston, will exhibit at the Saratoga convention the Graham "equalizing brake expansion" on a Boston & Albany coach. The car will be operated twice a day for the benefit of visiting officials.

All persons interested in the subject of protective paint for steel structures will receive a handsome card illustrating several eighteen story steel structures upon which Dixon's Silica-Graphite Paint has been used, if they will send their address to the Joseph Dixon Crucible Co., Jersey City, N. J. The card also contains suggestions for specification of the paint, and its well known durability has led to its specification and use upon many immense steel viaducts, bridges and manufacturing plants all over the world.

The Ball Bearing Company of Boston, Mass., has issued a neat little "Twentieth Century" catalogue, which fully describes and illustrates its remarkable line of ball and roller bearings for all kinds of machine construction. There seems to be little or no field wherein any ball or roller bearing may happily fit in which is not already covered by this firm, adaptability to all practical conditions appearing to be a characteristic result of General Manager Rogers' study. The baby again appears on the catalogue, "in enlarged detail," however, and this may be taken as indicative of the growth of the company's business since last year.

The Chicago, Rock Island & Pacific is equipping its passenger coaches with the Standard steel platforms, manufactured by the Standard Coupler Company of New York. It is understood that all of the important passenger coaches of this road will be fitted up with this valuable improvement.

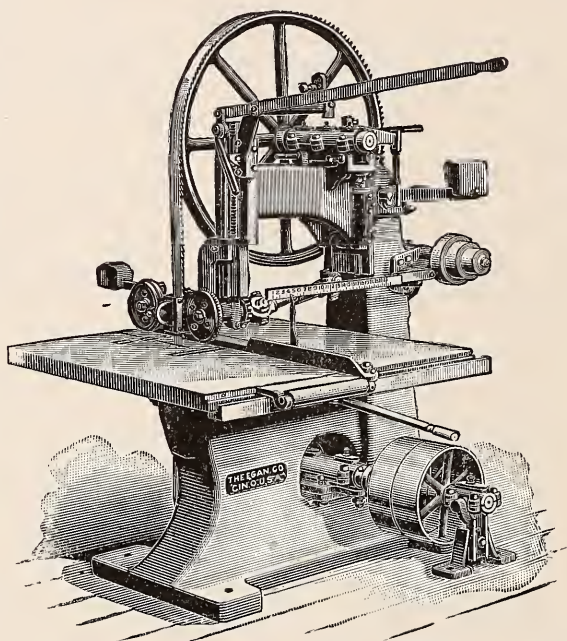
### A NEW AUTOMATIC BAND RIP SAW.

We illustrate a new machine, just brought out and placed on the market by The Egan Company, Nos. 216 to 236 West Front street, Cincinnati, Ohio, and patented February 27, 1900. It is their new automatic band rip saw.

This machine will, it is claimed, do the work of several circular rip saws, and is much safer to operate, as there is no danger of the material being thrown back and striking the operator. The saw blade is very thin and removes only a slight kerf, which is quite an item in ripping fine lumber. It will rip one inch or nine inches thick with equal facility and without changing blades. The adjustments are made very rapidly. The column is very heavy, cored, and perfectly free from vibration. The table is of ample size, always level, and has at the front a plainly stamped index.

The straining device is new and sensitive, and has a forward, backward and side adjustment. The feed is very powerful, and, both feeding-in and feeding-out rolls being placed close together, short stock can be worked to advantage.

Where flooring and narrow stuff is made in large quantities this rip saw can be fitted with "live rolls," which will return material to the operator for another cut, thus making it a labor saver. The manufacturers will willingly furnish prices and full particulars on request, and will also forward their new illustrated catalogue free.



AN EXPERIENCED railway equipment salesman and practical locomotive engineer, acquainted with ninety per cent of the railway officials in the United States and Canada, desires to make a connection with some responsible house. Address Salesman, care Master Mechanic.

WANTED—Position as master car builder, or foreman of car shops, by an experienced practical car builder. Thoroughly up to date. Accustomed for years to handling men. Address D. T. T., care of Railway Master Mechanic.

SITUATION WANTED—Young mechanical draftsman, twenty-nine, machinist, inspector, and thoroughly conversant with modern locomotive work; thorough, careful and accurate; can systematize work of motive power department; is open for engagement as head draftsman with railroad or system. References as to ability and character. Address, "Draftsman," care Railway Master Mechanic.

# RAILWAY MASTER MECHANIC

WALTER D. CROSMAN, EDITOR.

WILLIAM E. MAGRAW, MANAGER.

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CHICAGO, JULY, 1900.

No. 7.

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## The Work of the M. C. B. Convention.

The management of the M. C. B. convention, so far as the work of the President, Mr. Schroyer, was concerned, was almost ideal, and the proceedings were conducted in a dignified and business-like way. For this reason the convention was often ahead of its time-table, and there was ample time to complete the program without hurry at the last, which is not often the case. There was no question of prominent importance before this convention, and none of the reports are remarkable as exhibiting extended original research or as recommending any changes or improvements of far reaching interest.

The rules of interchange were revised, with few alterations, and without much discussion, the question of prices really occupying more time than those of principles.

The topical discussions continue to be a very useful feature of the convention, and in some cases were as valuable as committee reports.

The discussion on the repairs to pressed steel trucks showed that the small amount of work which has thus far been done, can be performed more cheaply at the home shop, than by sending the trucks to the manufacturers. The same will doubtless be true of pressed steel cars, but the attention of builders of both trucks and cars made of pressed steel is called to the importance of simplicity in design, always having in view the possibility of repairs, without too much loss of time, in the shops of foreign roads.

The question of re-weighing cars by foreign roads as a matter of interchange and charge, was discussed and the scheme received favorable indorsement, but was referred to a committee for report next year.

The experience of this convention teaches that changes in existing standards should not be made by a vote of the meeting before they have had intelligent consideration by a special committee similar to the one which originally created the standards. This was well illustrated by the

proposition to change the specification for steel axles by reducing the per cent of carbon, and to reduce the diameter of wheel seat of 80,000 pound axle from  $6\frac{1}{4}$  to 6 inches, the diameter now being  $6\frac{3}{8}$  inches. Both these standards had been established by a committee which made a careful study of the subject, and it was a wise decision, therefore, not to change them without first submitting the matter to a judgment equally well informed.

The proposition to close the slot and pin hole in the M. C. B. knuckle is one which will gradually settle itself. Solid knuckles will be used in larger numbers every year, and their introduction will lead to methods and devices which will meet all the requirements which the old knuckle provided.

The report on tests of triple valves was necessarily brief, as no tests had been made; and the discussion was equally brief, as it would soon lead to delicate commercial questions which members preferred not to stir up. Well informed members of the committee now believe that the vote of the convention to make no change in the standard requirements for triple valve tests leaves the subject in better shape than ever before. The real question at issue last year remains this year, and it is this: Should the M. C. B. Association obtain and test the New York triples without their consent? The association thought it important to make such tests, and the committee was appointed for the purpose. The act of the New York company in refusing to furnish the triples does not change the fact that information relating to their working when mixed with the Westinghouse valves is still very desirable. The enterprise of a railway paper and that of one or two progressive railways, is now performing the work which was expected of the committee. The only reason given by the committee for not obtaining the valves without the consent of the New York company and making the tests, is the fact that no precedent exists for it. In this important matter, conditions are different from any existing in the past, and action should be on things as they are, and not as they were when no such large interests were involved.

Slow progress is also indicated by the report on tests of brake shoes, though the subject has, by the action of this convention, been advanced to the stage when a specification for brake shoe metal based on the coefficient of friction will be developed. The committee is now instructed to make such tests as railway companies may request. The subject is now in such shape that we believe more progress will be made in the next year than in the past five years.

The report on freight draft gear is one of the old time variety, giving questions and answers, and an analysis of the different draft gear as they exist today. While this may seem a historical introduction to the subject, it can do very little good, as the problem has advanced away beyond the ordinary type of wooden draft timbers, and must now deal with a substantial metal structure. The use of the 50-ton steel cars in interchange will be so destructive to the ordinary wooden draft gear that one must soon be developed which will have resistance and durability equal to the steel construction. There is too wide a gap between wood and steel draft timbers to make it worth while patching up the former with metal, and a straight metal draft gear is the only one which should now be seriously considered by the committee as worthy of tests, and the report should be confined to this, unless it be to show, in a striking and convincing manner, the weakness of wood construction in the vital parts of modern cars.

Side bearings and center plates are becoming more interesting as the loads on them increase in large capacity cars. The service they are now compelled to perform is such as to warrant something better than rough and unlubricated sliding surfaces. The reports show that it is not possible to adopt standards for these details, but they call attention to the excessive loads per square inch now imposed on these details and the value of anti-friction devices in reducing the work required for their movement. The committee favors the concentration of the load on the center plates and, by the use of stiff bolsters, the maintenance of a constant space between side bearings. We are inclined to differ from this opinion and rather favor a larger expense for both center plates and side bearings, and the use of roller bearings in each. Successful side bearings with rollers have already been developed, and those in service two or three years were exhibited at Saratoga. Roller bearings for center plates have not yet been brought forward prominently, but we believe that the large capacity car requires something of this kind for its successful working, and that it would pay to spend a sufficient amount for that detail to make it an anti-friction device. The committee this year will have charge of both center plates and side bearings, and we trust they will make such thorough tests and investigations as will place the subject in a more satisfactory condition than it has ever been.

It should be noted that the subjects for next year deal almost entirely with questions relating to steel cars and the details of cars of large capacity.

Taken as a whole, the convention was quite successful, in spite of the fact that the reports were of rather an ordinary character and the discussion on them confined to very few members. It is certainly remarkable that in an association of over four hundred members, only six or eight should take an active part in the proceedings of the convention.

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## The Work of the Master Mechanics' Convention.

The first day's work of the Master Mechanics' Convention was a good illustration of the antiquated methods used in conducting the business of this association, and the lack of efficiency in its workings generally. This is largely due to the constitution and by-laws, which have been patched up from time to time, but have never been submitted to a thorough revision.

The admirable report of the committee on increased usefulness of the association contains numerous recommendations, which, if approved and carried out, will have a wonderful effect in clearing away many of the obstructions which now impede the free flow of the proceedings, and will introduce new and more progressive methods in the general conduct of the association. Nothing more important or far reaching in its good effects has occurred at a master mechanics' convention than the passage of the resolutions which form the conclusion of the above report. We regard this as the prominent feature of the convention, and one which will mark it as the time at which the association began to take on a new lease of life, and really increased its usefulness in a surprising manner.

The report of the committee on flanged tires for six and eight-wheel connected engines, while signed by experienced and responsible members, is evidently the work of an amateur, and the bulk of it, especially that relating to the dynamometer tests, is not worthy of record in the proceedings. And here we would quote with emphasis, a section of the report on "increased usefulness," on the character of reports, viz: "Some of the reports presented to the association are not prepared with sufficient care and are not thoroughly reliable." Railroad mechanical officers should feel that the information presented in these reports is the result of facts carefully determined under conditions best calculated to reveal the truth.

One of our objections to the report on flanged tires is, that the bulk of the report is made up of dynamometer diagrams and tables which have little meaning at best, and which are neither described or discussed. A so-called interpretation of the dynamometer records is really a description of the car, with which every one is familiar. The amplitude of vibration of the pencil in making the record is, in most cases, equal to the distance of the mean line from datum, and the actual pull cannot, under such conditions, be measured with the necessary degree of accuracy. When the speed per mile is given in the tables in decimals up to a ten thousandth of a mile, we are led to suspect that the actual readings are not correct within a half mile. The fact that a difference of a mile per hour should make little, if any, difference in the results, makes such records appear ridiculous. We question, also, whether the tractive resistance of an empty engine *hauled* is anything like that of the same engine when hauling a train. While we agree with the committee, in its conclusions, that it is desirable to have flanged tires on all drivers of mogul, ten-wheel and consolidation engines, such conclusions are not justified by the few dynamometer tests which the committee have had made and recorded. Our reasons are based on the good results in traction and tire wear obtained from numerous locomotives so arranged and in service for a number of years. The discussion of the report was simply a confirmation of this opinion.

The report on the ton mile as a basis for motive power statistics is an enthusiastic argument in its favor, but the recommendations are, perhaps, too far reaching in their application. The committee is not united in its recommendations, and the discussion of the report shows a discouraging confusion in the present methods of keeping ton mile statistics. The question will require vigorous action by an authoritative organization like the American Railway Association before it is rescued from the almost hopeless confusion into which it is rapidly getting.

The report on compound locomotives is a complete exposition of the state of the art at the present time, and the discussion on it was unusually interesting and instructive. Whatever change or correction the report required was well developed in the discussion, and both bore strong testimony in favor of compound locomotives, showing that they have in this country advanced beyond the experimental stage and must now be accepted as representing the best practice for both passenger and freight service.

The topical discussion on the limit of length for 2-inch tubes, brought

out some surprising facts, showing the practice of using such tubes; 16 feet long is not now unusual. In Russia they have been used as long as 17 feet 5 inches, and Mr. Vauclain expressed his opinion that there would be no objection to 2-inch tubes 20 feet long if required.

The report and discussion on bearing metal was quite favorable to soft metal bearings, and the value of a large per cent of lead was explained in a clear and convincing manner by Mr. Clamer.

The discussion on piston valves was entirely in their favor, and a number of important points, explaining recent practice, were brought out. The central admission type was generally favored, and it was shown that the irregularity in valve motion usually found with this type could be best corrected by the use of a direct motion from the link block; that is, a form of rocker which does not reverse the motion of valve rod with respect to the link block. Many forms of packing rings have been used with piston valves, but it is now thought that an ordinary snap or spring ring will be found as satisfactory as any.

The report on electric power transmission in railway shops is very conservative, and shows the value as well as the limitations of that form of transmission. The advantage, so far as fuel economy and cost of maintenance is concerned, is not thought important. The chief benefit to be derived from electric power is found in its saving of labor in a variety of ways, due to its convenient application and general adaptability.

One of the best points made in the discussion on pooling was that of Mr. Henderson, who claimed that locomotive design and proportions change materially every ten years, and that it is better to wear out an engine by large yearly mileage in ten years, and then get a new one, up to date in its design, than to run the engine on so small a mileage that its life will be twenty years, during the last ten years of which the engine must be regarded as a back number.

Taken altogether, the Master Mechanics' convention was a notable one, on account of the high character of the reports and the unusual interest in the discussions; but, like the Master Car Builders' convention, it is unfortunate that so small a portion of the membership takes an active part in the proceedings.

## A NEW DYNAMOMETER CAR—ILLINOIS CENTRAL RAILROAD AND UNIVERSITY OF ILLINOIS.

In our last issue we had something to say about the road testing work with dynamometer cars which Prof. L. P. Breckenridge, of the University of Illinois, had been doing, and about what he proposed to do, particularly with his new car. His first car, built jointly with the Big Four road, we described quite fully in our issue of June, 1899. The new car, built jointly with the Illinois Central, follows the same principle as the first car, and forms the subject of our present illustrations. From the following description (which is written for our pages by Mr. Edward C. Schmidt, instructor in railway mechanical engineering in the University of Illinois) it will be gathered that the chief difference between the two cars lies in the dynamometer proper, which consists of three cylinders set tandem, instead of the single cylinder used in the first car. Mr. Schmidt's description follows:

The car is now being built at the Burnside shops of the Illinois Central Railroad, at Chicago, and is expected to be completed and ready for operation about July 1. It will be owned and operated jointly by the Illinois Central Railroad and the Railway Mechanical Engineering Department of the University of Illinois, the car being built by the former, and the apparatus and other equipment by the latter.

The car is designed for general railway experimental work and will be adapted for the following purposes, for each of which it has its special equipment:

1. Measurement of train resistance.
2. Autographic track inspection.
3. Locomotive road tests.
4. Air brake tests.
5. Station tests.

Hydraulic transmission of the pressure and motion has been adopted for both the apparatus for dynamometric work and for track inspection; the latter, however, is not being at present installed.

The car has been designed under the direction of Mr. Wm. Renshaw, superintendent of machinery, Illinois Central Railroad, Professor L. P. Breckenridge, of the department of mechanical engineering of the University of Illinois, and Edward C. Schmidt, instructor in railway mechanical engineering of the same university.

The car itself has been specially designed for this work and is shown in plan in Fig. 1. It has been built particularly heavy, in order to withstand the usage it will receive in the heaviest freight service. It is 45 feet 4

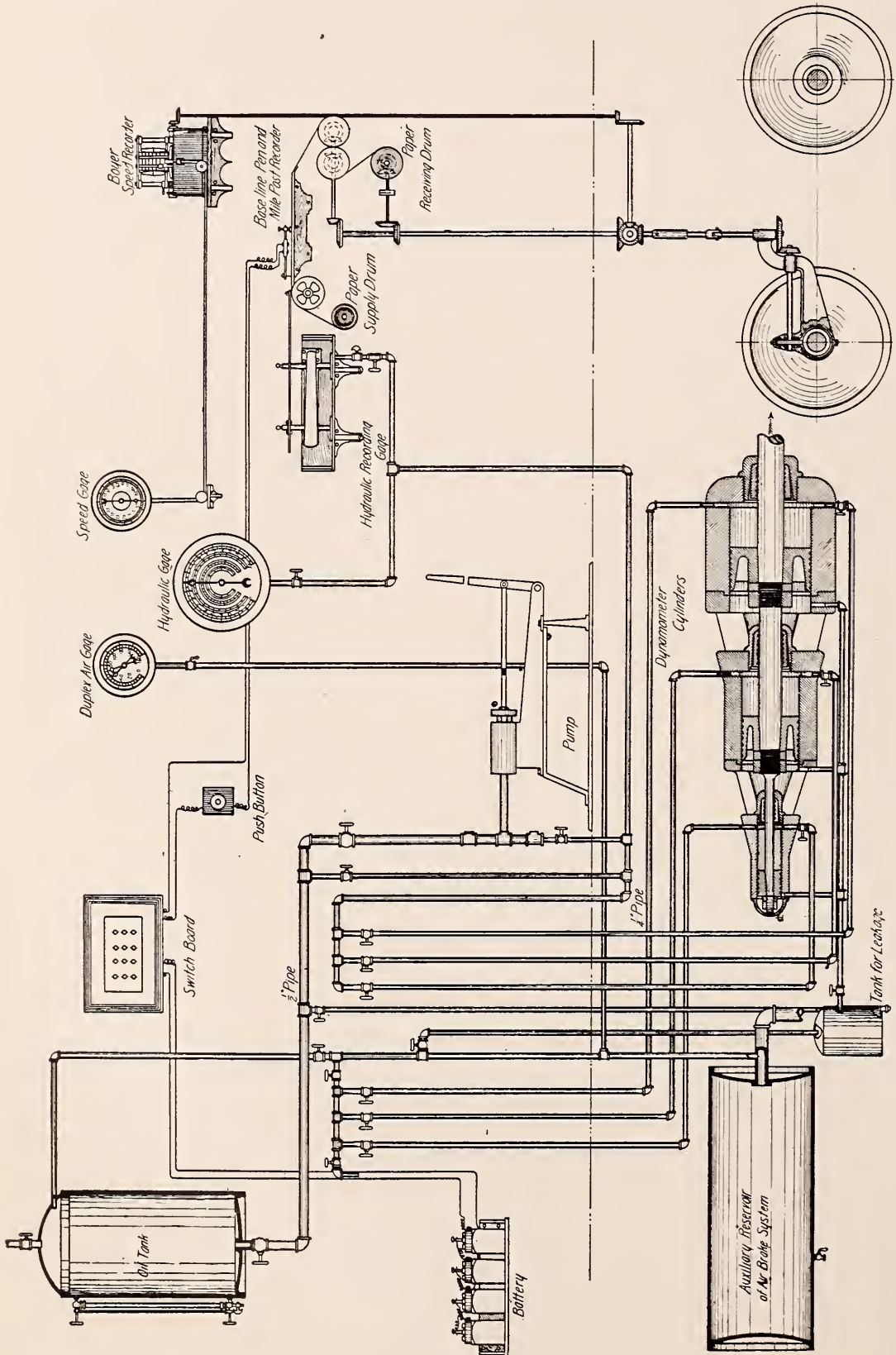


FIG. 2—A NEW DYNAMOMETER CAR.

inches in length and 40 feet over the end sills, which is as long as is compatible with the necessary stiffness and rigidity. It is 8 feet  $4\frac{3}{8}$  inches wide inside, and 9 feet  $1\frac{5}{8}$  inches outside, with an extreme width of  $10\frac{1}{2}$  feet over the observation windows. About 15 feet in the rear end is occupied by the berths, lockers, closets and toilet room, leaving 25 feet working space in which are placed the tables and instruments.

A lookout in the rear of the car affords facilities for observing the handling of the train, and in it are placed the push-buttons controlling the signals to the operators below, and also controlling the pens which mark on the dynamometer record the location of mile posts, stations, curves and grades. The projecting windows at the front end also provide a means of watching the train and engine.

The next three figures show the general arrangement and some of the details of the apparatus used in experiments for the measurement of train resistance, which constitutes at present the more important part of the equipment, the track inspection apparatus not being designed as yet.

Fig. 2 is a diagram showing the various parts of the apparatus in their relations to one another. As previously intimated, the pressure due to the pull on the drawbar is taken in a cylinder filled with oil, and this pressure transmitted thence by the oil to the recording and indicating gauges in the car above. The record of the amount of drawbar pull is made on a continuous strip of paper, 6 inches wide, which is drawn past the marking pen on the recorder at the rate of 13.2 inches per mile. This paper is driven from the car axle, as indicated, and upon it are marked, in addition to the curve showing the pull on the drawbar, the location of mile posts and stations, and also time.

The mile post pen, which is controlled by electro-magnets, draws a continuous line, and at mile posts and stations is drawn slightly aside by these magnets, which are operated from a push-button touched by the observer in the lookout. The pen recording time is similarly made, and is automatically controlled by a clock which makes electric contacts every 5 or 10 seconds, as desired. A speed record is also obtained upon a separate chart in the speed recorder shown at the right.

The oil pump receives its supply from the oil supply tank, and by properly arranged piping, forces it into the three cylinders of the dynamometer.

Compressed air, taken from the auxiliary reservoir of the air brake system, is used to clear the oil from the cylinders when necessary, and

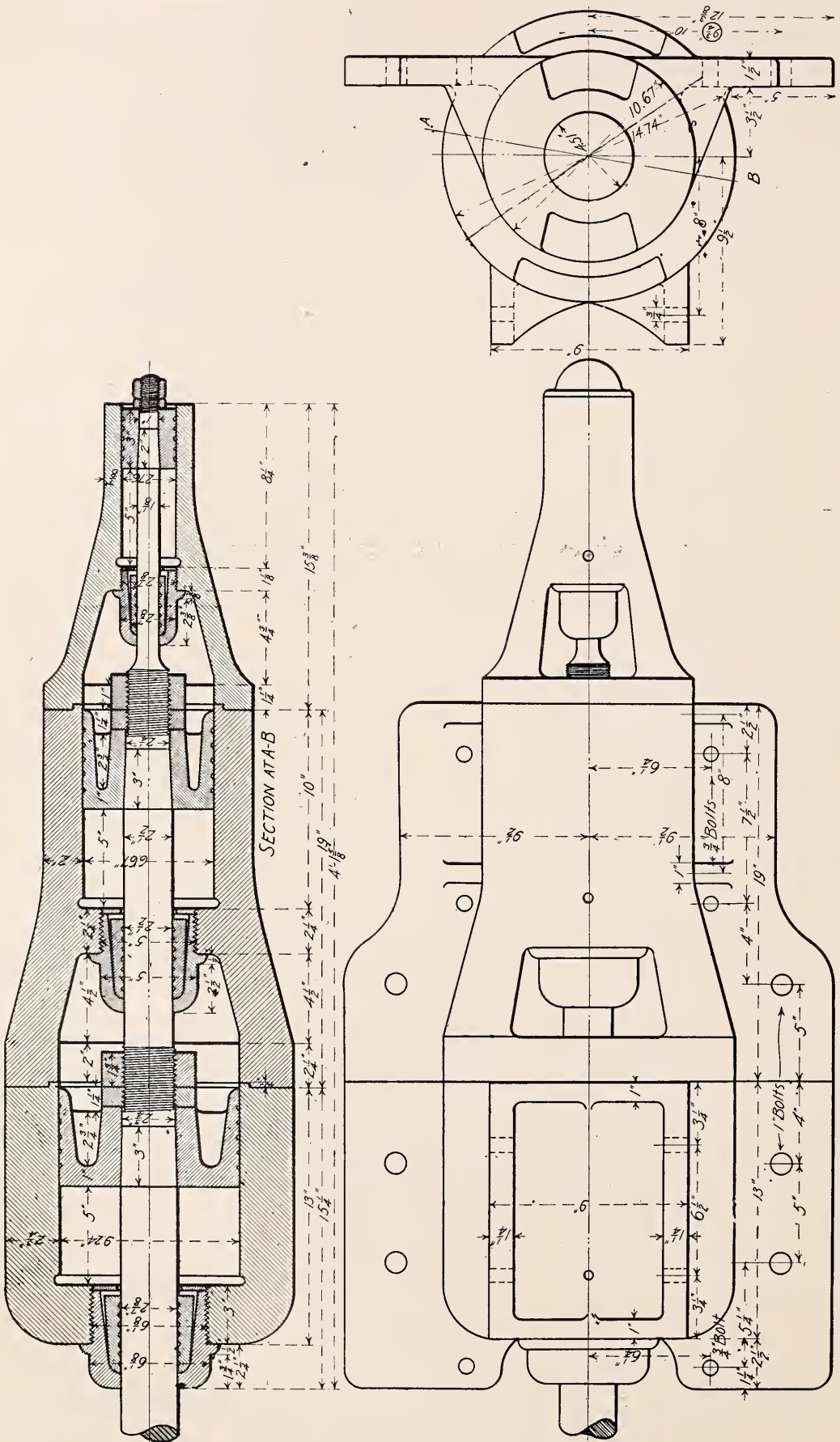


FIG. 3—A NEW DYNAMOMETER CAR—THE CYLINDERS.

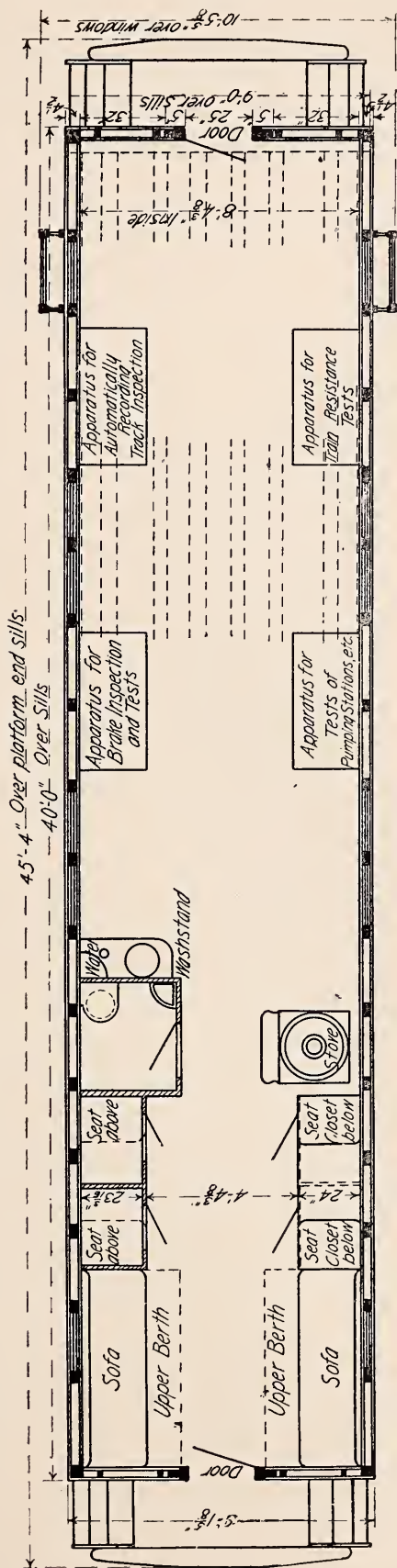


FIG. 1—A NEW DYNAMOMETER CAR—FLOOR PLAN.

also to aid in filling them and to blow back from the leakage tank whatever oil leaks by the pistons and stuffing boxes of the three cylinders.

From the switch-board, electric connections are made to the various signals and pens, to the revolution counter in the car which shows the revolution of the driving wheels, and also to the electric signals for indicator cards at the front end of the engine.

The dynamometer cylinders are shown in Fig. 3. They are made in three castings, held together by stud bolts not shown in the drawing. The effective area of the largest cylinder (No. 1) is 60 square inches; of the second (No. 2), 30 square inches, and of the smallest (No. 3), 5 square inches. It is intended that the working pressure of the oil in the cylinders shall be from 300 pounds per square inch, to 1,000 pounds per square inch and for this range of pressures cylinder No. 1 has sufficient capacity for the heaviest freight service; No. 2 will be used when working with a train of ordinary tonnage, while No. 3 will be used for passenger service. In this last case the working pressure may be somewhat higher. If it should become necessary, cylinders 1 and 2 could be coupled up in tandem, thus giving an effective piston area of 90 square inches.

The piston rod is connected to a drawbar yoke of special design, and is so arranged that when the piston

travels forward too far beyond its working position the pull is taken on the springs of the ordinary drawbar rig. Pushes on the rod are likewise received immediately upon these springs. An electric "tell-tale" arrangement notifies the operator when the piston passes its proper limits on account of the leakage of oil.

The cylinders are reamed, the pistons ground, and the piston rod ground where it moves through the stuffing boxes. The stuffing boxes were designed particularly for this arrangement, and consist essentially of the inner sleeve or gland, which is ground internally to fit the rod, and grooved, as shown, to help retard the leakage. The forward end of the gland is ground spherical, and fits into a ground spherical seat in the stuffing box casting. This spherical seat is used to permit the three sleeves to align themselves properly on the rod. The pressure of the oil keeps the gland on its seat, and this oil pressure is supplemented by the pressure of several helical springs placed between the rear end of the sleeve and the plate shown at the inner end of the stuffing box.

Considerable difficulty was experienced in making the joints between the cylinder and pistons and between the stuffing box and rod sufficiently good to prevent undue leakage; but this has now been accomplished, and the leakage under the upper limit of the working pressure, i. e., 1,000 or 1,200 pounds per square inch, is not sufficient to in any way interfere with the proper working of the apparatus. The pistons will move forward on account of the leakage, but so slowly that the cylinders can be refilled from the pump at stops, or, if necessary, when the cylinders are under pressure.

This design was resorted to, in order to avoid the uncertainty concerning the frictional resistances incident upon the use of the usual packed pistons and stuffing boxes.

The cylinders have been calibrated, in connection with their gauges, upon an Olsen testing machine, and the total pull on the rod necessary to overcome the friction in the apparatus found to be about 30 pounds. The cylinders are secured to the draft timbers by means of the flanges shown at the sides and top.

In Fig. 4 is shown the table upon which are placed the dynamometer recording gauge, the rolls for driving the paper chart, and the Boyer speed gauge. The vertical shaft shown projecting through the floor under the middle of the table derives its motion from the car axle, by means of spiral gears and bevel gears. Its motion is transmitted, by means of the gears shown, to the speed gauge and to the paper driving

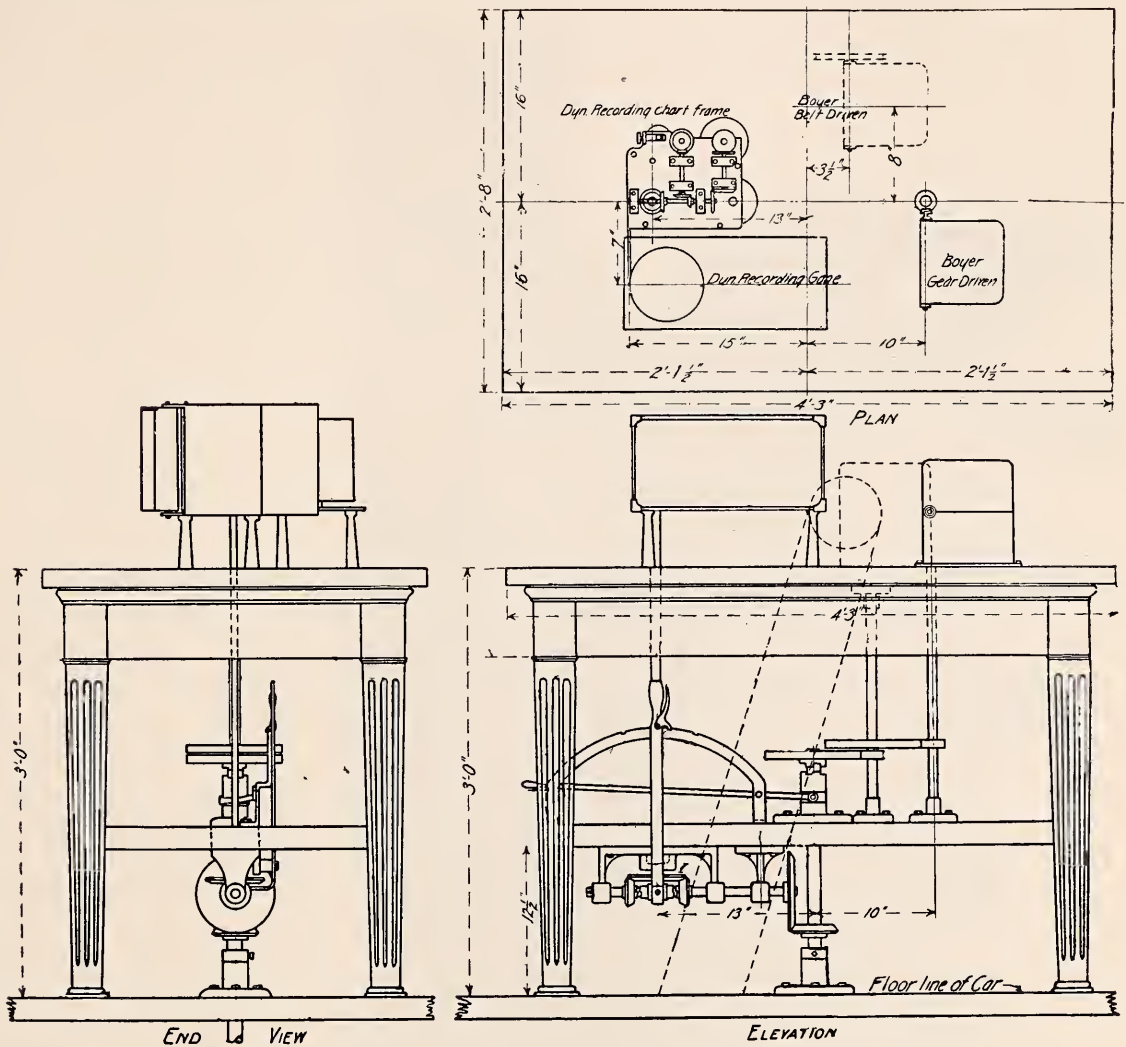
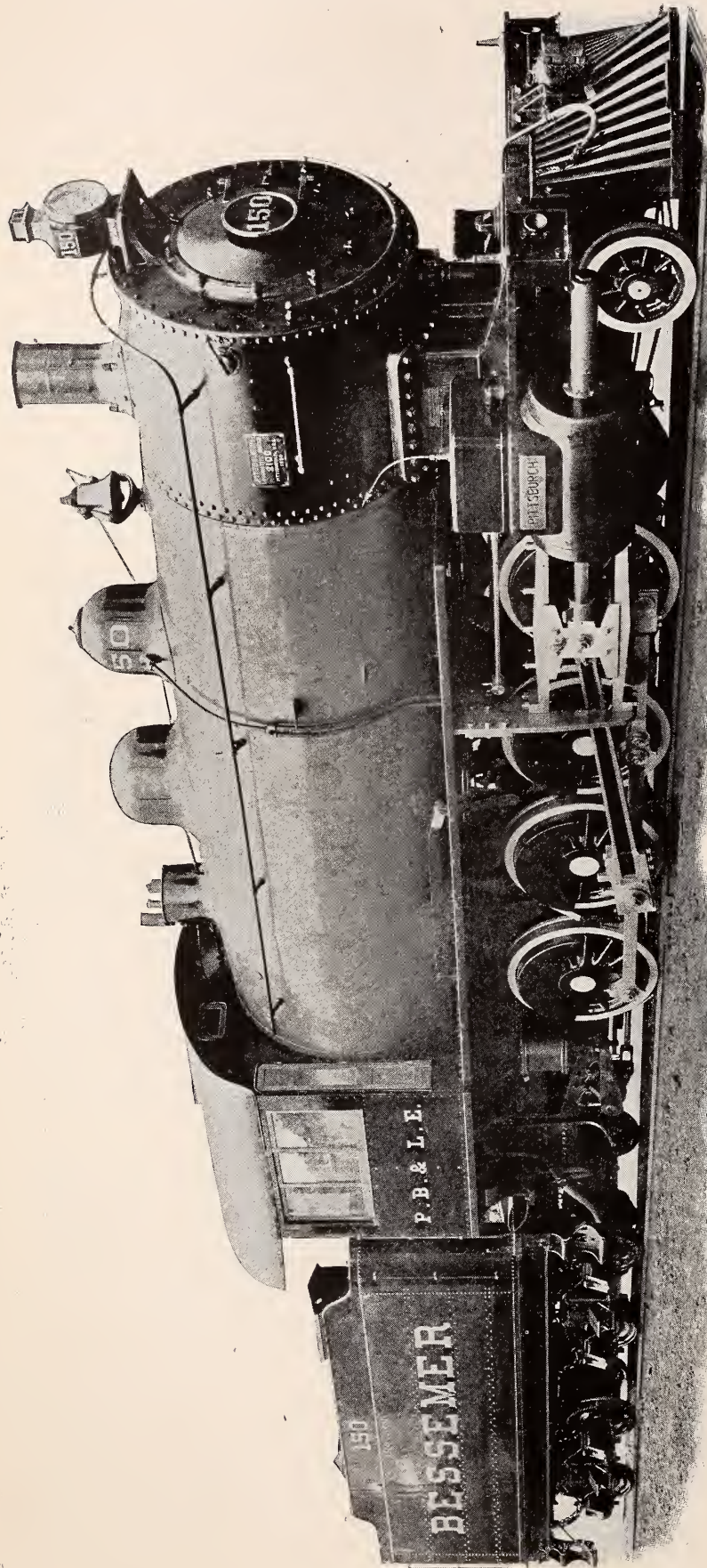


FIG. 4—A NEW DYNAMOMETER CAR—THE RECORDING TABLE.

apparatus. This last consists simply of a pair of driving rollers, around which the paper passes, and a supply roller and receiving roller. The paper is drawn from the former and fed to the latter, after running over the drum of the recording gauge seen also at the left.

In addition to this apparatus, the car is equipped for locomotive road tests with gauges for indicating and recording boiler pressure and steam chest pressure, a duplex air gauge, an air brake train line pressure, recording gauge, and the other apparatus used in locomotive tests.

The track inspection apparatus and other frame apparatus are to be installed as soon as may be practicable.



THE HEAVIEST AND MOST POWERFUL LOCOMOTIVE EVER BUILT.

### PITTSBURGH CONSOLIDATION FOR THE PITTSBURGH, BESSEMER & LAKE ERIE.

Total weight—250,300 pounds; weight on drivers—225,200 pounds; cylinders—24x32 inches; drivers—54 inches; heating surface—3,805 square feet, of which 241 square feet is firebox and 3,564 square feet tube surface; grate area—36.8 square feet; fuel—bituminous coal; working steam pressure—210 pounds; boiler 84 inches; tank capacity—water 7,500 gallons; coal 14 tons.

## THE HEAVIEST AND MOST POWERFUL LOCOMOTIVE.

The Pittsburgh Locomotive Works recently completed for the Pittsburgh, Bessemer & Lake Erie Railway, two consolidation locomotives of truly Brobdingnagian proportions. On the opposite page we give a perspective view of one of these monster engines; but the figures, which we give in the following lines, reveal the impressive dimensions which this latest product of American genius possesses more strikingly, perhaps, than does the reproduction from the photograph.

This engine weighs 250,300 pounds, of which 225,200 pounds are on the drivers, 25,100 pounds being on the truck wheels. It has 24x32-inch cylinders; 54-inch drivers; a straight top boiler (with tapering back end) which is 84 inches in diameter at front sheet, and is designed to carry 220 pounds of steam; a firebox 132 inches long, 40 $\frac{1}{4}$  inches wide, 82 $\frac{7}{8}$  inches deep at front end and 70 $\frac{7}{8}$  inches deep at back end; a grate area of 36.8 square feet, and a total heating surface of 3,805 square feet, of which 241 square feet is firebox and 3,564 square feet tube surface.

The boiler shell is of 1-inch steel. It contains 406 solid-drawn steel tubes, which are 2 $\frac{1}{4}$  inches in diameter and 15 feet long. The frames are very heavy and are made of armor plate. The firebox water space is 4 inches wide—front, back and sides. The main driving journals are 10x13 inches, and the front, intermediate and back journals are 9x13 inches. The main crank pin is 7 $\frac{1}{2}$ x8 inches. The main driver centers are cast steel—the others steeled iron. A single 5 $\frac{3}{4}$ -inch nozzle is used. The steam ports are 20 inches long and 1 $\frac{3}{8}$  inches wide, and the exhaust ports 20 inches long and 2 $\frac{1}{4}$  inches wide. The valves have greatest travel of 6 inches, an outside lap of 1 inch and a lead in full gear of 1-10 inch. Piston valves, now so popular, are not used on this engine, the balanced D valve being retained. The tank has a water capacity of 7,500 gallons, and a coal capacity of 14 tons; it has a steel channel underframe. Westinghouse-American brakes, M. C. B. coupler and Westinghouse friction draft gear are used.

The heaviest locomotive before this, was the Brooks Illinois Central engine, weighing 232,200 pounds, of which 193,200 pounds were on the drivers. This was illustrated in our issue of October, 1899.

## A NEW PISTON VALVE.

The American Balance Slide Valve Company of Jersey Shore, Pa., and San Francisco, have just brought out a balanced piston valve containing very important improvements.

The construction is very simple, having only the addition of one "wedge" ring. The functions of this wedge ring are to prevent the live steam from getting to the interior of the main ring; to wedge the main ring into a plug while under steam pressure, and to prevent all lateral wear, either while under steam or running without pressure.

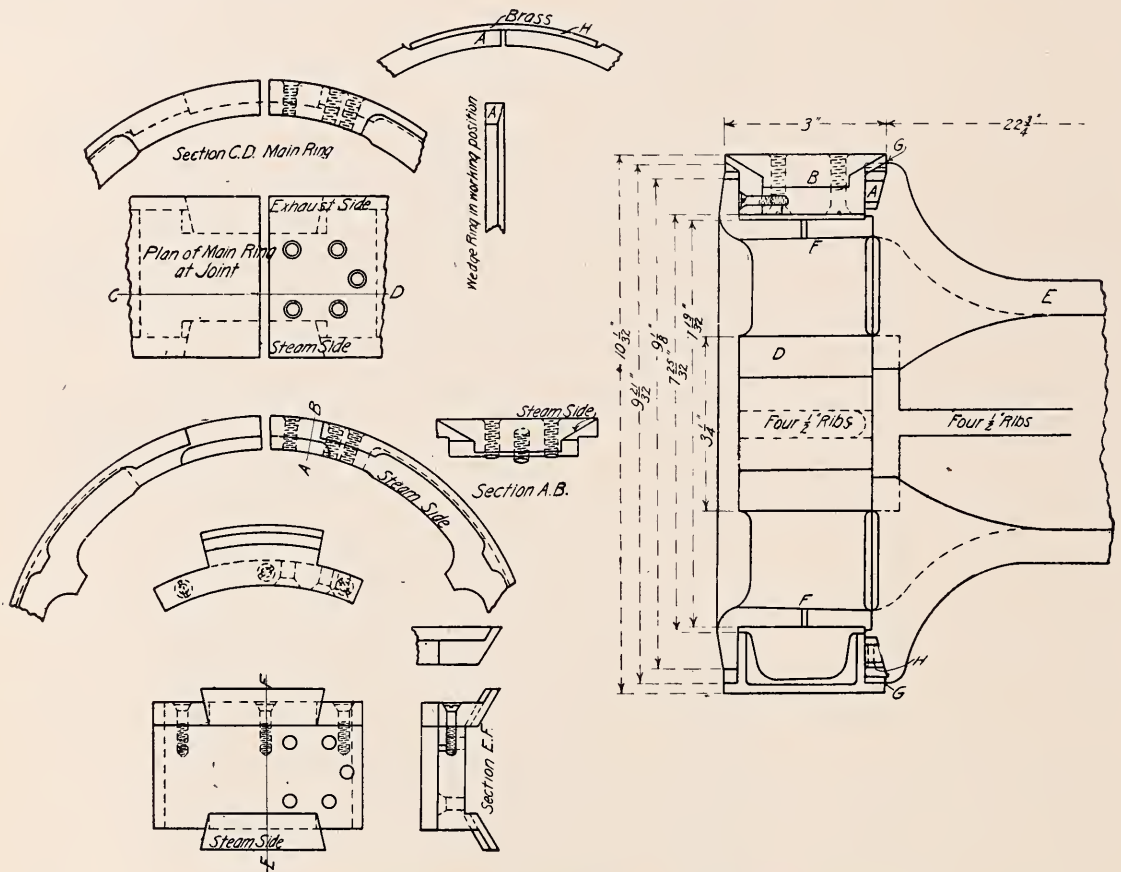


FIG. 1—NEW PISTON VALVE—FOR THE C. & N. W. RY.

By the action of this wedge ring, a positive steam joint is formed between the side of the main ring and the wall of the valve on the live steam side, thus preventing any live steam from getting to the interior of the main ring and expanding it against the steam chest casing. This permits of the use of wide rings, while previously it has been impossible to use them, because of their excessive friction, caused by the steam expanding them against the valve casing. At the same time, the steam pressure, exerting a force on the outer circumference of the wedge ring,

wedges the main ring rigidly against the wall of the valve, which makes a plug of the main ring while under steam, thus preventing the excessive wear of the valve casing in the center, while the valve is working at cut-off, and also preventing the excessive wear of the bridges which connect the casing over the ports. When the throttle is shut off, the main ring is free to adjust itself to the cylinder, automatically taking care of the wear.

We illustrate a type of wide ring valve made for the Chicago &

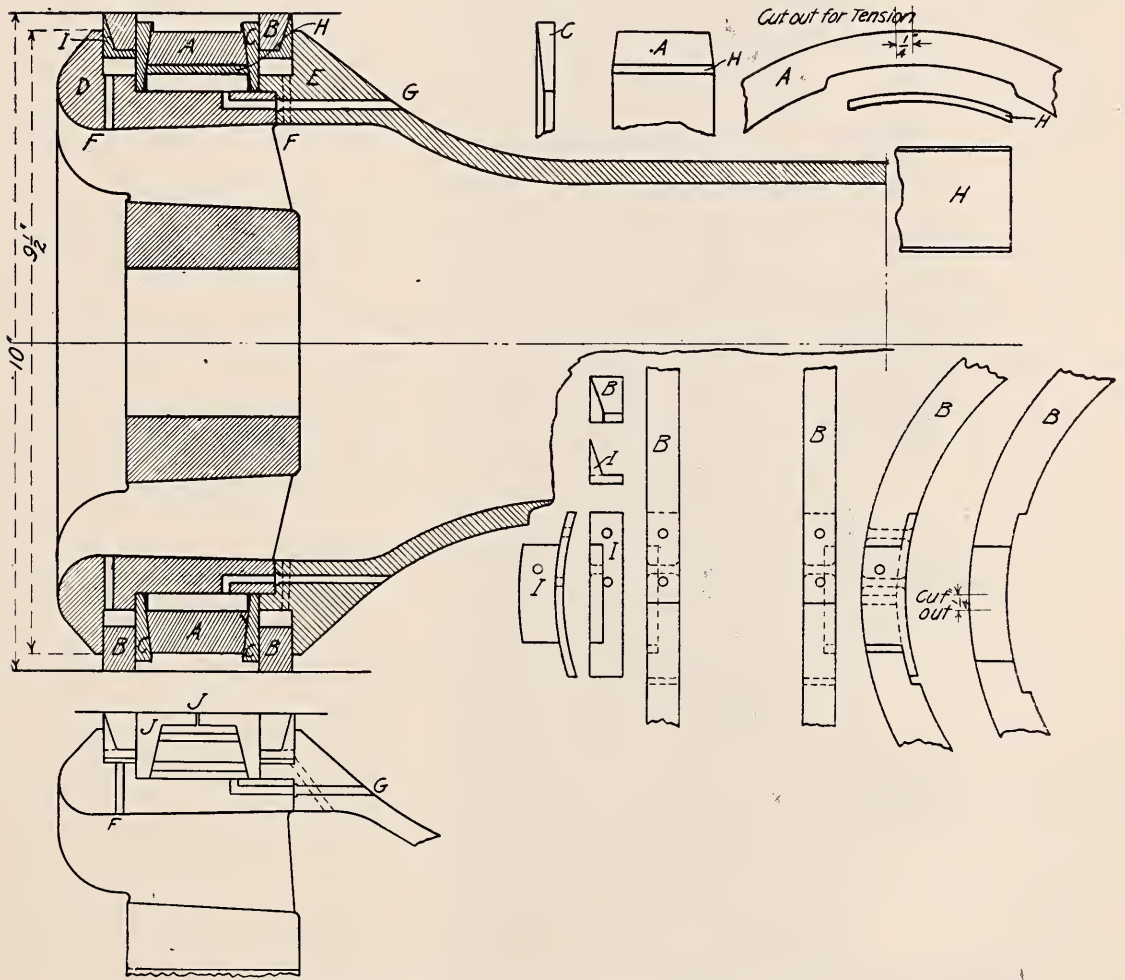
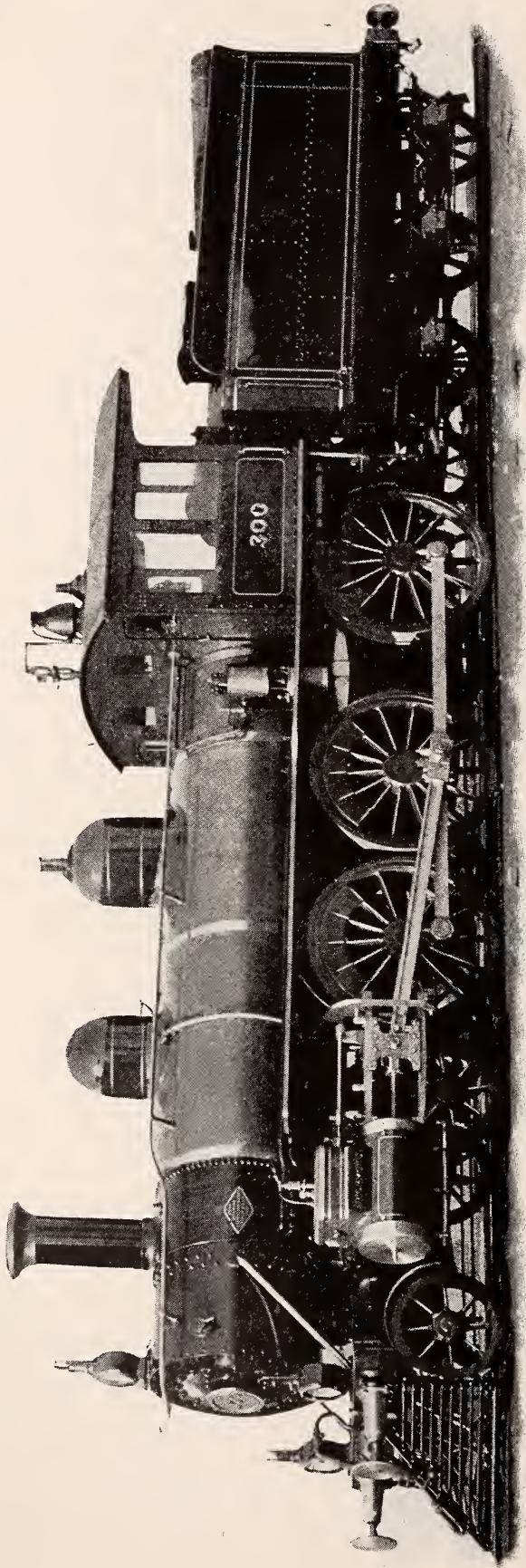


FIG 2—NEW PISTON VALVE—NARROW RINGS.

Northwestern Railway, and one showing the application to a type with two small rings. In Fig. 1, A is the wedge ring, B the main snap ring, D the follower, E the valve spool, and F relief holes from interior of main ring to exhaust; G are holes to admit live steam to wedge ring; H shows forms of joints covering cut on the wedge rings; I shows forms of joints covering cut in main rings. It will be noticed that by the form of joint used to cover the cut in the main snap rings, continuous or unbroken steam and exhaust lines are maintained.



RICHMOND TEN-WHEEL LOCOMOTIVE FOR FINLAND.

Total weight—90,000 pounds; weight on drivers—65,000 pounds; cylinders—16 x 24 inches; drivers—62 inches; heating surface—1,194 square feet, of which 80 square feet is firebox and 1,114 square feet tube surface; grate area—152 square feet; fuel—coal; working steam pressure—180 pounds; boiler—52 inches; tank capacity—water 2,100 gallons; coal, 5 tons.

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The same reference letters refer to same parts in Fig. 2 as in Fig. 1, with the addition of the solid rings "C," which are slipped over the follower and form the inner walls of the snap ring grooves, and ports G, which lead to the interior of the wedge ring, expanding it to clamp the ring, while in Fig. 1 the wedge ring is contracted to clamp the ring. The principles in the operation of both types shown are the same. The main rings, as shown, each present a bearing surface of 94.24 square inches against the casing, and with this large surface, without pressure to expand, the ring should wear very little, and with the clamping effect of the wedge ring further preventing it from expanding while working under steam, it would seem that wear of the rings or the casing itself should be reduced to the minimum. It seems especially important that the main ring is held as a plug while working at short cut-off (always over the bridges), as this seems to insure a very even wear of the casing for its entire length.

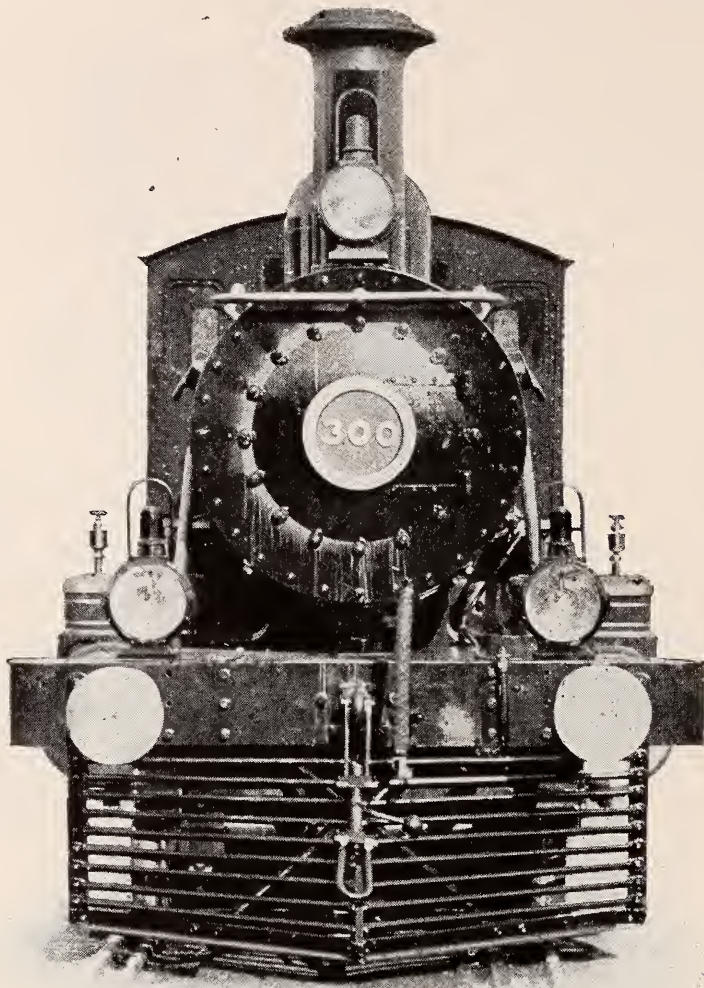
This valve attracted a great deal of attention at the Master Mechanics' Convention where it was exhibited last month, and received a great deal of most favorable comment. It is called the American balanced piston valve and is manufactured at Jersey Shore, Pa., by the American Balance Slide Valve Company.

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## RICHMOND TEN-WHEEL PASSENGER LOCOMOTIVE FOR FINLAND.

Among the later American locomotives going abroad are ten passenger engines of the ten-wheel type, which have been built by the Richmond Locomotive Works for the Finland State Railways. One of these engines is now a part of the American exhibit at the Paris Exposition, and we give herewith a side and end view of this engine. The other nine have been shipped direct to Helsingfors, Finland.

These locomotives weigh 90,000 pounds, of which 65,000 pounds are on the drivers. They have 16 x 24-inch cylinders; 62-inch drivers; straight top, radial stayed boilers, 52 inches in diameter, designed to carry 180 pounds working pressure; heating surface of 1,194 square feet, of which 80 feet is firebox and 1,194 feet tube surface; and a grate area of 152 square feet.



RICHMOND LOCOMOTIVE FOR FINLAND—FRONT VIEW.

Coal will be used for fuel. The tanks, which have a steel frame, have a capacity of 2,100 gallons of water and five tons of coal.

The special equipment includes Westinghouse brakes, Pintsch lighting system, copper firebox and staybolts, brass tubes, Latowski steam bell, Dewrance (English) water gauges, Holden & Brooks (Manchester, England,) injectors, U. S. metallic piston rod and valve stem packing and American balanced valves.

## THE MASTER CAR BUILDERS' CONVENTION.

The Master Car Builders' Association met in its thirty-fourth annual convention at Saratoga, N. Y., June 18, with an unusually large number in attendance; President Schroyer in the chair and Secretary Taylor at his desk. The sessions lasted three days and the work done was in sequence, as follows:

### GENERAL OPENING BUSINESS.

After opening by prayer, an address of welcome from the mayor and the reading by Mr. Schroyer of his annual address, an abstract of which we shall give in our next issue, the financial reports were presented. These showed the present membership of the Association to be 463, of which 265 are active members, 190 representative members and 8 associate members. There are now 1,343,131 cars represented in the Association. The Association has now in its treasury the comfortable sum of \$9,836.22, with all bills paid.

The report of the standing committee on supervision of standards and recommended practices of the association was then presented by Mr. A. M. Waitt, chairman of the committee. The report is as follows:

### SUPERVISION OF STANDARDS AND RECOMMENDED PRACTICE.

[A. M. WAITT, G. L. POTTER, WILLIAM APPS, Committee.]

Your committee has given the members an opportunity to suggest any desired modifications of the standards and the various recommended practices of the Association, and begs leave to report as follows:

There seem to be very few desires expressed for changes in the standards and recommended practice, and only those standards are mentioned in connection with which the committee would recommend a change. The references are to the Proceedings of 1899.

1. Journal Box and Details for Journal 5 by 9 inches, page 419, M. C. B. Sheets 13, 14 and 15.

It is recommended, inasmuch as experience has shown a considerable breakage in the back end of the journal box for 5 by 9 inch journal for 80,000 pound capacity cars, that the opening at the back end of the box, corresponding with the dust guard, be increased from a 3 3-16 radius to a 3 3/8 radius, making the opening 6 3/4 inches wide, instead of 6 3/8. The height of opening to remain unchanged.

2. Air Brakes—general arrangement and details, page 421.

It is recommended that on M. C. B. Sheet 9, a standard brake pipe nipple be shown, located directly back of the angle cock, the nipple being 10 inches long. This is provided so that in event of the threaded end of the pipe being damaged, it could quickly be repaired by introducing another nipple, instead of having to take down the whole length of pipe.

3. Screw Threads, Bolt Heads and Nuts, page 425.

It is recommended, in connection with the subject of standards for screw threads, bolt heads and nuts, page 425, that this subject be assigned for special discussion in

connection with the report on square bolt heads and nuts, presented at the 1899 meeting, page 124, of the Proceedings, with a view of taking action upon the recommendations of the committee as to the modification in the present M. C. B. standards for bolt heads and nuts.

4. Specifications for Steel Axles.

It is recommended, that in view of replies received from several members, special consideration be given at the convention, by discussion, to the recommendations made by several members that the percentage of carbon shown in the recommended specification for steel axles should be reduced, in the line with best practice.

5. Uncoupling arrangements for M. C. B. Couplers, page 443, Sheet M. C. B.—B.

It is recommended that this practice be modified by showing the uncoupling lever extending to both sides of the car, instead of to one side only, as at present.

In connection with standards for "Wheel Circumference Measure," and the recommended practices for "Loading Poles, Logs and Bark on Cars," "Air Brake Tests" and "Springs for Freight Car Trucks," it is suggested that special committees are assigned to report on these subjects.

In conclusion, the committee would suggest that recommendations 1, 2 and 5 be submitted to letter ballot for adoption, and that recommendations 3 and 4 be made special topics for discussion at the convention.

Recommendations 1, 2, 3 and 5 were ordered sent out to letter ballot for adoption. Recommendation 4 was briefly discussed, but the suggestion that the carbon in the steel axle specification be reduced did not meet with favor. The result was that the chemical specification for all steel axles was ordered referred to a special committee to be appointed, to report at the next convention. The action on recommendation 3 implies that the recommendation of last year's committee on bolt heads be submitted to letter ballot for adoption as a standard. In this connection the Secretary was instructed to take up this matter of bolt heads with the other technical associations and with the manufacturers. In presenting this report, Mr. Waitt read a letter received from Secretary Mosely of the Interstate Commerce Commission, referring to the lack of uniformity in uncoupling arrangements and to the bad condition in which these appliances are often found, and suggesting a rule to govern receipt of cars in which these appliances are defective. Mr. Waitt asked that this matter be referred to the arbitration committee, with request that a proper rule covering the case be prepared, classing it with "missing parts," and it was so ordered.

Topical talks were then taken up, as they were later during the sessions. We expect to give them in part in later issues.

The report of the standing committee on brake shoe tests was next presented by its chairman, Mr. S. P. Bush, as follows:

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**BRAKE SHOE TESTS.**

[S. P. BUSH, GEO. GIBBS, R. P. C. SANDERSON, Committee.]

At the time of last year's convention, it was thought it would be desirable to make further tests of brake shoes during the year, on account of new brake shoes being introduced. The committee, however, finds that there are so many of the brake shoes now being presented that are still in an experimental condition, that it would not be wise to go to the expense of conducting further tests until some of those that are already on trial shall have demonstrated their efficiency in service sufficiently to lead the committee to believe that they will continue in use.

This report brought out an extended discussion, covering the history and the prospects of brake shoe tests. Mr. Bush explained that the committee had decided that it was not its function to keep on indefinitely testing brake shoes that any inventor might bring out, but that it should test only those which railways were using to some extent. The association's testing apparatus was at Purdue, where any one could have shoes tested at a nominal expense. Professor Goss explained that tests had been made at Purdue of shoes of some six or eight makers; but these tests could not be reported, for the results were more or less confidential. There would probably have been more tests, but the fees interfered. He suggested that the Master Car Builders' Association should directly order shoe tests, the reports of which would go to the standing committee, to be considered as a part of its work; if this were done, the costs would be lessened. After a vigorous discussion, during which the committee on triple valve tests and that on coupler tests acquainted the association with the fact that they, too, were in a doubtful and unsatisfactory position with relation to the tests which they were supposed to make, it was voted to give the brake shoe committee definite instructions. These instructions, in substance, are: the committee is directed to test such brake shoes as may be presented to them by railway companies represented in the association, and which seem to have made sufficient departure from those previously tested to have affected their efficiency and durability; the committee is directed to formulate specifications governing the limitation of the coefficient of friction for a satisfactory brake shoe (leaving the question of wearing quality for the purchaser to settle for himself); the committee to notify the railways of the time of the year it intends to make the tests; it being understood that the cost of the tests shall not be assumed by the Association.

**TRIPLE VALVE TESTS.**

Mr. G. W. Rhodes, chairman of the standing committee on triple valve tests presented his report. He referred to the fact that last year

the committee of three members was increased to five, in order that two members familiar with the use of the New York triple valve should be on the committee; and he explained that the instructions given the committee were to make rack and train tests, and that \$5,000.00 expenses had been authorized for this work. He read correspondence had with the New York and Westinghouse people relative to arranging for the tests. A meeting of the committee was held in Chicago in November, at which both brake companies were represented. At this meeting the present recommended standard of brake efficiency was gone over, paragraph by paragraph, but as the representative of the New York company was authorized to simply attend the meeting and not to offer comment on the standards, no progress was made. The New York company was subsequently notified of the situation and finally stated that it did not consider it part of its business to recommend or advise the committee what the test should consist of; it had at one time offered suggestions which had been ignored, and did not care to repeat the experience. Mr. Rhodes explained to the convention that these suggestions were made long ago—just when the committee was fresh from its original work—and that it could not then consistently change its requirements. Now, ten years later, with new conditions, it seemed time to again go over the requirements. But this could not be done without the co-operation of all the brake companies. After extended comment on the situation by several members, the committee's report was adopted, which means that the specifications stand as they are.

The interchange rules were then taken up and disposed of quickly, considerable time being given, however, to a thorough review of the prices.

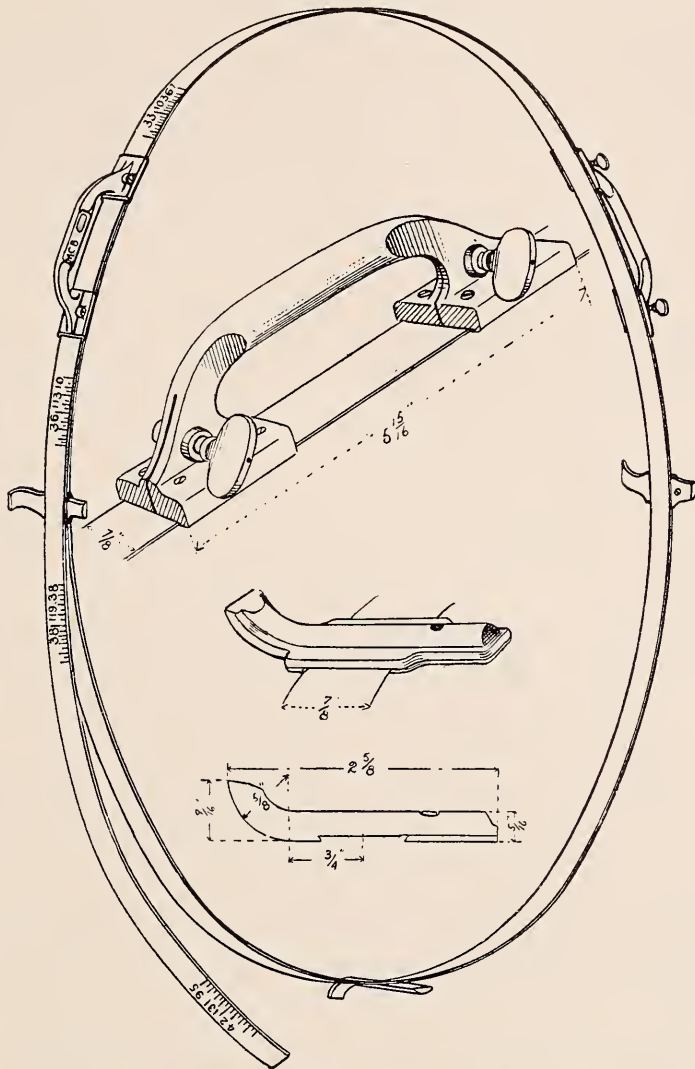
The committee on design for wheel circumference measure presented its report. It gave a brief history of the present measure, and proceeded, in substance, as follows:

#### **WHEEL CIRCUMFERENCE MEASURE.**

[J. J. HENNESSEY, E. S. MARSHALL, Committee.]

In February of this year, your committee issued a circular of inquiry asking what changes, if any, were desirable to be made in the present design of wheel circumference measure, and among the replies received, a design (which is illustrated in this report) was submitted by one of the members which meets with the approval of your committee.

It will be observed by reference to this illustration that at proper distances on the gauge there are vertical marks indicating the correct theoretical circumference measure for 33-inch, 36-inch, 38-inch and 42-inch wheels, the same information being given for 26-inch, 28-inch and 30-inch wheels in their respective positions. On the left-hand side,



PROPOSED WHEEL CIRCUMFERENCE MEASURE

at the top, the diameter of wheel indicated is stamped, and on the right-hand side the correct corresponding circumferential measure in inches and hundredths of an inch, thus: 33-inch wheels, 103.67; 36-inch wheels, 113.10; 38-inch wheels, 119.38; and 42-inch wheels, 131.95.

On each side of the vertical lines are spaced six shorter vertical lines  $\frac{1}{8}$ -inch apart. By this method of measurement, if a wheel were exactly the correct circumference the indicating slide on the scale would cover the center line. If the wheel were larger in diameter, the indicating slide would fall short of the center line by 1, 2, 3, 4 or more marks, and such a wheel would be indicated as + 1, + 2 or + 3, etc., showing that the circumference of the wheel was  $\frac{1}{8}$ -inch, 2-8 inch or  $\frac{3}{8}$ -inch more than the correct standard. If the indicating slide extended beyond the center line, the circumference of the wheel would be less than the standard and would be indicated in the reports as - 1, - 2, - 3, etc., showing that the wheel was  $\frac{1}{8}$ -inch, 2-8 inch or  $\frac{3}{8}$ -inch less than the proper size.

The committee believes that by this method of measurement more uniformity in the matter of inspection and mating of wheels can be obtained, and the inspector will have a clearer idea of what the marks on his circumference measure really indicate. The committee would recommend the adoption of this measure in lieu of the present wheel circumference measure.

The report was received, committee discharged, and the recommendations ordered to letter ballot.

The committee on design for journal box, bearing, wedge and lid for 100,000 pound capacity cars; also, design for journal bearing and wedge gauges for 80,000 and 100,000 pound cars, was then presented. It was, in substance, as follows:

**JOURNAL BOX, BEARING AND WEDGE FOR 100,000 POUND CAPACITY CARS; AND BEARING AND WEDGE GAUGE FOR 80,000 AND 100,000 POUND CARS.**

[WM. GARSTANG, J. J. HENNESSEY, W. H. MARSHALL, Committee.]

This committee submitted a carefully prepared report, offering designs which will go to letter ballot for approval. In presenting the designs the committee said in substance:

In preparing these plans it has been the aim to design the parts, as far as possible, with a view of using present standards without detriment to the design. This has been found practicable with regard to the journal box lid only. The present standard lid for 5 by 9-inch boxes is of sufficient size to cover the necessary opening in the proposed 5½ by 10-inch box, by reducing the overlap on each side.

The design of the brass is made with a view of reducing the non-wearing parts to their minimum weight and size consistent with the required strength, and to increase the bearing and wearing surface as much as possible.

The size of the box is kept as small as possible to decrease weight and increase its strength, with special reference to making the box of sufficient capacity for oil and waste, and at the same time limiting that capacity to an amount that will be sufficient for proper lubrication, but will not admit of a wasteful or unnecessary amount.

We recommend the box to be made with circular bottom, as it has all the advantages that have already been discussed relative to that point; at the same time it is recommended to allow the square bottom to come under the list of standards for any who may prefer this bottom, either for a larger oil capacity or other preference.

We desire to call attention to the fact that the box, wedge and brass as described will interchange with the box, wedge and brass now in use on about fifteen thousand 100,000 pound capacity cars, which are practically all the cars of this capacity now being operated.

In the preparation of the drawings the notations made on them allow of the same elasticity in preference to materials, etc., as was decided and adopted in the case of the same parts for the 80,000 pound car.

In the brief discussion on this subject the point was made that the gauges were not just satisfactory; and it was voted that the question of having gauges for the box of all capacities and additional gauges for the wedges, be referred to the committee on subjects. The report as a whole was received, the committee discharged, and its recommendations ordered to letter ballot for recommended practice.

The committee on revision of rules for loading long materials was then presented by Mr. Stark, of that committee. The report, which we omit, was ordered sent out to letter ballot, for recommended practice.

It was announced that the committee on revision of recommended practice for springs, including design for springs for 100,000 pound cars, had no report ready; and the committee was continued for another year.

The committee on standard center plates then reported, through its chairman, Mr. R. H. Johnson.

No definite recommendations were made in the report, which was devoted mainly to a compilation of answers to inquiries. These showed a wide variety of views. The committee dwelt particularly upon the evil of light construction of castings, criticised the length of center castings, and urged smooth fitting and lubricated center plates.

The report was received and the committee discharged. It was considered in connection with the next report, that on side bearings, which was presented by Mr. B. Haskell, of the committee. The conclusions of this latter committee were as follows:

#### SPREAD AND DESIGN FOR SIDE BEARINGS.

[J. W. LUTTRELL, B. HASKELL, H. M. PFLAGER, Committee.]

This committee reviewed the replies to its circulars and described tests that it had made on the road and concluded as follows:

The result of the tests would indicate that the most satisfactory condition for service would be to have the weight carried on the center plates, and with a clearance between the side bearings. While the anti-friction bearings, under certain conditions, produced an average slightly better, the difference is insignificant. Furthermore, it would appear that a correct adjustment is necessary, otherwise the results would not be as satisfactory.

With a clearance between the bearings the car traveled 148 feet, or 75 per cent farther than when the entire weight was equally distributed between the side bearings and center plates. It is, therefore, apparent that a greater force would be required to haul a train in the latter condition; the increased resistance not only entailing additional cost in power, but reflecting an increased cost in flange wear of wheels, wear on the rails and general wear and tear to car body and trucks, due to shocks from unevenness of track, frogs, crossings, etc., occasioning a severer service when the car is down on the side bearings, more so than if the trucks had freedom of movement at the side bearings, vertically, as is the case when there is clearance.

The fundamental requirement in maintaining this clearance is a construction of truck and body bolsters which will insure a minimum amount of deflection. Your committee is of the opinion this cannot be obtained with wooden bolsters, as the possibilities of deflection in their use demands a greater clearance at the outset, and which, unless given frequent attention, gradually disappears. It is believed the best results can only be obtained from a good form of metal bolster. In the matter of distance between the top

and bottom side bearings, or the clearance, your committee agrees with the majority of the recommendations received, that this should be from  $\frac{1}{4}$  to  $\frac{3}{8}$  inches with metal bolsters; but it is unnecessary to establish an arbitrary figure, if the amount of clearance approximates the figures stated. With wooden bolsters this dimension should be greater, for the reasons previously stated, or from  $\frac{1}{2}$  to  $\frac{3}{4}$  inches.

The extent of contact surface of center plates is also considered an important factor as influencing the proper movement of trucks in traversing curves and in relation to the side bearings. It is well understood that safe practice opposes excessive weight for each square inch of bearing surface; and that better results will be derived from center plates with large area than if too small. The ones used under the car in making the tests had a bearing area of 28.28 square inches each, producing 1,405 pounds per square inch with a car body and load of the weight stated. Your committee considers this plate too small, and is of the opinion that the size should be such as will impose about 800 pounds per square inch of contact surface.

As to anti-friction side bearings, your committee has not been able to satisfy itself that this type of bearing has attained a sufficient degree of perfection, as far as can be learned, to insure superior results compared with the present practice, considering the increased cost, especially in freight car construction. Theoretically, a device which will facilitate the movement of the truck when traversing a curve would be of advantage; but from the information obtained, it is demonstrated that the rollers, which enter into the construction of nearly all anti-friction side bearings, soon become flattened and then the bearings are of no more value than the older design, if as good.

In the instructions given your committee the inquiry is made as to the benefits to be derived from the use of a satisfactory anti-friction bearing; as previously stated, the difficulty seems to be in getting one which is satisfactory, although it would appear from the tests made that the benefits would hardly compensate the increased cost.

After careful investigation and inquiry among a large number of companies, your committee is convinced that the best results can only be obtained from a proper clearance between the side bearings. In fact, it developed that an important line was refusing cars unless there was such clearance, doubtless an evidence that it is considered a question of safety under some conditions.

In presenting this report, Mr. Haskell asked that it be referred back to the committee, with instructions to report further on anti-frictional side bearings; he had used roller bearings for three years without finding evidences of flattening. Secretary Taylor read a letter from H. M. Pflager, also of this committee, disagreeing with the report in those parts stating that rollers in anti-friction side bearings soon became flattened in service. In view of the differences of opinion among the committee it was voted that, in accordance with Mr. Haskell's suggestion, the subject be referred back to the committee; the committee was also instructed to consider the subject of center plates in connection with the side bearing matter, the committee on center plates having presented no specific recommendations.

The committee on draft gear next presented its report, through its chairman, Mr. J. R. Slack, its conclusions being as follows:

## DRAFT GEAR.

[JOHN R. SLACK, JAS. MACBETH, W. E. SHARP, Committee.]

1. The ordinary type of draw gear, known as the Master Car Builders' recommended practice, is deficient in strength, both in method of attachment to draw timbers and in capacity of spring. The strains imposed upon this, both in pulling and buffing, by heavy freight locomotives cause frequent failures and make it an expensive draft gear to maintain.

[The committee was divided in its second recommendation, Messrs. Macbeth and Sharp indorsing twin springs, as follows:]

2. A form of draft gear, with metallic draft beams and twin springs, with draft rods running to needle beams, is the most desirable. Malleable iron is the best material for the draft beams. Buffing timbers should be protected with suitable malleable iron draft caps. The use of the twin springs is desirable, as it maintains the present standard yoke for coupler.

[Mr. Slack stood out for the tandem springs, and worded recommendation 2 as follows:]

2. A form of draft gear which is a modification of the tandem type, appears to be the most desirable form. Instead of using metal cheek pieces bolted to wooden draft timbers, malleable draft arms should be used bolted to the sills of the car, thus doing away with the wooden draft timbers entirely. Draft rods should be run back to the needle beams. Tandem springs should be used and arranged so as to bring them both in action in pulling and buffing. The tandem spring appears to be preferable to the twin springs side by side, as the draft arms can be brought closer together, which makes a better construction, and does not require the use of such long follower plates as the twin springs. The springs used should be the same as the Master Car Builders' standard,  $6\frac{1}{4}$  by 8 inches.

[The committee, as a whole, signed the first recommendation and the following concluding paragraphs:]

The committee is not at present prepared to submit any design, but is of the opinion that a proper design should follow the lines as above stated.

In conclusion, the committee would suggest that it might be desirable to make some tests to determine how much of the shock, especially of buffing strains, is absorbed by the two-coil spring, and also by the tandem spring, and what is the efficiency of the various methods of attachment to the draw timbers.

The report was received and the committee (to be increased to five members) continued for another year, and the executive committee was instructed to consider the matter of having this committee make tests according to the suggestions made in its report. In the discussion the point was made that 30 per cent of cars on the repair track require repairs to the draft rigging. It was urged that roads should aid the committee by making independent investigations of various forms of draft gear; and it was suggested that a good plan would be to equip locomotive tenders with the riggings, because in that way more reliable and more quickly available data could be obtained than if cars were so equipped. It was also suggested that the committee investigate the Westinghouse friction draft gear.

The report of the committee on uniform section of siding and floor-

ing was next due, but the committee had no report ready; it was continued for another year. The committee on metal dead blocks and safety chains was also not ready, and was continued for another year.

The committee on air brake appliances presented its report, through Mr. A. M. Waitt, one of its members. The report is as follows:

### AIR BRAKE APPLIANCES AND SPECIFICATIONS FOR AIR BRAKE HOSE.

[A. L. HUMPHREY, A. M. WAITT, W. H. MARSHALL, Committee.]

Your committee sent out a circular of inquiry regarding any suggested additional standards for air brake appliances, slack adjusters, additional air brake power upon heavy capacity cars and in connection with specifications for air brake hose. Only eight replies were received to the circular, showing, apparently, that very little vital interest is taken in this subject at the present time.

It seems to your committee that those in charge of motive power and car departments on railroads should see that employes who have to do with the repairs, maintenance and adjustment of air brakes on cars give more attention to the importance of a correct piston travel, in order to have the brakes operate as nearly as possible at their point of maximum efficiency.

Your committee would call attention to the great neglect regarding the proper care of air brake cylinders on freight cars. Many seem to think it simply necessary to remove the oil plug in the cylinders and put in a quantity of inferior grade oil, leaving the packing leathers oftentimes hard and badly cut or worn. Experience seems to show that a light grease is more advantageous to use than a heavy oil, and it has also been found desirable to have the cylinders made without any oil hole, thereby making it necessary, whenever the cylinder is to be oiled, to take off the cylinder head, and so that at the same time the lubricating is done the packing leather and rings and the inside of the cylinder will receive proper attention in the way of cleaning, and any other necessary repairs required.

Your committee believes more attention should be given to reducing the number of elbows that are found in the piping of many cars. Every sharp bend in the pipe means a retarding of the action of the brake and added friction in the movement of the air through the pipes. As far as possible, in designing air brake piping for cars, "ells" should be eliminated and long, easy bends substituted.

It has been suggested by one of the air brake companies that on Plate 9 of the association standards for air brakes on freight cars, the dimensions showing the location of angle cocks should be given, as well as the angle at which this cock should stand with reference to the vertical. Your committee would recommend that this feature be referred to the committee on supervision of standards, for them to consider and make definite recommendations at our next convention in 1901.

Your committee does not believe that it would be advisable to continue a general committee on air brake appliances and specifications for air brake hose at the present time, but there would seem to be an opportunity for a special committee to take up the subject of *The Use of Slack Adjusters* and the *Consideration of the Necessity of Additional Brake Power on High Capacity Cars*, together with the subject of *Specifications for Brake Beams for High Capacity Cars*.

It has also been recommended by some, that further consideration be given to the subject of *Air Brake Hose, Specifications* by a committee who will take up this subject exclusively.

The report was received and the committee discharged. The executive committee will consider the suggestions contained in this report, and take such action as may be deemed proper.

The report of the standing committee on tests of M. C. B. couplers was then presented by Mr. W. S. Morris, of that committee as follows:

### TESTS OF MASTER CAR BUILDERS' COUPLERS.

[W. W. ATTERBURY, W. S. MORRIS, W. P. APLEYARD, H. MONKHOUSE, F. A. DELANO, Committee.]

It will be remembered that at the last meeting of the association, the general subject of the "Master Car Builders' Coupler" was considered of sufficient importance to warrant the appointment of a standing committee of five, the work of the committee to be somewhat of the character of your standing committees on brake shoes and triple valves.

The work of your committee during the last year has been largely that of perfecting the details of the work submitted at the last meeting of the association, and the committee has, therefore, been as yet unable to do any work on the more serious question, that of the tests of the Master Car Builders' couplers.

#### *Drop Testing Machine.*

The drop testing machine which has been adopted as recommended practice has now been thoroughly developed and the detail drawings form a part of this report.

Subsequent to the last meeting of the association, Purdue University, through Prof. R. A. Smart, with the approval of the late President Smart, and subject to the approval of its trustees, made a proposition to your committee, to the effect that a drop testing machine, of the design approved by your committee, be constructed by the university at its expense, under the direction of your committee; that such machine, when built, shall be the property of Purdue University, and shall be installed in its laboratory, to be at all times subject to the use of the Master Car Builders' Association, through its proper committee, for official research, the university to furnish such aid and assistance and subsidiary apparatus as may be convenient; the machine to be at all times usable by Purdue University for educational and commercial purposes; all of the above to apply to any improvements in the machine which may be devised by your committee.

The association will note that the conditions are practically those under which the Master Car Builders' brake shoe and air brake plants have been installed, except that in this case the plant would be the property of the university.

Your committee submitted the proposition to the executive committee and was by it empowered to act in the matter, and has, therefore, believing the proposition to be exceedingly fair, taken it up with Purdue University and is now awaiting advice of the favorable action by the trustees of that institution.

Your committee hopes that before the next meeting of the association this drop testing machine will be constructed and in operation, and some definite results obtained from the same.

#### *Worn Coupler Gauge.*

The Secretary of the association was authorized, and has arranged with the Pratt & Whitney Company, of Hartford, Connecticut, to manufacture this gauge, and your committee is advised that at the present time 241 of these gauges are under process of construction.

#### *Coupler Contour Gauge.*

This gauge, which was somewhat modified, with the approval of the Association at

its last meeting, is now being manufactured by the Pratt & Whitney Company, and the members of the Association should be able to obtain them on order.

*Twist Gauge.*

The twist gauge, as approved as "recommended practice" at the last meeting of the Association, has been in use experimentally by your committee for some little time, and some slight changes and modifications have been found necessary. Your committee does not feel warranted, as yet, in placing this gauge in the hands of a manufacturer, as there is a possibility that a more extended trial will demonstrate that some further changes may be required.

*Marking of Master Car Builders' Couplers.*

In view of the fact that some couplers are bought on time specifications, it has been suggested that a method of marking similar to that now in general use on air brake hose be adopted for couplers. Your committee submits, as its recommendation for this purpose, the method outlined on the attached drawing. This arrangement can be followed exactly on a large number of couplers, but, unfortunately, on some the design of the shank is such that some rearrangement will be necessary. These isolated cases will have to be treated as they may be brought to the attention of the committee.

In the event of the proposed method meeting the approval of the association, your committee would further recommend that it be embodied in the specifications and the same changed to read as follows:

"The name of the coupler and class of bar must be cast on the top side of head of bar in letters and figures three-fourths inch long and raised one-sixteenth inch. Each drawbar must also have plainly cast upon it the *Master Car Builders' standard label of dimensions and size, and in the location as shown in detail on drawing which forms a part of these specifications.* Each knuckle must, etc."

*Increased Dimensions of Shank of Coupler.*

Your committee has given this subject considerable thought, but is not at present prepared to recommend an increase in the dimensions of the shank of the coupler, in view of the fact that such radical changes as the committee would desire to make will necessitate very material changes in such standards of the association as pertain to the spacing of center sills, location and dimensions of draft timbers, etc.

It is possible that the development of the metal center sill or metal draft timber may bring about such a design of these parts as will permit the use of a coupler with an increased shank. Before this matter can be definitely settled it may require a joint meeting of your standing committee on couplers and your committee on draft gear.

*Master Car Builders' Coupler Knuckle.*

As the interstate commerce law in regard to the use of automatic couplers becomes operative on August 1, 1900, the necessity for the link and pin disappears. Your committee believing, therefore, that the time for the abandonment of the link pin hole and slot is now at hand, hereby ask for such discussion of the subject as will enable your committee to intelligently make its recommendations.

After brief discussion it was voted that the committee be instructed to make tests, notifying the railway companies of the date set for same, and asking them to send such couplers as they wish to be tested—the testing to be done at the expense of the association.

The work of the convention closed with the election of officers,

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which resulted as follows: President, J. T. Chamberlain; first vice president, J. J. Hennessey; second vice president, J. W. Marden; third vice president, F. W. Brazier; executive committee, E. D. Bronner, J. H. McConnell, William Apps. Treasurer, John Kirby. After the convention Mr. Joseph W. Taylor was reappointed secretary.

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## THE MASTER MECHANICS' CONVENTION.

The American Railway Master Mechanics' Association met in its thirty-third annual convention at Saratoga, June 21, President McConnell in the chair and Secretary Taylor at his desk. The sessions lasted three days, and the work done was, in sequence, as follows:

### GENERAL OPENING BUSINESS.

After opening prayer, and an address from Mr. A. J. Pitkin of the Schenectady Locomotive Works, President McConnell read his address, extracts from which we shall give later.

The financial reports were then presented, showing the membership of the association to be now 665, of which 620 were active members, 26 honorary, and 19 associate. The association was shown to have on hand the sum of \$3,468.63.

The first report taken up was that of the committee on "What can the Master Mechanics' Association do to increase its usefulness?" which was presented by Mr. T. R. Browne, chairman. The conclusions of this committee follow, and we may be able, later, to present some of the body of this excellent report:

### WHAT CAN THE MASTER MECHANICS' ASSOCIATION DO TO INCREASE ITS USEFULNESS?

[T. R. BROWNE, G. M. BASFORD, L. M. POMEROY, Committee.]

This report teemed with good ideas which were summarized in the form of the following suggestions:

- A nomination of officers by a nominating committee;
- An improved method of admitting associate members;
- The taking of record votes on questions of practice;
- More preparation for the introduction of discussions, and more complete plans for their consideration;
- The abolition of the universal practice of appointing as chairman of a committee the member who suggests the subject for committee investigation to the committee on subjects;
- Recommendations to the president, by the committee on subjects, of members best qualified to present them;

Committees of investigation composed of small numbers of individuals ;  
 Provision for the reception of individual papers ;  
 Strict adherence to the rule requiring the presentation of long papers by abstract ;  
 The co-operation of railway clubs and special organizations in the presentation of opinions on practice, and in the suggestion of subjects for investigation ;  
 More explicit instructions to committees as to arrangement, and advancing conclusions in reports ;  
 The appointment of several additional standing committees on subjects concerning motive power progress ;  
 Increased responsibilities of the committee on subjects in the actual work of the convention ;  
 Provision for a thorough printed index of the proceedings of the Association from the first volume ;  
 An effort to make the reports presented to the association thoroughly reliable ;  
 A typographical arrangement of reports which will render the conclusions and decisions more easily found ;  
 The establishment of a library similar in plan to that of the Western Railway Club.

The committee also proposed the following resolutions :

*Resolved*, That a committee be appointed to consider the suggestions made in this report, and present later in this convention recommendations for such changes in the constitution as may be necessary to carry them into effect.

*Resolved*, That a committee be appointed with full authority to act in the preparation of a complete printed index of the proceedings of this Association, from the first volume to date, the expense to be defrayed by the treasury, upon the approval of the executive committee.

The report was received and the resolutions offered at its close were formally adopted. The President immediately appointed as a committee to serve under the terms of the first resolution, Messrs. Robert Quayle, S. M. Vauclain and H. A. Gillis ; and as a committee to serve under the terms of the second resolution, Messrs. F. A. Delano, S. P. Bush and C. M. Mendenhall, this latter committee having full authority to act in the preparation of a complete index of the Proceedings of the Association from the first volume to date.

Topical talks were then taken up, according to the rule calling for them at the noon hour, and these were continued at intervals during the succeeding sessions ; we hope to give their substance in a later issue.

The report of the standing committee on "The extent to which the recommendations of this Association have been put into practice," was then presented by the chairman of the committee, Mr. F. A. Delano. The substance of this report follows :

#### **THE EXTENT TO WHICH THE RECOMMENDATIONS OF THE ASSOCIATION HAVE BEEN PUT INTO PRACTICE.**

[F. A. DELANO, A. SINCLAIR, H. MIDDLETON, Committee.]

This committee presented a valuable report, the important features of which we will present in a later issue. Nothing conclusive was to be obtained as to how far the

recommendations had been adopted ; but the committee had gone through the history of the association and dug out what had been adopted or recommended by the association or by its committees, and the portions of the report covering this interesting feature are what we shall give later. The committee met with discouraging results in its work of inquiry as to the extent of adoption. It sent out altogether 600 circulars of inquiry ; only 23 individuals, representing 21 railways and 6,347 locomotives, replied. The committee in closing said :

Your committee does not feel that from so small a number of answers out of so large a membership it would be proper to draw final or affirmative conclusions, but certain negative conclusions can at least be drawn. It is found that the recommendations of the association have been unanimously approved by those answering this circular in only seven cases. They have been approved, with a small minority against it, in twenty-seven cases. They have been disapproved by a large minority and in some cases even a large majority in thirty-two cases, while in the remaining twelve cases the opinion is too varied to classify.

The report was received without discussion and the committee discharged. This disposes of the one standing committee of the Association.

The report of the committee on the relative merits of cast iron and steel tired wheels was then presented by Mr. A. M. Waitt, a member of the committee, as follows :

#### RELATIVE MERITS OF CAST IRON AND STEEL TIERED WHEELS.

[J. N. BARR, A. M. WAITT, H. S. HAYWARD, A. L. HUMPHREY, JOHN HICKEY,  
Committee.]

The committee appointed to report on the relative merits of cast iron and steel tired wheels beg leave to submit the following :

The only report giving data has been received from the Union Pacific Railroad, in which they state that the average cost of mileage of 33-inch cast iron freight car wheels is 8 cents per thousand miles ; the average cost of steel tired wheels is 45 cents per thousand miles.

Mr. G. W. Rhodes, of the Burlington & Missouri River Railroad, advises that he is of the opinion that 33-inch cast iron wheels made to the M. C. B. standard test are a safer wheel than some of the steel tired wheels on the market.

Under these circumstances, your committee is unable to add anything additional to the report printed in last year's proceedings.

The report was received and the committee continued. Mr. Rhodes, in explaining the reply that he sent to the committee, said that the original dangers with cast iron wheels lay in their heating up under long continued brake application, and consequent bursting. Nowadays, however, the thermal test had apparently done away with this danger. His feeling seemed to be that the cast iron wheel had been improved to a condition of safety more radically than had at least some of the steel tired wheels.

The report of the committee on the advantages of the ton mile basis for motive power statistics followed, being presented by Mr. H. J. Small, chairman. We give the conclusions, only, of this committee :

### TON MILE BASIS FOR MOTIVE POWER STATISTICS.

[H. J. SMALL, C. H. QUÉREAU, W. H. MARSHALL, Committee. Mr. Marshall, not agreeing with some of the recommendations, declined to sign the report.]

The ton mileage for the use of the motive power department should include the weight of the entire train.

For the use of the operating department, it is probable that all that is needed is the weight between the tender and way car.

The best interests of both departments will be best served by a joint committee representing both.

#### *For the Motive Power Department.*

We recommend that all the items making up the cost of engine service be on the ton mile basis ;

That the statistics of all classes of engine service be on the same basis ;

That in passenger service, five tons for mail, baggage and express cars in main line service, three tons for such cars in branch line service, and two tons for all cars carrying passengers, be added to their scale weights ; passenger cars handled deadhead in freight service should have nothing added to their scale weight ;

That engines in work train service be credited with the actual weight of the entire train, to be determined on the same basis as for freight engines, and with ten miles per hour ;

That switch engines, having 18 by 24-inch cylinders, carrying 145 pounds steam pressure, and having driving wheels fifty inches outside the tire, be credited with 200 tons and eight miles per hour ; for others, the tonnage should be in proportion to their power, compared with that of the standard, and eight miles per hour ;

That for pusher and double-heading service, the credit for each engine attached to the train be its proportion of the ton mileage, based on its power, for the distance covered by each ;

That it is desirable to group the individual fuel statement and oil statement, each service by itself ;

That the statistics for main line and branches be separate ;

That the weight of the contents of freight cars handling way freight should be that with which it left the terminus ;

That the ton mileage of mixed trains, where both freight and passengers are handled in the same train, should be credited to that service which is entitled to the greatest per cent of it ;

That the tonnage of a locomotive should be its weight in working order, plus that of the tender with half its capacity of coal and water.

This report was discussed to some considerable extent, but there was marked difference of opinion among convention members, as well as among the committee, the special bone of contention appearing to be as to whether the weight of the locomotive should or should not be included with the weight of the entire train. The situation appeared to be that the subject was too new, and too much entangled with allied considerations of round house expenses, switching service, varying ser-

vice as to grades, light mileage, etc., to be ready for final consideration at this time. Accordingly, the committee was continued for another year.

The report of the committee on flanged tires was presented by Mr. S. Higgins, chairman, its conclusions being as follows:

### FLANGED TIRES.

[S. HIGGINS, W. H. THOMAS, WM. GARSTANG, Committee.]

The committee described at considerable length, tests which it made on the Lehigh Valley road, with a self-registering dynamometer car, and concluded its report as follows: "The results obtained justify the members of the committee in concluding that it is desirable to have flange tires on all the drivers of mogul, ten-wheel and consolidation engines. With mogul and ten-wheel engines the tires should be set so that the distance between the backs of flanges will be  $53\frac{1}{4}$  inches. With consolidation engines, the tires on front and back pairs of wheels should be set so that the distance between backs of flanges will be  $53\frac{1}{8}$  inches; with the other two pair of drivers the tires should be set so that the distance between backs of flanges will be  $53\frac{1}{4}$  inches. It should be understood that the committee assumes that the engines will have swinging trucks."

The discussion which followed was extended, and quite fully supported the conclusions of the committee.

The report of the committee on compound locomotives followed, being presented by its chairman, Mr. J. F. Deems. The conclusions of the committee were as follows:

### COMPOUND LOCOMOTIVES.

[J. F. DEEMS, A. E. MITCHELL, JOHN PLAYER, J. E. SAGUE, J. H. SETCHEL, Committee.]

The committee presented a very elaborate report, reviewing the "state of the art" of compounding quite thoroughly, bringing the whole subject down to date. It submitted the following conclusions:

1. Compound locomotives have not come into general use in America, but are gradually emerging from the experimental stage.
2. Compounds have been in use in freight service longer than passenger service, and there are more in such service; but in recent years there seems to be a disposition to use them also for fast, heavy passenger service. The compound is not as well adapted to switching service as the simple engine.
3. The ton mile system forms the basis of comparison between compound and simple locomotives. The average saving of the compound in coal consumption is 16.5 per cent.
4. The actual saving of the compound depends upon the price of coal. The greatest economy will be attained where the compound is worked continuously well up to its limit. The opportunity for saving is greater in freight service than in passenger.
5. The compound is not so flexible an engine as the simple.
6. There should be no difference in the size of drivers between the compound and simple engine in the same service.
7. The compound may be successfully pooled, if such practice is followed, with simple engines.

8. The rating for compounds should be no higher than simple engines of the same class, weight and steam pressure.

9. If it be desired to work the engine simple over maximum grades, the rating may be slightly higher for the compound than for the simple engine.

10. The correct ratio of cylinders is difficult to determine, as other factors than the determination of such ratio as will secure the minimum cylinder condensation enter into the question. In the two-cylinder type, it is of paramount importance that the work in both cylinders be equalized as closely as possible for all positions of the reverse lever. This is easier accomplished if the ratio be kept down, and in freight engines it seems that a ratio of about  $2\frac{1}{3}$  to 1 would be acceptable, while for passenger a slightly higher ratio, 2.37 to 1, might be used.

For the four-cylinder compound the most important question is that of equalizing the pressure on the high and low pressure pistons, and a ratio of 3 to 1 gives good results.

11. Manual control of compounding feature is preferable to the automatic.

12. There is no necessity for having any trouble due to the use of a large cylinder, if proper care be used in the design of the piston.

12½. There is less danger of setting out fires from the stack of the compound than of simple engines.

13. It is necessary to relieve the cylinders while drifting, large relief valves being used on four-cylinder compounds, and the by-pass on two-cylinder compounds.

14. The piston valve is preferable to the slide valve, as more perfect balance is secured, and consequently less wear of valve and seat, and less strain on valve motion.

15. When comparisons have been made between compound and simple engines, the pressures were usually the same.

16. In starting, it is necessary to work the engine simple; that it is bad practice to so rate the engine that it will be necessary to work it simple over heavy grades.

17. Engineers are apt to abuse the privilege of working the engine simple.

18. With the same supplies at hand for the repairs on compound engines, there is no necessity for the compound remaining out of service for repairs any longer than the simple engine.

19. The cost of boiler repairs is less on the compound, and may average 19.6 per cent less than for the simple engine.

20. The cost of maintaining the machinery on the compound is a little more than on the simple.

21. The cost of lubrication on the compound will be about 15 per cent more than on the simple engine.

22. The compound will be an economical machine whatever the price of fuel.

23. More compounds are in use where the fuel is expensive than where it is cheap.

23½. There is no necessity for any difference in the size of the exhaust nozzle of the compound and that of the simple.

24. Many and careful comparisons have been made of the relative performance of the compound and simple engine, and the position of the compound in railway economy may now be determined.

25. It is possible to build a compound that will give satisfaction equal in tractive power to any of the simple engines.

26. The low pressure piston will give better results if made of cast steel with a bronze bearing ring cast in its periphery.

27. The most notable improvements have been in the intercepting valve, in steam distribution, and better design of the machinery.

28. Attention is called to the necessity of further improvement in design of machinery, intercepting valve, and steam distribution.

29. With the modern machines the compound holds its place as against the simple, and it is not advisable to change any in use into simple engines.

The thoroughness and remarkable value of this report were fully recognized in the extended discussion which followed its presentation; but exceptions were taken to some of the conclusions by several of the members. Particular and strenuous objection was made to conclusion No. 1, to the effect that the compound was only "gradually emerging from the experimental stage," and upon formal vote this conclusion was ordered to be stricken out. The discussion was not only interesting, but very instructive, and we will give it in substance in our next issue.

The report of the committee on journal bearings, cylinder metals and lubrication, presented a good report through its chairman, Mr. W. C. Dallas.

This report was accorded very valuable discussion, which we shall give later in connection with extracts from the report.

The report of the committee on piston valves was presented by Secretary Taylor, and was in substance as follows:

### PISTON VALVES.

[S. P. BUSH, WM. MCINTOSH, H. SCHLACKS, Committee.]

Nearly all of those reporting as having had experience with the piston valve speak favorably of it, and this, in the judgment of your committee, is satisfactory evidence that it has merit. The advantages of the piston valve are generally stated as follows:

For steam pressures exceeding 185 pounds the piston valve offers considerably less resistance than the slide valve, thus reducing the work the entire valve gear must perform, and reduces the internal resistance of the locomotive, which is thought to be considerable in modern high pressure engines.

For steam pressures higher than 185 pounds the question of valve lubrication is very much simplified and the difficulties of cut valves and seats are very much diminished.

The cost of maintaining the piston valve seems to be no greater than that of maintaining the slide valve. This statement is not based on a large number of figures, but rather on the judgment of those using the piston valve.

The area of admission and exit openings can be very materially increased with the piston valves, which, with higher power locomotives, seems to be a very important advantage, and it is well known that, in order to obtain the highest efficiency from a locomotive, it is not only necessary to get the steam into the cylinder promptly, but to get it out again.

The committee believes that, in adapting the piston valve to the simple engine, the internal admission type has, possibly, a slight advantage in that the loss of heat of steam going into the cylinders is somewhat less than in the case of the external admission type.

Some railways and locomotive builders, when designing valve gear for piston valves having internal admission, assumed that the valve gear as designed for external admission

would answer for those with internal admission. Practice develops that this is a mistake, and that in order to obtain the proper steam distribution, the valve gear must be specially designed for the internal admission.

In designing the piston valve, attention is called to the necessity of obtaining the benefit of all the area of admission and exhaust which the principle of the piston valve affords. The committee thinks that this has not always been taken advantage of to the full extent.

One point in piston valve construction that has been found to have a material effect on steam distribution has been somewhat overlooked, namely, the difference in area between the forward and rear end, the area of the rear end being reduced by the area of the piston rod; the two ends are therefore out of balance, and as a result the motion of the valve in one direction is deranged as compared with the motion in the other direction, inasmuch as the lost motion in the valve gear is taken up in an opposite direction from that which is ordinarily the case. This based upon experiment on the part of the committee, and from the statement of an individual to the effect that a locomotive equipped with piston valves ran for quite a distance with one of the valve stems broken, the valve making its regular movement by being pushed ahead by the end of the broken valve stem in one direction, and pushed back again in the opposite direction by the excess pressure on the forward end of the valve.

The committee finds a great variety of packing used for piston valves. It can be said, however, with perfect certainty that plain snap packing rings will give entirely satisfactory service.

The discussion was participated in by but few, but it was entirely and decidedly favorable to the piston valve. We will give this talk later.

The committee on power transmission by shafting vs. electricity reported through Mr. Geo. Gibbs, its chairman. Following are the conclusions of this most admirable report, which we shall give practically in full in our next issue.

#### POWER TRANSMISSION BY SHAFTING vs. ELECTRICITY.

[GEO. GIBBS, F. MERTSHEIMER, WILLIAM RENSHAW, W. A. NETTLETON, R. A. SMART, Committee.]

This report was a thoroughly admirable treatise upon its topic, and we shall give it space in full in a later issue. The conclusions of the committee were as follows:

1. In a small shop, consisting of practically one building, having an equipment of small tools for light work only, electric transmission will not be found a paying investment. In such a shop, however, an electric lighting dynamo will be a convenience, and may be utilized to run a few labor saving electric tools, such as a cylinder boring outfit, a turntable motor, etc.

2. In an extensive railway shop plant, the installation of a central power station and electric transmission will always be found advisable, as it will not only result in the most economical system in respect to operation, but will make possible far more important shop economics, namely, an increase in quantity and quality of output, and a reduction in cost of handling the same.

This report was discussed at considerable length, and the substance of the talk we propose to give in a later issue.

The report of the committee on the best type of stationary boiler for shop purposes was presented by Secretary Taylor.

Discussion on this report was not extended, and was in the main adverse, the value of the committee's suggestion that tests be made being questioned, and other suggestions as to methods of superheating steam being deprecated.

The election of officers resulted as follows: President, W. S. Morris; first vice president, A. M. Waitt; second vice president, J. N. Barr; third vice president, G. W. West; treasurer, Angus Sinclair. After adjournment the new executive committee met and reappointed Mr. Joseph W. Taylor secretary.

## THE CAR FOREMEN'S ASSOCIATION OF CHICAGO.

### JUNE MEETING.

The regular meeting of the Car Foremen's Association of Chicago, was held in Room 1741, Monadnock Building, Thursday evening June 14. President Morris called the meeting to order at 8:00 p. m. Among those present were:

Angell, F. R.	Depue, Jas.	Krump, M.	Swift, C. E.
Aley, David	Deen, C.	Kline, Aaron	Stagg, C. S.
Baker, A. F.	Evans, W. H.	Kamen, Fred	Stimson, O. M.
Bossert, Chas.	Guthenberg, B.	Marsh, Hugh	Schultz, Aug.
Bundy, C. L.	Groobey, Geo.	Murray, D.	Schultz, F. C.
Bates, G. M.	Gruhlke, Edw.	Morris, T. R.	Sharp, W. E.
Barton, J. E.	Grieb, J. C.	Nightengale, H.	Wolfe, Chas.
Bell, W. A.	Hedrick, E.	Olsen, L.	Williams, Thos.
Blohm, Theo.	Harvey, H. H.	Perry, A. R.	Wirtz, L. C.
Callahan, J. A.	Hanson, W. L.	Prickett, J. A.	Wentsel, Geo.
Carey, C. H.	Hunt, T. B.	Roof, C. S.	Wessell, W. W.
Callahan, J. P.	Hansen, A. P.	Spees, Wm. F.	Wilcoxson, Geo.
Cook, W. C.	Jones, R. R.	Senger, J. W.	Wilcoxson, W. G.
Constant, E. J.			

The minutes of the previous meeting were approved as printed in the RAILWAY MASTER MECHANIC.

The committee on broken center plates and center pins was not ready to report, and was given another month.

Secretary Kline reported the following list of new members:

H. J. Beckman and A. F. Baker, C., M. & St. P.; A. Bawnes, C. & N. W.; J. Kinsch, C., B. & Q. Ry.; G. T. Rohrback, S. R. T. Co.; Wm. Zerbst, Nelson Morris Co.

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**RESPONSIBILITY FOR BROKEN DRAFT TIMBERS.**

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President Morris: The first subject is the discussion postponed from the last meeting, in regard to responsibility for broken draft timbers, etc., in connection with missing coupler. This is a subject that we are all very closely concerned in, and I would like to hear a very full and free discussion on it.

Mr. Bates (C., B. & Q.): Since our last meeting, I have had occasion to look up two cases of this kind, and in both instances I found the coupler and its attachments intact and in good order. I do not believe I have changed my opinions concerning this subject, and I still think it proper to charge for the draft timbers.

President Morris: That is, you do not consider it a combination?

Mr. Bates: No, sir; I do not.

Mr. Prickett (C. & E. I.): I, also, had a case since our last meeting. This coupler was brought in—had been pulled out; the draft timbers and the carry iron were broken; the car was chained up to another car. I found the coupler was all right, and the spring and followers all right. I think it is perfectly proper to charge the owner in cases of that kind.

President Morris: Did I understand you to say that the car was brought in on a chain and the draft timbers broken while car was being handled with chain?

Mr. Prickett: Yes, sir. The draft timber bolts were loose, and allowed the draft timbers to spread, and the coupler fell out. It is the fault of the car owner in not keeping the draft timbers in perfect shape.

Mr. Sharp (A. C. L.): In the case just cited by Mr. Prickett, the fault was with the railway company receiving the car in that condition. The rules provide protection for him for making those repairs. If he neglected to make them, and the car is further damaged, I am of the opinion he is responsible for the additional damage.

Mr. Bates: I do not want it to be understood that the cases which I found were the same as those mentioned by Mr. Prickett; the draft timbers were broken at the draft lugs, and later on the coupler came out. I think they are precisely the same as in the case brought up at the last meeting night, and that is what I had reference to.

President Morris: I think it is generally understood that the question under discussion relates to draft timbers that are broken before the drawbar was pulled out, and not afterward. I believe it is also pretty well understood that draft timbers broken on account of car being

handled on a chain, should not be charged to the owner. The question before us is one in which the draft timbers were broken, the coupler lost as a result of the broken draft timbers, and the car put on the repair point with coupler missing.

Mr. Bell (Wab.): I am of the opinion that in a case as you have explained it, the subsequent damage, while due to the failure of the draft timbers, the owner is responsible for. I do not think it is a combination in that case.

Mr. Callahan (C., L. S. & E.): I think, in the question as stated, there is no doubt but what the owner is responsible. But in a case as stated by Mr. Prickett, where the timbers were broken bringing the car to the shop, the party doing the damage should pay for it. A few days ago, one of our connections delivered us a car where the draft timber bolts were broken on one side, and in order to get the car unloaded and save him a job, I took the car. In getting the car over to be unloaded they jerked the draft timbers clear off and pulled out part of the end sill. I took the car back to the guilty man and told him to take the car back and repair it.

Mr. Murray (P., C., C. & St. L.): I do not see much opportunity for discussion in the question the way it is laid down. If the draft timbers were broken before the drawbar was missing, there should be no discussion — the owner is responsible for the draft timbers.

President Morris: If the coupler is turned in, or can be procured, and it is found that everything is all right, there is no question but what it is owner's responsibility; but if the coupler cannot be found, then the question arises as to who is to pay for it.

Mr. Roof (S. R. L.): I cannot exactly agree as to the responsibility for broken draft timbers, caused by bringing in a car chained up. This certainly is a defect for which the company damaging the car is entirely responsible; and, furthermore, even if the coupler be lost, the company making repairs, not knowing at the time as to the condition of the coupler, and living up to the spirit of the rules as they now exist, could not, in justice to the car owners, charge them for the draft timbers and the coupler. They would not render a bill if they lived up to the true spirit of the rules.

Mr. Bates: The rules say that we cannot charge for a missing coupler, and it does not matter whether the draft timber is broken or otherwise. Section 4 of Rule 5 says that you cannot charge for the coupler — only for the labor of applying it. It is assumed that all lost

couplers are in good order, and for that reason I claim there is no combination.

Mr. Grieb (C., M. & St. P.): It seems to me that the question at issue here depends on what construction should be given to the term "coupler missing." If it relates to a coupler that is lost and not found, and there is damage done to the draft timbers, it does not seem to me proper to make any charge. If, however, you recover the coupler and find that it and its attachments are uninjured, it is proper to charge for the draft timbers. In the latter case, it is simply returning the coupler and its attachments to the car and renewing the draft timbers. Arbitration case 484 covers one parallel to this question, and shows that it simply depends on whether you are able to show whether the coupler is all right or not, and if it is all right, then you can charge for the draft timbers. The burden of proof as to whether the coupler is in good condition or not, rests with you. If you find that the coupler and its attachments are in good condition, you can charge for the draft timbers.

Mr. Hunt (P., Ft. W. & C.): The case which Mr. Grieb cites here seems to bear him out in his argument, and still when you look at it from another light, the other gentlemen seem to be borne out. I believe we consider that if a coupler is missing it is in good order. Section 4 of Rule 5 reads: "Bills may be rendered against car owners for the labor only of replacing couplers, drawbars, brake beams (including their attachments, such as shoes, heads, jaws and hangers), brake levers, top and bottom brake rods that have been lost on the line of the company making the repairs," which goes to show that the parties getting up these rules considered that the coupler, with its attachments, and everything pertaining to it, is in good order—simply pulled out and lying along the line of road somewhere, in good order, and worth its full value to that company on whose line it lies. Now, that being the case, I do not know that this case is a combination. It seems to me it is not, as the coupler is not broken, and I believe it will take the coupler to make the combination. So I do not see how you can get over that, according to Section 4 of Rule 5.

Mr. Bates: I believe Mr. Grieb is right, in this way: If a railway pulls a coupler out of a car and wants to charge the car owner with a new one, I think the burden of proof rests with that company to ascertain the condition of the coupler; but in a case like this, when the draft timbers are broken first and where the coupler is pulled out, I do not believe there is anything wrong in charging for the draft timbers.

Mr. Grieb: For the benefit of Mr. Bates, I would like to quote a little from arbitration case 484, previously stated, as having some bearing on this particular question: "The drawbar and attachments were lost and, apparently, the draft timbers and deadwood were damaged. The burden of proof that this was not a combination rests with the party doing the damage. It has not shown that the damage to draft timber was not accompanied by simultaneous damage to either the couplers or drawbars, drawbar springs, drawbar pockets, or their substitutes or followers, and is therefore not entitled to make bill, and this charge should be withdrawn." I do not think the Car Foremen's Association of Chicago would undertake to legislate in opposition to a decision rendered by the arbitration committee. This decision is very forcible and very plain, compelling the party having the car in his possession to show positively that the coupler is in good condition. If you fail to do so, there is attached to you the doubt as to whether a combination does exist. If you are not able to clear yourself of that doubt, in justice to yourself and your neighbor, you should give him the benefit of it and make no charge. It occurs to me, also, that there would be no difficulty in recovering the lost coupler; it is a valuable portion of the car, and all roads issue instructions to their trainmen to bring in such parts. The matter is one that very readily adjusts itself, and there should be no difficulty in determining whether the coupler and its attachments are in good condition or not. At any rate, I do not see how you can clear yourself of suspicion without showing definitely that the coupler and its attachments are in good condition before making any charge.

Mr. Bates: I would like to ask Mr. Grieb if the car was not received from connecting line with defects to the draft timbers, in the case he just cited?

Mr. Grieb: I do not know whether it was or not. I take the position, however, that it cuts no figure whether it was or not.

Mr. Bates: I think that it does.

Mr. Hunt: I am not sure that that has any bearing on the case at all; that is on a drawbar. Now, there have been rules formulated since that decision was made, for couplers. It is now couplers that we have to contend with, and not drawbars; and according to Section 4 of Rule 5, they have decided that a missing coupler is not a broken coupler.

Mr. Sharp: I would like to call Mr. Hunt's attention to the last word in the second to the last line in the section he has just quoted —

“drawbars.” It does not seem to me that this covers couplers only. The question of bill for labor only, for making repairs as named in this Section 4 of Rule 5, applies to couplers where there is no other defect. If the car arrives with the coupler missing, and no other defects, you are entitled to render bill for labor only, assuming that that coupler and its attachments are in good order; but according to arbitration case 484, which has never been changed by the arbitration committee, the burden of the proof rests with the company handling the car; they have got to prove that this coupler and attachments are in good condition before they are entitled to render any bill.

Mr. Bates: I would like to have that decision read in full.

(Secretary reads case.)

Mr. Bates: As you have all heard, from the reading, case 484 was quite complicated. The car was handled between several railways, and they all have record that the car had some defects to the draft timbers, which should have been repaired. I cannot see how you can call that a parallel case to this one.

Mr. Sharp: May I read a little abstract from the Interchange Manual, which was published in this year: “In both cases the argument is raised that the draft timbers were both damaged before the final damage, necessitating repairs, was done. It is the duty of all roads to give foreign cars the attention necessary to put them in safe hauling condition, and in case of breakage or damage resulting from neglect of this, such neglect will not relieve the road from responsibility for damage which it claims would not have occurred if the car had been repaired at the proper time.”

Mr. Bates: The case under discussion now, is simply an instance where the draft timbers were broken first and no other damage resulted. As I understand it, the coupler merely pulled out, and it is conceded by all that a missing coupler is in good order on the line that pulled it out.

President Morris: I do not think that is quite the understanding, Mr. Bates. As I understand the case, the car has two broken draft timbers and a missing coupler, or it comes into the station in that condition. We do not know whether the coupler is broken or not. That is what we want to find out. If we know that positively, then the case settles itself.

Mr. Bates: As I have just said, if the coupler is on your own line it is in good order.

President Morris: I do not think it is conceded that it is in good order.

Mr. Bates: The rules say that you cannot charge for a missing coupler under any conditions, and I do not see why you cannot consider it in good order in this case.

President Morris: That is in case of a missing coupler only. Where there is a combination of two broken draft timbers it alters the case altogether.

Mr. Hunt: In looking over this rule further, I see drawbars are mentioned—"couplers or drawbars"—so that a missing drawbar is according to this rule, supposed to be in good condition. Now, if the coupler, or drawbar, as the case may be, is not broken, and the rules as much as say that a missing coupler or drawbar is not, because they only allow you to charge the labor in replacing it; hence there cannot be a combination.

Mr. Morris: As stated by me at our last meeting, the practice of the Chicago, Milwaukee & St. Paul Railway, at Chicago, and I think all over the system, is, if the car is brought to the repair track with two broken draft timbers and a missing coupler, we hold that car until we can find out positively whether the coupler is broken or not, before we decide whether we or the owner is responsible, and if we fail to recover the coupler we take it for granted that we are responsible, or, in other words, we cannot prove that the owner is, and we accept the responsibility ourselves, and, personally, I know that we have recovered the couplers a number of times and found them broken, which, of course, settled the case so far as responsibility was concerned.

Mr. Grieb: I offer a motion to the effect that a coupler lost in connection with two broken draft timbers, deadwood, etc., forms a combination prohibiting any bill; that in speaking of this coupler as lost, we consider it lost beyond recovery. However, if it be recovered and found in good condition, that a charge for draft timbers be proper; in other words, making it dependent on the recovery of the coupler and finding out definitely whether or not it was in defective condition.

This motion was duly put and carried.

#### LABOR CHARGE FOR REMOVAL OF BRAKE HEAD.

President Morris: Question No. 2 is in regard to labor charge for the removal and replacement of a brake head, or fork, on a metal brake beam in cases where they are riveted on.

Mr. Bundy (S. R. L.): I have taken the position that a charge of three hours' labor would be about right on a metal brake head that has to be riveted on to the beam; but three hours may be a little too much. Now you take the Marden beam, or the Monarch, or beams of that type, and I think from two to three hours, or about three hours' labor—two hours for removing and applying the beam and one hour for the head—would be a proper charge.

President Morris: What do you find in bills against your company, usually?

Mr. Bundy: I do not know as I can answer that. Possibly Mr. Cook can give us the information.

Mr. Cook (S. R. L.): We usually find that they charge us three hours' labor; but at the same time, when the position was reversed, and we charged, on a defect card, three hours' labor, the bill was questioned.

Mr. Grieb: We had this question up some time ago. We considered we were entitled to some little extra labor, in addition to the time allowed carsmiths for putting on a beam, and it was decided that one hour be added.

Mr. Sharp: It seems to me that two hours is ample. We all know that it does not take two hours to remove and replace a brake beam; and if we change the brake head or brake fork, which is riveted on, it is a very small matter, involving usually one, not more than two rivets, and I am of the opinion that two hours' labor would be sufficient.

Mr. Roof (S. R. L.): I agree with Mr. Sharp, especially with reference to a metal brake beam where a great many of the heads that are removed, are removed and applied without taking the beam off, which can be done. Even if the beam is removed—a Sterlingworth or a Marden beam—it is not necessary to consume an hour in removing and applying the beam. I think, therefore, a charge of two hours is sufficient.

Mr. Marsh (C., N. Y. & B.): I believe that three hours would be about right. It will take all of that time to take the brake beam from the car, take it to the blacksmith shop, have a new head riveted on, and replace the beam on the car. It generally requires the services of two men; and in taking the common wages paid ordinary truckmen you get the rate out of them, but considering the blacksmith, where you have a high-priced man, the amount allowed by the M. C. B. Rules does not cover the price paid that man. Take the time consumed, and the amount, and it will average up about three hours.

Mr. Roof: I do not think that it is necessary to take the brake beam off; nor does it require the services of a high-priced man; and I do not think a foreman would take the beam off and take it to the blacksmith shop to have the head riveted on; furthermore, I do not believe the higher officials of any railway would uphold a foreman who went to this trouble and spent an unnecessary amount of time in doing a small job of this kind, as the rivets can be driven cold while the beam is on the car.

Mr. Marsh: I do not believe, either, that there is a railway in this country which would be willing to pay for a half-way job of riveting, and I do not believe a rivet sprung cold is going to hold. I would just as soon have a pine stick stuck in.

Mr. Roof: Many trunk line roads today in building all their tanks are setting the rivets cold.

Mr. Bates: I do not agree with any of these gentlemen; I believe that one hour is sufficient. On our road we have a portable forge, and, furthermore, we have no blacksmiths doing this work. The man who does the riveting gets the same wages as the car repairers and does just as good riveting as any blacksmith. They never remove any beams for this work, and I am safe in saying that one hour covers the entire time. We do all our riveting outside, and never take a beam to the blacksmith shop to have it done.

Mr. Deen (C. J.): As far as removing the beam is concerned, I do not think that it requires much time. I had a couple of men take out a pair of wheels, remove the brake beam, and repair it, all in two hours.

Mr. Cook: The rules specify an arbitrary charge of two hours for removing and applying a beam, and if any additional work is done, I do not see why time should not be charged. If you gain on that two hours one time, you may lose on it another time; so it will even up in the end. Those time allowances were put in the rules to be used, and I do not see any reason why we should single out one item and deviate from the allowance set forth in the rules. They allow two hours for taking the beam off and applying it again, and that charge should be adhered to in all cases, then make an additional charge for the actual time that is expended in taking off the defective head and riveting on the new one.

Mr. Prickett: I agree with Mr. Cook. The rules allow two hours for removing and replacing a wooden brake beam, and I should think

that two hours would be sufficient to take the head off a metal beam and rivet it on again. I do not think we should charge any more than two hours.

Mr. Hunt: I am inclined to believe that, when this charge of two hours for a brake beam applied was put in the rules, there was taken into consideration the fitting up of the beam, because many beams are of wood and the head and jaws must be fitted to them, and if a beam is broken there has to be another beam fitted up and applied, and it was more for that, possibly, that a time allowance of two hours was given in the rules. Of course it will not take two hours to take a beam off and put one on, but where the time comes in is in fitting the beam up. It says, "brake beam, one, replaced, two hours." That term "replaced" is used all through the rules, and in many instances means fitting up the parts; but further on in this rule it says, "Brake beam, one, metal, blacksmith labor repairing, two hours." Now, I suppose it can be claimed that putting in rivets is blacksmith work and, possibly, in many instances the beam would be taken to the blacksmith shop and riveted up, and you could, possibly, in this case, make a charge of two hours for this riveting, but I think that would be too much. Two hours, it seems to me, would cover the whole job, but it certainly ought not to be more than three hours.

Mr. Sharp: I am a little like Mr. Bates; I think we have all been talking way around the subject. I thought when I first read it that it referred to a brake beam; but it says: "How much labor should be charged for removing and applying a brake head or fork on a metal brake beam, in cases where they are riveted on?" Mr. Bates has demonstrated the fact that they put them on for not to exceed, I suppose, 15 cents. Now, if that is the case, why should there be an arbitrary charge of three hours, which would be 60 cents for doing this class of work? It seems to me that it takes care of itself. The bills, in my mind, should be rendered for the amount the work costs.

Mr. Marsh: I still hang on to the three-hour argument. I believe that an hour and a half for two men would be consumed in removing the beam, taking it to the blacksmith shop, having the head riveted on, and replacing it on the car. Now, if a railway company or private company wishes to expend its money for little hand forges, or such things, and can do the work for less, it certainly should be allowed to get some interest on the investment; but take it with a railway company, where hot metal is used, it is blacksmith work, and not ordinary truck work;

and if a railway company uses forges of the kind mentioned by some, it certainly should get the benefit of it; but I do not believe there are any two men living who can remove a beam, take it to the blacksmith shop, have it riveted and put back on the car in two hours. I would make a motion that a reasonable amount to be charged for renewing a brake head or fork on a metal brake beam would be three hours.

The motion was carried by a rising vote of 21 for, 17 against.

#### LABOR CHARGE FOR REPLACING BROKEN COUPLER AND CARRY IRON.

President Morris: Question No. 3 relates to charge for labor in replacing a broken coupler and carry iron at the same end of car.

Mr. Grieb: It seems to me that this case, as stated, is simple enough. It does not occur to me that the replacement of the carry iron in connection with a broken coupler involves any additional labor. The usual practice in taking out the coupler is to take the carry iron off, or, at least, slack it down, and therefore it seems to me a little bit stiff if you were to double up on the labor charge, or work this accumulative racket that we find practiced occasionally. I suppose these repairs were all made at the same time (it specifies here "at the same end"), therefore it would be my opinion that the proper labor charge would be two hours for replacing a broken coupler and a carry iron, no additional labor being allowable for the replacement of the carry iron, at same end and same time.

Mr. Prickett: In this case I do not see where you can get back of the rules. You have got to take the carry iron off to replace the coupler, or slack it down, as Mr. Grieb says, and the rules allow two hours for replacing a coupler or drawbar, and I do not see that you can put any additional charges on the carry iron, as the carry iron in most all cases has got to come down before you can get the coupler out and a new one in.

Mr. Deen: With a pocket coupler you have got to take the carry iron down, in order to get the coupler up, and I do not see why they should charge more than two hours. If it is a stem coupler, you can do it that much quicker, and I think two hours plenty of time to do the work.

Mr. Bell: I do not think there should be any discussion about this. The rules provide two hours as sufficient; and I think we all agree that two hours is sufficient. The carry iron has got to come down in most cases.

President Morris: Has any one been charging more than two hours for doing that work? Has any one had any bills presented for labor in excess of two hours?

Mr. Deen: I have had bills in two or three cases where they billed two hours for applying the coupler and an hour for the carry iron; but I took note that they never got pay for more than two hours.

Mr. Grieb: We had a bill presented to us, not very long ago, where they charged us four hours — two for the coupler and two for the carry iron. We brought a little reason on paper down to them, and they reduced the charge to two hours.

President Morris: We seem to be pretty much all of one opinion in regard to this case. Two hours seems to be the proper charge.

#### A CASE IN DISPUTE.

We now come to the fourth and last question. This is a case in dispute between two railway companies as follows:

“A” delivered one of its stock cars to “B.” B returns car to A a month later with two center sills, two draft timbers and one end sill broken, and draft rigging all pulled out. A makes claim on B for defect card to cover those defects. B declines card, advising car had loose draft timbers and one draft sill split and bolted when car was received by it, and that the center sills and draft timbers were broken and draft rigging all pulled out by reason of a rotten end sill. A claims broken end sill removed did not show sufficient decay to cause it to break under fair usage. Is A entitled to a card?

Mr. Sharp: I believe that the party doing the damage is responsible to the car owner for the defects. Arbitration case 484, which decided question No. 2 in this evening's program, plainly states that the failure on the part of the railway to take the necessary precautions to prevent damage to a car, makes them liable. That is the argument in this case—that the car was in a defective condition when received by railroad B. The failure on their part to put the car in a fit condition to be handled and prevent further damage, makes them responsible to the owner.

Mr. Grieb: I would like to say that I fully coincide with the opinions expressed by Mr. Sharp, and for the reason that there is an arbitration ruling, case 465, which is an exact duplicate of the one before us. It does not seem to me that there is any question or argument in this late date, and I do not think the excuse of old defects, rotten sills, etc., can be taken into account. The party handling the car has the privilege, under the rules, to put this car in safe condition, and if he does not do that, he does not properly protect his own interest or that

of the owner. If he chose to run the car in that condition, and a combination arises, he is entirely responsible.

Mr. Hunt: I agree entirely with Mr. Grieb. I think A has the best of this argument. The claim made by B would not hold water at all, according to the M. C. B. Rules. If the car did not suit him, he ought not to have taken it. That is the rule; and if he further damaged the car, of course he is in for the defects; but I might mention that there is one way out of such difficulties. If, in cases of this kind, he found that the parts are rotten, etc., the only way would be to have a joint inspection. A joint inspection sometimes develops things which are not seen at first, and oftentimes one gets free from paying what really he ought not to pay. According to the M. C. B. Rules, B is responsible for the damage to this car.

Mr. Grieb: I would like to say, in reply to what Mr. Hunt has advocated, that it occurs to me that these post-mortem examinations come in a little late and with very bad grace. If the car is in a generally dilapidated condition, Rule 7 makes ample provision for the car. If they do not avail themselves of the privilege, they ought to pay for it. There ought to be a fine for running cars in such condition.

Mr. Hunt: I do not quite agree with Mr. Grieb on that, for the reason that we are compelled to handle cars that are in bad shape — cars that ought not to be handled; but they are brought to us, and we have got to handle them, and possibly before you can get them to the transfer track you have pulled the entrails out of them. Not your fault, maybe; maybe it is. But in some cases the post-mortem is all right. There is a great deal develops after the car is damaged that was not shown before, and a great deal that is recognized by the owner too.

Mr. Bates: This case, as I understand it, is as follows: A delivers this car to B, empty, for business on B's line, and it seems to me if B elects to handle the car a whole month and then turns it back to the owner in bad condition, he ought to be responsible.

Mr. Olsen (C., M. & St. P.): I think that B is responsible in this case, and in all cases of the same kind. I do not think cars ought to be run that have loose timber bolts or loose draft rigging. If loaded, they should be transferred; if empty, they should be repaired.

Mr. Marsh: I can see but one side to this question. The railway company accepts the car, and takes it over its line, and, after running it for a month or two, and the car is returned, insists on its being unsafe to run. If it broke the sills, tore out the draft timbers, and damaged the car generally, I think it ought to pay for the fun it has had.

Mr. Bell: Of course, I fully agree with Mr. Grieb in regard to this matter. I think the post-mortem examinations do sometimes reveal things it is well for us to know. I have a case in mind wherein a sill was rotten, "punky,"—that was the inspector's statement—and I assure you that an inspector, unless he took his scraper or his knife, or something to run into that, would not have discovered it at all. The car had been through the shops, and the parties making the repairs to that car must certainly have known that it was in that condition; however, it was painted. Now, I think the post-mortem examination in that case was all right. I know it saved our company quite a sum of money.

Mr. Roof: I would make a motion that the company handling the car and damaging it, is responsible; or, in other words, in the case under discussion, that A is entitled to a defect card.

Motion carried.

The meeting here adjourned.

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## EXHIBITS AT THE SARATOGA CONVENTIONS.

Acme Railway Equipment Co., Easton, Pa., represented by T. L. McKeen, mgr.; exhibits, McKeen carry irons and twin spring draft attachment. Buffer platform, vestibule, steel underframing for car platforms.

Adams & Westlake Co., Chicago, represented by F. B. Jones, W. S. Bartholomew, E. H. Stearns, J. W. Cross, A. S. Anderson, L. A. Gray; exhibit, Adlake acetylene gas car lighting system.

American Balance Slide Valve Co., Jersey Shore, Pa., represented by J. F. Wilson, pres.; R. J. Davis, sec'y; F. Trump, mech. engr.; exhibit, American balance slide valves, for locomotives, marine and air engines, and American balance piston valves.

American Brake Co., St. Louis, represented by E. L. Adreon, Jr., H. A. Wahlert; exhibit, automatic slack adjuster.

American Brake Shoe Co., Chicago, represented by E. L. Adreon, Jr., O. H. Cutler, E. Caldwell, J. W. Gardner, A. Gemunder, F. W. Sargent, G. H. Sargent, W. W. Snow; exhibit, brake shoes.

American Car & Foundry Co., St. Louis, Mo., represented by E. S. Marshall, B. A. Hagerman, Jr., B. H. Jessen; exhibit, Canda box car, self-cleaning wooden gondola car, D., L. & W. structural steel hopper car, all designed for 100,000 pounds capacity.

American Carbide Lamp Co., Philadelphia, represented by E. M. Parkhurst, vice pres. and gen'l mgr.; A. C. Buell, C. D. Washburn; exhibit, lighting apparatus in B. & A. R. R. car.

American Coupler Co., Chester, Pa., represented by F. F. Bennett; exhibit, American coupler.

American Locomotive Sander Co., Philadelphia, Pa., represented by Chas. Longstreth, pres.; Harry Vissering, supt.; exhibit, Leach track sanding apparatus, showing operation.

American Dust Guard Co., Columbus, Ohio, represented by James Timms ; exhibit, dust guards.

American Machinery Co., Grand Rapids, Mich., represented by J. W. Oliver, C. G. Jones ; exhibit No. 0, 3, six sizes Oliver wood trimmers, showing latest improved types of this machine.

American Steam Gage Co., Boston, Mass. ; exhibits, duplex air brake gauges, pop safety valves, Thompson improved indicators.

American Steel Foundry Co., St. Louis, Mo., represented by J. W. Robinson, J. N. Bell ; exhibit, cast steel car trucks.

Armstrong Bros. Tool Co., Chicago, represented by Paul Armstrong ; exhibit, planer and machine shop tools.

Atlantic Brass Co., New York, represented by W. G. Bosworth, A. J. Stott ; exhibit, A. B. C. journal bearings.

Atlas Railway Supply Co., Chicago, represented by R. B. Kent, E. Nash ; exhibit, Atlas primer and surfacer, I. X. L. composition for wood and iron work.

Automatic Air & Steam Coupler Co., St. Louis, represented by N. F. Niederlander, pres. ; E. L. Adreon, Jr., sec'y and treas. ; exhibit, working  $\frac{1}{4}$  size model of air and steam coupler.

Automatic Track Sanding Co., Boston, Mass. ; exhibit, pneumatic track sanders for locomotives.

Ball Bearing Co., Boston, Mass., represented by W. S. Rogers, treas. and gen. mgr. ; A. O. Van Dervort ; exhibit, roller journal bearings and ball thrust bearings.

Baltimore Ball Bearing Co., Baltimore, represented by J. E. Nerwood ; exhibit, ball side bearings.

F. W. Bird & Son, East Walpole, Mass., represented by M. A. Garrett, J. B. Hicks ; exhibit, torsion proof car roof.

Bierbaum & Merrick Metal Co., Buffalo, represented by W. H. Barr, S. B. Merrick ; exhibit, Lumen bronze.

Bettendorf Axle Co., Davenport, Iowa, represented by W. P. Bettendorf, pres. ; exhibit, pressed steel car underframes.

Bliss Manufacturing Co., Pawtucket, R. I., represented by N. H. Colwell ; exhibit, Wood's platform gate, Crone's patent air gate.

Boston Artificial Leather Co., New York, represented by W. N. Dole, gen. mgr. ; Wm. Walden ; exhibit, full line of moroccoline in all colors and grains and fancy embossed patterns ; car seats with their new dull finish.

Boston Belting Co., Boston, represented by G. H. Forsyth, J. F. Muldoon, F. T. Alden, G. S. Wood ; exhibit, air brake, steam and car heating hose, mats and matting.

Bradley Co., Syracuse, N. Y., represented by J. Lucas Smith ; exhibit, upright and level power harness.

Buckeye Coupler Co., Columbus, Ohio, represented by James Timms.

Butler Drawbar Attachment Co., Cleveland, represented by G. L. Weiss ; exhibit, tandem attachments.

Carborundum Co., Niagara Falls, N. Y., represented by F. H. Manley, E. J. Eames ; exhibit, carborundum wheels of all sizes.

L. C. Chase & Co., Boston, represented by R. R. Bishop, Jr. ; exhibit, full line of Sanford mills car plushes, consisting of samples of all grades of plain and frieze goods. New Chase leather for smoking cars, car curtains and seats, and some exceedingly beautiful rugs for use in state room cars.

Chicago Grain Door Co., Chicago, Ill. ; represented by J. S. Mallory ; full size Chicago grain door, security and lock brackets.

Chicago Pneumatic Tool Co., Chicago, represented by J. W. Duntley, W. O. Dunt-

ley, Jos. Boyer, Frank Boyer, H. S. Hunter, Thos. Aldcorn, J. M. Towle, C. Smith, J. Parr, C. H. Haeseler, C. W. Laughlin, J. V. Bell, G. S. Fowler, C. E. Walker, C. W. Owston; exhibit, Chicago reversible drills, Boyer Drill, Chicago rotary drill, flue cutters, flue welders, Chicago piston breast drills, Chicago rotary breast drills, 10 H. P. motor, Boyer long stroke riveting, clipping and calking hammers, shell riveters, Boyer speed recorder, Chicago sand runners, Chicago painting machine, Chicago oil rivet forges, Boyer yoke riveters, Chicago staybolt biter and chuck, yard dolly bars.

Chicago Railway Equipment Co., Chicago, represented by E. B. Leigh, A. J. Farley, C. F. Huntoon, B. F. Pilson, F. G. Ely, T. E. Crane, E. G. Buchanan; exhibit, National Hollow, Kewanee, Diamond brake beams, automatic side bearings.

J. R. Clancy, Syracuse, N. Y., represented by C. W. Browne; exhibit, wrought steel hose clamps.

Cleveland City Forge & Iron Works, Cleveland, represented by G. L. Weiss; exhibit, turnbuckles.

Cloud Steel Truck Co., Chicago, represented by C. L. Sullivan, W. E. Smith, W. P. Bettendorf; exhibit, Bettendorf bolsters, Cloud pedestal and arch bar trucks.

Consolidated Car Heating Co., Albany, N. Y., represented by R. P. Scales, J. F. McElroy, W. P. Cosper, C. Hawley, W. P. Waldman; exhibit, steam, hot water and electrical car heaters.

Consolidated Railway Electric Lighting & Equipment Co., New York, represented by J. D. Rice, pres.; Jno. N. Abbott, vice pres. and gen. mgr.; J. L. Watson, sec'y and treas.; Col. Jno. T. Dickenson, gen. agent; P. Kennedy, chf. engr.; J. F. Riddle, J. F. Kelly; exhibit, car lighting by electricity generated from the axle, together with fans operated by same power.

L. N. Cox, New York, represented by L. N. Cox, J. R. Roddey; exhibit, torches.

Crosby Steam Gage & Valve Co., Boston, represented by S. G. Reid; exhibit, Water-back steam gauges, muffler and plain pop valves, chime whistles, Johnstone blow-off valve, spring seat globe and axle valves.

Curran & Burton, Boston, Mass., represented by G. M. Carpenter, H. H. Huff; exhibits, Huff track sanding device, Huff automatic steam blower, Huff auxiliary variable exhaust.

Curtain Supply Co., Chicago, represented by W. N. Forsyth, gen. mgr.; A. L. Whipple, gen. sales agent; exhibit, Burrowes & Forsyth "roller tip" and Acme and Climax cable car curtains and fixtures.

E. M. Dart Mfg. Co., Providence, R. I., samples of the Dart union couplings and flanges.

Dayton Malleable Iron Co., Dayton, Ohio, represented by R. C. Schenck, president; W. B. Ernshaw, secretary; O. G. Needham, assistant superintendent; exhibit, draft riggings of different types.

Frank S. DeRonde Co., New York, represented by Frank S. DeRonde; samples showing the application of lythite cold water paint. Also, full size models of a pneumatic painting machine.

Detroit Lubricator Co., Detroit, Mich., represented by H. C. Hodges and W. E. Bryant; exhibits, Detroit lubricators with tippett attachment, back pressure valves for steam chests.

H. K. Doolittle, Watertown, N. Y., represented by H. K. Doolittle and W. J. Esmond; exhibit, improvement in windows.

Drexel Railway Supply Co., Chicago, represented by R. L. Brown; exhibit, the Schroeder grain door and Caldwell brake shoe.

Dunlop & Plum, Columbus, Ohio, represented by Ed. Journeay and Frank H. Plum; exhibit, the U and W piston air drill.

O. M. Edwards, Syracuse, N. Y., represented by O. M. Edwards ; exhibit, window fixtures.

Fairbanks Co., New York City, represented by J. R. Bennett, S. C. Smith, J. N. Goff, A. W. Handy ; exhibits, Fairbanks valves and packing, Nicholson compression couplings, Nicholson adjustable lathe mandrels, Merrill pipe cutting and threading machines, Oster stocks, dies and screw plates, dust flanges and couplings, Walker magnetic chucks, durable wire rope, pneumatic appliances.

Fox Machine Co., Grand Rapids, Mich., represented by G. W. Leary ; exhibit, wood trimmers and woodworking machinery.

Garry Iron & Steel Roofing Co., Cleveland, Ohio, represented by E. C. Powers, C. S. Bigsby and A. Axtell ; exhibit, Garry revolving pneumatic crane and pneumatic car jack.

Gaskins Car Coupler Co., Arcadia, Fla., represented by W. E. Daniel ; exhibit, car couplers, showing coupler operated on a curve.

Gem Manufacturing Co., Pittsburg, Pa., represented by Henry Butterfield ; exhibit, patent clearing oil can, steel, brass and copper, for locomotives and shop use.

Gold Car Heating Co., New York City, represented by E. E. Gold, E. H. Gold, J. E. Ward, W. E. Banks, James Watson ; exhibits, car heating apparatus, duplex coil system and straight steam.

Goodwin Car Co., New York City, represented by J. M. Goodwin, F. D. Laughlin, asst. genl. mgr.; S. C. Higbee, M. C. B., and H. R. Lehle ; exhibit, model of the Goodwin car.

Gould Car Coupler Co., New York City, represented by F. P. Huntley, sec'y ; Dr. C. W. Gould, G. H. Widner, P. R. Diamond, W. F. Richards ; exhibit, passenger and freight slack adjusters, improved M. C. B. journal box, malleable draft rigging for freight equipment with spring buffer blocks, the Gould vestibule continuous buffer and improved steel platforms.

Hale & Kilburn Manufacturing Co., Philadelphia, represented by H. T. Bigelow and B. F. Pilson ; exhibit, pressed steel seats, both walkover reversible, with automatic foot rails.

M. C. Hammett, Troy, N. Y., represented by M. C. Hammett : exhibit, Sansom bell ringer.

Harrison Dust Guard Co., Toledo, Ohio, represented by F. B. Harrison, genl. mgr. ; exhibit, dust guards in four sizes, for forty, sixty, eighty and one hundred thousand pound capacity cars.

Heywood Bros. & Wakefield Co., Boston, Mass., represented by F. H. Henry, Bertram Berry ; exhibit, Wheeler, Henry & Bushnell car seats and rattan parlor and private car chairs.

Homestead Valve Manufacturing Co., Pittsburg, Pa. Full sized model of Homestead locomotive blow-off valve.

Illinois Malleable Iron Co., Chicago, represented by O. C. Mann ; exhibit, the Bruyn automatic swing smoke jack.

International Correspondence Schools, Scranton, Pa., represented by W. N. Mitchell ; exhibit demonstrating car on D. & N. track.

Jenkins Bros., New York City, represented by C. W. Martin and John Williams ; exhibit, valves, packing and magnetic lamp holder for incandescent lamps.

H. W. Johns Manufacturing Co., New York City, represented by F. M. Patrick, J. E. Week and E. G. Sparks ; exhibit, complete assortment of asbestos goods, including fire felt locomotive lagging, vulcabeston for piston rods, packing valves, stems and air brake packing rings.

Joyce-Cridland Co., Dayton, Ohio, represented by J. O. Joyce, T. H. Cridland, F. I. Joyce ; exhibit, full line of jacks, track, locomotive, hydraulic, geared and single lever.

Philip S. Justice & Co., Philadelphia, Pa., represented by P. J. Mitchell; exhibit, Reliance hydraulic jacks.

M. E. Kanaly Co., Cambridgeport, Mass., represented by M. E. Kanaly; exhibit Kanaly door hanger, with steel track and axle for freight cars, baggage cars and warehouses.

Keasbey & Mattison Co., Ambler, Pa., represented by R. L. Thomas, W. L. Gilmore, Maj. W. J. Harwood; exhibit, locomotive, magnesia, lagging and train pipe covering.

Keystone Drop Forge Works, Philadelphia, Pa., represented by A. Morris Hall, manager; exhibit, the Keystone connecting link, to take the place of a weld for connecting brake, guard, or wrecking chains.

Knitted Mattress Co., Canton Junction, Mass., represented by F. W. Sumner; exhibit, knitted elastic padding for car seats, cab and caboose cushions, table padding for dining cars.

Koko Cream Co., New York City, represented by G. L. Waitt; exhibit, Koko cream, demonstrating cleaning car interiors and other varnished surfaces.

Lappin Brake Shoe Co., New York City, represented by J. D. Gallagher, N. P. Hobart, T. B. Kirby, F. H. Coolidge, H. G. Darwin, F. O. Brazier, W. S. DeHart; exhibit, car and locomotive brake shoes.

Leach, Simpson & Collier, Chicago, represented by W. M. Simpson and F. P. Collier; exhibit, Ferguson locomotive fire kindler.

Lunkenheimer Co., Cincinnati, Ohio, represented by C. E. Houghton and John Desmond; exhibit, injectors, globe valves and swing check valves.

Manhattan Rubber Co., New York City, represented by J. W. Lowell; exhibit, air brake hose, rubber packing, Victor driving brake packing, gaskets, zigzag stitched belt and hard rubber valves.

Manning, Maxwell & Moore, New York City, represented by F. P. Smith, C. Swan, W. O. Thompson, Geo. Sevey; exhibit, Metropolitan injector, boiler checks, main steam valves, intermediate swing checks for delivery pipes, Hancock single and double inspirators, duplex boiler check, Ashcroft steam gauges and Consolidated safety valve.

Manning Signal Lamp Co., Des Moines, Iowa, represented by L. S. Coffin; exhibit, signal and switch lamps.

McCord & Co., Chicago, represented by A. C. McCord, J. A. Lamon, G. N. Calib, A. M. Rockwell; exhibit, McCord journal box, McCord coil spring damper, Johnston hopper door.

Michigan Lubricator Co., Detroit, Mich., represented by F. W. Marvin, president, and assistant; exhibit, improved Michigan No. 3 lubricator in nickel and black enamel finish, and improved No. 2 with automatic steam chest plugs, and Nos. A, B and C air pump lubricators.

Monarch Brake Beam Co., Detroit, represented by H. W. Frost, T. E. Corliss, J. S. Andrews, R. C. Fraser and W. Rutherford; exhibit, "Monarch" and "Solid" brake beams.

Moran Flexible Steam Joint Co., Louisville, Ky., represented by H. U. Frankel, pres.; T. W. Moran, supt.; exhibit, full supply of joints of all sizes, ranging from 1 to 1,500 pounds, all metal steam heat couplings, with models showing working of same.

Thornton N. Motley Co., New York City, represented by T. N. Motley and R. S. Mercer; exhibit, Johnstone flexible stay bolt, Symons automatic air brake recorder.

National Car Coupler Co., Chicago, represented by J. Hinson; pres.; J. M. Waugh, sec'y; exhibit, National car coupler with Miller combination steel platform and continuous platform buffers, Hinson drawbar attachment.

National Railway Specialty Co., Chicago, represented by J. M. Hopkins; exhibit, N. R. S. journal bearing key, Royal dust guard.

National Elastic Nut Co., Milwaukee, Wis., represented by A. H. Davis; exhibit, self-locking steel nuts, square and hexagon, sizes  $\frac{3}{8}$  to  $1\frac{1}{4}$  inches, inclusive.

National Malleable Castings Co., Cleveland, Ohio, represented by S. L. Smith, J. V. Davison, F. B. Whitlock, R. B. Owen, W. E. Coffin, F. R. Angell, M. C. Pilson; exhibit, Tower coupler, mounted, showing operation in service, new Stevenson oil box and lid.

National Lock Washer Co., Newark, N. J., represented by Daniel Hoyt.

New York Air Compressor Co., New York City, represented by W. P. Pressinger, C. E. Walker, C. Korneman; exhibit, straight line and duplex air compressors.

New York Leather and Paint Co., New York City. Full line of samples of Pegamoid for upholstering car seats and backs, and for head linings and curtains for cars.

A. O. Norton, Boston, Mass., represented by A. O. Norton, Harry Norton, J. D. McIlwain; exhibit, the Norton patent ball-bearing jacks and "sure drop" track jacks.

Pantasote Co., New York City, represented by J. M. High and H. M. Grier; exhibit, section of palace car showing car seats, car curtains and car head linings.

Peerless Rubber Manufacturing Co., New York City, represented by C. H. Dale, W. J. Courtney, C. S. Prosser and L. J. Lamasney; exhibit, air brake hose, steam hose, engine and tender hose, gas hose, packing, rubber matting, hose for pneumatic tools.

Pearson Jack Co., Boston, Mass., represented by A. N. Richardson; exhibit, Pearson car replacing jack, Pearson king bolt clamp and Goodwin brake beam clamp.

Penberthy Injector Co., Detroit, Mich., represented by G. H. Andrews; exhibit, Erwin steam ram.

Philadelphia Pneumatic Tool Co., Philadelphia, Pa., represented by J. W. Tierney, Geo. W. Barton, J. K. Henry, Leo Tierney and J. Keller; exhibit, calking, riveting and chipping hammers, yoke riveters, piston, rotary and breast drills, chain hoists, rammers, flue cutters, rollers and reamers.

Pittsburg Crushed Steel Co., Pittsburg, Pa. Samples of steel emery of different sizes for grading purposes.

Pneumatic Crane Co., Pittsburg, Pa., represented by C. E. Pettee, W. H. Halsey; exhibit, self-propelling hoist and trolley, with reversing air motor.

Powers Regulator Co., Chicago, represented by W. P. Powers, pres., and Chas. F. Pierce; exhibit, entire system of automatic temperature controllers as applied to railway cars and sleepers.

Pressed Steel Car Co., Pittsburg, Pa., represented by E. A. Schoen, J. B. Brady, G. E. Macklin, J. T. Milner, J. M. Maris, J. M. Hanson, F. G. Ely, A. G. Glover; exhibit, New York Central flat car, C. & A. gondola, Great Northern hopper gondola, Erie hopper gondola, Penna. Rd. hopper gondola, all with a capacity of 110,000 pounds.

Pyle National Electric Headlight Co., Chicago, Ill., represented by Mark Ross; exhibit, photographs showing the effect of headlight on the track.

Railroad Supply Co., Chicago, represented by P. Hien, C. Fitch, C. A. Herriman, P. H. Wilhelm and H. H. Green; exhibit, Hien, Wegg, Solid and Detroit couplers, draft rigging and Hien head and Potter shank.

Railway Appliances Co., Chicago, represented by Geo. H. Sargent; exhibit, Gilman Brown emergency knuckle.

Rand Drill Co., New York, represented by W. H. Traver, F. Parsons, J. H. Castle; exhibit, Rand air compressor.

Robert W. Randle, Richmond, Ind., represented by Mr. Randle; exhibit, car coupler and mail crane.

Roberts Car & Wheel Co., Three Rivers, Mich., represented by W. H. Frisby; exhibit, Donovan pressed steel wheel and Wilkins emergency clamp.

H. Sabine, Cambridge, Mass., represented by H. Sabine, W. C. Sabine ; exhibit, ball-bearing automatic couplers.

Safety Car Heating & Lighting Co., New York, N. Y., represented by Robert Andrews, vice pres. ; S. B. Hynes, secy. ; R. M. Dixon, engineer ; D. W. Pye, O. C. Gateley, William St. John, E. F. Slocum, W. H. Hooper, B. V. H. Johnson, M. P. Stevens ; exhibit, car lighting and heating apparatus ; the new features are fancy deck lamps, bracket lamps, gas ranges for private cars, and buoy lantern.

Schenectady Locomotive Works, Schenectady, N. Y., represented by A. J. Pitkin, L. R. Pomeroy, J. E. Sague ; exhibit, one New York Central mogul, one Northern Pacific ten-wheel compound and one Northwestern fast express engine.

Wm. Sellers & Co., Philadelphia, represented by S. L. Kneass, C. Conlisk, C. Parisoe ; exhibit, Wm. Sellers' latest '87 improved re-starting locomotive injector ; also, old-style boiler check and new-style double valve boiler check, model '87 improved boiler injector and feed water strainer.

Shelby Steel Tube Co., Cleveland, Ohio, represented by L. B. Thornburgh, W. S. Miller, T. V. Church, R. C. Hallett ; exhibit, boiler tubes and safe ends and seamless cold-drawn steel tubes for mechanical purposes.

Sherwin-Williams Co., Cleveland, Ohio, represented by W. B. Albright, E. N. Richardson, J. H. Eames and Thomas Madill ; various exhibits, showing application of railway paints.

Simplex Railway Appliance Co., Chicago, represented by W. V. Kelley, R. P. Lamont and H. A. MacClyment ; exhibit, simplex bolsters for 80,000 pound capacity cars, also, same for 60,000 pound ; Susemihl frictionless roller side bearing.

Smillie Coupler & Manufacturing Co., Newark, N. J., represented by C. H. Taylor and Stephen D. Barnett ; exhibit, Smillie improved coupler.

Standard Coupler Co., New York City, represented by Geo. A. Post, H. H. Sessions, A. P. Dennis and E. F. Pride ; exhibit, Standard steel platform and improved Standard passenger coupler.

Standard Pneumatic Tool Co., Chicago, represented by E. N. Hurley, J. D. Hurley, H. J. Kimman, G. A. Barden, W. Jennings, F. D. Price, F. A. Barbey, E. W. Irwin, H. M. Kearns and Charles Howard ; exhibit, pneumatic drills, boring machines, pneumatic hammers, reversible boring machines, reversible flue rolling machines, chain hoists, reversible staybolt reaming and tapping machines, long stroke riveters and yoke riveters.

Standard Paint Co., New York City, represented by R. L. Shainwald, J. N. Richards and J. C. Shainwald ; exhibit, P. & B. rubberoid car roofing for building roofs and locomotive roofs, P. & B. waterproof insulating papers for refrigerator cars, P. & B. waterproof preservative paints.

Standard Railway Equipment Co., St. Louis, Mo., represented by P. H. Murphy, S. H. Wheelhouse ; exhibit, pneumatic tools.

Star Brass Manufacturing Co., Boston, represented by C. W. Sherburne, E. C. Sawyer, C. H. Musgraves ; exhibit, air and steam gauges, chime whistles, pop valves.

Sterlingworth Railway Supply Co., Easton, Pa., represented by F. W. Coolbaugh, Geo. C. Murray, C. H. Boaz and W. H. Day ; exhibit, rolled steel car, rolled steel truck, and rolled steel body and truck bolsters and rolled steel brake beam.

Thornburg Coupler Attachment Co., Detroit, represented by W. N. Thornburg ; exhibit, coupler attachments with single, double or triple springs.

United & Globe Rubber Manufacturing Co., Trenton, N. J., represented by W. Sickel and W. R. Lindburg ; exhibit, complete samples of rubber supplies.

United States Metallic Packing Co., Philadelphia, represented by Chas. Langstreth and W. H. Crawford, Jr. ; exhibit, metallic packing instruction card covered with paraffine, making it indestructible for shop use.

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Universal Car Bearing Co., Chicago, represented by H. D. Kyle and D. J. Durrell ; exhibit, car bearings.

Universal Railway Supply Co., Chicago, represented by H. D. Kyle and D. J. Durrell ; exhibit, car doors.

Walworth Manufacturing Co., Boston, Mass., represented by G. E. Pickering ; exhibit, Stilson wrenches, ratchets, stocks and dies ; pipe vises, taps and cutters ; nipple holders, steam whistles, and Smith's railway track ratchets.

Waterbury Tool Co., Waterbury, Conn., represented by H. G. Hoadley ; exhibit, Williams' Universal ratchet drill, simplex lathe, center grinder.

West Disinfecting Co., New York City, represented by E. Taussig and J. D. King ; exhibit, complete line of disinfectant and disinfecting appliances, from spray pumps to the latest electric apparatus.

Western Railway Equipment Co., St. Louis, represented by Louis A. Hoerr ; exhibit, combination lug and follower casting, Economy slack adjuster, tandem combination lug and follower, sill and carline pocket, bell ringer, Western flush door, interchangeable door, safety and security truck and casting, the Mudd sander, the Lindstrom non-freezing suction pipe, St. Louis flush door, Acme pipe clamps, Downing card holder, Acme tender pocket, lugless draft beam, side bearings.

J. H. Williams & Co., Brooklyn, represented by G. M. Russell ; exhibit, car, track and pipe wrenches, hoist hooks and eye bolts.

Woven Steel Hose & Cable Co., Trenton, N. J., represented by W. H. Janeway, Jr. ; exhibit, woven steel hose.

Wm. Yerdon, Fort Plain, N. Y., represented by Mr. Yerdon ; exhibit, Yerdon's improved double hose band.

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### WATCHES FOR RAILWAY MEN.

The Webb C. Ball Company, of the Ball Building, Cleveland, Ohio, are extensive watch manufacturers. They make a specialty of "building good watches for good railway men," at reasonable prices. They argue, with excellent reason, that, next to a good wife, a railway man's watch is his most constant and faithful companion. On the reliability of a railway man's watch his life frequently depends, as do many other precious lives intrusted to his care. With this fact held constantly in view, the company has built up a large trade in watches designed especially for the use of railway men. The company turns out seven models, under registered trademarks, as follows: Official R. R. Standard Watch, official B. of L. E. Standard Watch, official B. of L. F. Standard Watch, official B. of R. T. Standard Watch, official O. R. C. Standard Watch, official O. R. T. Standard Watch, official 999 Standard Watch. These watches are practically identical in grade, finish and quality, excepting their respective trademarks, which give each an individuality. The trademarks are branded on the dials and driven in the plates of all the movements. The watches are all made 17 and 21 jewels, with steel escapement wheels, single and double roller action and sapphire pallets. The firm do not sell movements or cases separately. All their watches are properly cased up and sold complete at an established uniform standard price, the object of this rule being to insure a perfect fit as between movement and case, and to further insure time keeping and stable value.

## PERSONAL MENTION.

Mr. John Higginson, formerly master car builder of the Canadian Pacific, is dead.

Mr. B. Johnson, division master mechanic on the Atchison, Topeka & Santa Fe, at Topeka, has been made engineer of tests of that road. Mr. Thomas Paxton, division master mechanic at Fort Madison, has been transferred to Topeka, succeeding B. Johnson. Mr. John Purcell, heretofore general foreman on the Atchison, Topeka & Santa Fe, at Argentine, has been promoted to be master mechanic at Fort Madison, vice Thomas Paxton, promoted.

Mr. T. E. Merritt has been appointed general foreman on the Chicago, Rock Island & Pacific, at Horton, vice M. C. Conrad, resigned.

Mr. A. C. Adams has been appointed general foreman on the Chicago, Rock Island & Pacific, at Goodland, Kan.

Mr. A. L. Humphrey, superintendent of motive power of the Colorado Midland, has been appointed to the same position on the Colorado & Southern, vice John Forster, resigned.

The office of chief inspector of fuel and locomotives has been restored on the Wabash, and James Bruce, superintendent of the Chicago terminals, has been reappointed to the position.

Mr. C. B. Royal, hitherto master mechanic of the Seaboard Air Line, at Portsmouth, Virginia, has been made master mechanic of the Florida Central & Peninsular, at Jacksonville, Fla.

Mr. J. M. Davis has been appointed general foreman of the Brightwood shops of the Big Four, vice J. M. Bruner, resigned.

Mr. W. E. Fowler, master car builder of the Colorado & Southern, has resigned, and his office has been abolished.

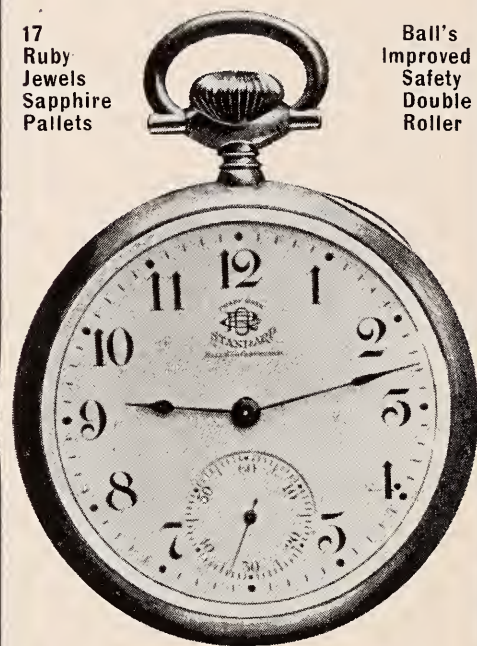
Mr. J. A. Riley, for twenty-eight years in the service of the Michigan Central, has resigned. He commenced with the road, in 1852, as fireman, and in 1872 was made division master mechanic, which position he held continuously until the present date.

## Modern Watches For Modern Men

Passenger trains with a slow-freight speed and watches of alarm clock proportions and timekeeping qualities have given place to the modern lightning expresses and neat, accurate watches. Brains and nerve now are prime requisites with modern railroad man; and none the less important to his comfort and success is a modern, :: :: :: trustworthy timepiece :: :: ::

17  
Ruby  
Jewels  
Sapphire  
Pallets

Ball's  
Improved  
Safety  
Double  
Roller



## Our Railroad Standard Watches

—built to meet the requirements of close and fast schedules, are a product of this skillful and progressive age; in every sense modern, they are right up to the second in construction and timekeeping qualities. We have an authorized agent in every railroad center; communicate with him, or, if he is not conveniently near, write us.

## The Webb C. Ball Co.

WATCH MANUFACTURERS

Ball Building

Cleveland, O., U. S. A.

# RAILWAY MASTER MECHANIC

WALTER D. CROSMAN, EDITOR.

WILLIAM E. MAGRAW, MANAGER.

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IF we speculate on the probable ultimate maximum capacity for coal and water of locomotive tenders we will arrive, possibly, at as valuable conclusions as did those who considered the question years ago; but we often wonder if those who are using, or who are preparing to use, what now are considered large tenders have demonstrated to their own, or to their superiors', satisfaction that the tenders having capacity of 12 to 15 tons of coal and 6,000 to 7,000 gallons of water are necessary or even desirable. Particular conditions in each case must govern the conclusion, but we suspect that some are building large tenders just because some others have built large tenders, and the former have not taken the trouble to learn the conditions which require the latter to use large tenders. The condition of water supply, or of the water obtainable at some particular part of a road, may make it necessary or desirable to take at one station sufficient water to make a long run, but it seems hardly right that this condition should fix the size of tender for the whole road. It costs money to haul water and coal, whether they be in locomotive tenders or in cars. The coal item is the smaller, and as this is usually taken at the place most convenient for delivery we may disregard it. In most districts water is obtainable at short intervals and, so far as it being possible to get water is concerned, there is no need of hauling it any great distance. This declaration does not, of course, apply to arid districts of greater or less extent. Generally, therefore, there is a choice of stopping for water, or of scooping it, and of using large capacity tenders in which to haul the water and so reduce the number of stops. The cost of water stations must be considered, and also the cost of stopping, but there is an offset to these in the amount saved in hauling water and in increased facilities for handling traffic by having water stations close together; the operating department would have a water station every four or five miles. Sometimes water stations are located in undesirable places, and if a large tender

tank will make it possible to cut out a water station at which undesirable water is obtained, or will make it possible to pass a station at the foot of a grade, particularly an opposing grade, then the large tank is necessary. The desire is to emphasize the fact that it costs considerable to haul water in locomotive tanks, and that if this cost is not justified by local conditions the large tank should not be used.

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THE committee of the Master Mechanics' Association reported that the compound locomotive has not been shown to be as "flexible" as the simple locomotive, and, after some discussion, it was learned that by "flexibility" the committee meant that when the compound was properly designed for some particular service it would show some economy over the simple locomotive, and that the amount of saving would vary, decreasingly, with the changes in service. If such is the case, it will be interesting a few years hence to compare the record of the present first-class freight and passenger compound locomotives when they have passed from the important service and have served time hauling locals, accommodations and work trains. If our ideas of the compound locomotive are correct, we must not expect the same amount of economy to be shown, when more engines are in service, as is shown now, because when it is decided to build compound locomotives that service is selected for them in which it is expected they will show best results. Of course, it is difficult to say to what service the compound is best adapted; some select freight service for it, some select passenger service and others select switching service. The compound has been used in elevated railway service with simple locomotives, and has given such good returns that whenever it was necessary to take engines out of service, and a choice was possible, the simple engines were the first selected. These facts would indicate that the compound can be designed for any particular service and good results be obtained, and we rather suspect that the compound locomotives designed for through freight and passenger service will finally show about the same economy when they are serving in local and accommodation service; the economy will, however, be reduced in work train service because the ratio of the time, working and idle, is such that the opportunity to produce a saving is small.

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## REPAIRING PRESSED STEEL TRUCKS.

One of the Master Car Builders' topical talks was based on the question: "When pressed steel trucks are broken on a foreign road, should not repairs be made by the manufacturers or the owners, in place of repairs being attempted by the road on which the car may be?"

Mr. B. Haskell, in opening the talk, said that he had had experience in three cases with trucks that were distorted. In two cases these were easily repaired in the boiler shop. The repairs to one truck cost about \$9.00 and to the other about \$6.00. In the third case the trucks had just been received and he could not give figures. His road had 350 cars with steel trucks, 250 of which it had had about three years, and this was the extent of the damage sustained. Of course, most of those using steel trucks could not maintain dies and presses for repairing them. Therefore, the best parties to repair them would be the manufacturers. The majority of the roads operating steel trucks would prefer to make repairs themselves, if they could not be made by the manufacturers.

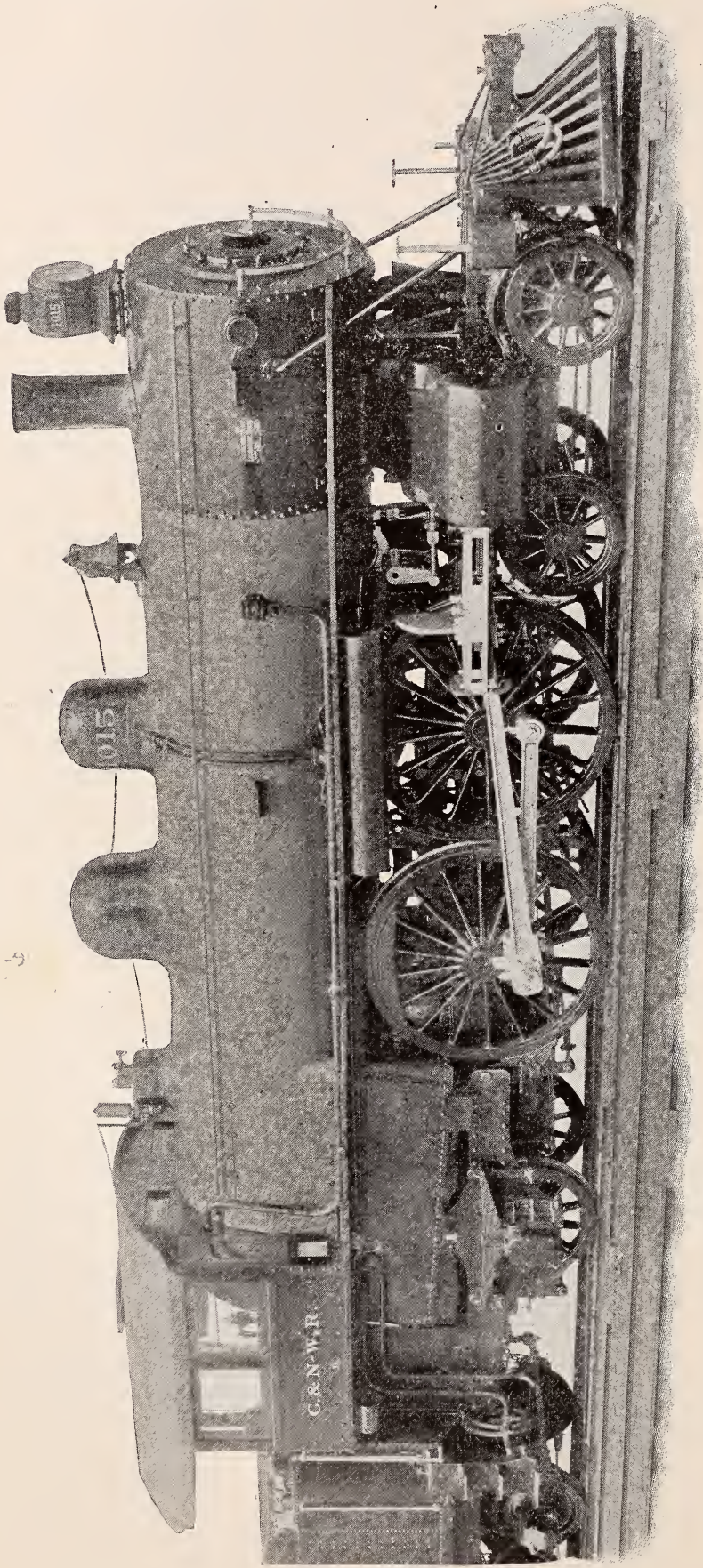
Mr. Johnson believed it would be necessary for each company to make its own repairs, because of the difficulty of returning trucks to the manufacturers. Mr. G. W. Rhodes indorsed this view, and said further: "My opinion is, that not only should the railway companies be prepared to do this work themselves, but that the manufacturers of these metal parts of cars will be wise if they construct them in such way that the railways can repair them."

Mr. A. M. Waitt stated that on his road the practice was about as follows: "Once a month, or once in two months, whatever accumulations there may be of trucks badly out of shape or wrecked, are sent to the manufacturers and they repair and return them. If there is any hidden defect which has caused the damage, for which the manufacturers are responsible, they repair the trucks and return them without expense. If the railway company is responsible for the damages, as a result of wreck or collision, the company pays for the cost of repairs." Continuing, Mr. Waitt said: "It will be desirable, in the near future, to prepare for doing the repair work ourselves. I believe the time is coming when the matter of simplicity in these special forms of construction will be given more prominence than it is at the present time. I believe that the railways themselves must prepare to do repairs of that sort. We have held off from doing this work, largely because the repair shops have been wood-working shops, but the time seems to be coming when there will be less difference between the car shop and boiler shop than at the present time."

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## “NORTHWESTERN TYPE” PASSENGER LOCOMOTIVE—C. & N.-W. RY.

The Schenectady Locomotive Works are building six heavy passenger locomotives for the Chicago & Northwestern Railway, two of which have been already delivered, and have been doing satisfactory work in



“NORTHWESTERN TYPE” PASSENGER LOCOMOTIVE—C. & N.-W. RY.

Total weight—160,000 pounds; weight on drivers—90,000 pounds; cylinders—20 x 26 inches; drivers—80 inches; heating surface—3,015.88 square feet, of which 170.7 square feet is firebox, 28.27 square feet water tube, and 2,816.91 square feet tube surface; grate area—46.2 square feet; fuel—

bituminous coal; working steam pressure—200 pounds; boiler—68 $\frac{3}{8}$  inches; tank capacity—water 5,200 gallons; coal, 8 tons.

service. These engines, a view of one of which we give on page 428, have been christened the “Northwestern type,” and are something after the Atlantic type, embodying a modification of the frame arrangement to permit the use of outside journals for the trailing axle. The Chicago, Burlington & Quincy “Prairie type” of locomotive led in the working out of this idea, however.

One of the advantages gained by the design shown is obtained through the spreading of the points of support at the firebox. The wide firebox, with the ordinary form of frame, necessitates considerable overhang, whereas, with this form, the excessive overhang is obviated, and the point of support at the mud ring is at its extreme width. This helps to steady and prevent excessive vibratory movements at high speeds. This construction also permits the use of a more rational form of ash pan and keeps the bearings well away from the heat thereof. The large grate area rendered possible by this arrangement is obtained without an abnormally long firebox—the opportunity of increasing the width being presented.

These engines weigh 160,000 pounds, of which 90,000 pounds are on the drivers. They have 20x26 inch cylinders; 80 inch drivers; straight top boilers 68 $\frac{3}{8}$  inches in diameter, designed to carry 200 pounds working pressure; heating surface of 3,015.88 square feet, of which 170.7 square feet is firebox, 28.27 square feet water tube and 2,816.91 square feet tube surface; and a grate area of 46.2 square feet. The engines will burn bituminous coal.

Piston valves are employed, provided with inside admission and direct connection to the valves. This motion gives excellent results, the steam distribution being practically perfect at all points of cut-off.

Work on this engine was commenced in the drawing room two months before the engines were turned out of the shops. Being a new design, this required new drawings and patterns throughout. Complete calculations were made of the center of gravity, distribution of weight, and total weight, and they came out almost exact as compared with the actual weight and distribution when ready for the road. As a matter of fact, the actual weights were slightly less than the figured weights.

The special equipment on these engines includes Dunbar piston packing, Jerome metallic piston rod packing, hemp valve stem packing, cast steel driver centers and driving boxes, Carbon steel boiler sheets and firebox, Taylor iron staybolts, Monitor injectors, Westinghouse-American combined brakes on back of drivers and trailer, Westinghouse pump and air signal, Vogt type throttle, Magnesia sectional lagging on boiler and cylinders, Leach sanders, Golmar bell ringers, and Ashton pop valves.

## STANDARDS OF, AND PRACTICES APPROVED BY, THE MASTER MECHANICS' ASSOCIATION.

At the Saratoga convention of the American Railway Master Mechanics' Association a notably valuable report was presented on "The Extent to which the Recommendations of the Association have been Put into Practice." The report was not particularly valuable in the way that it was expected to be, for the members neglected wofully to reply to the inquiries made by the committee; but it was and is of peculiar value, in that it presents in compact form the various recommendations of the association to date. From this report we extract this information, omitting the data as to the extent to which the recommendations have been followed, for the reason that the replies were so meagre (twenty-three in number) that they are practically inconclusive:

On the subject of

### *Standard Nuts, Standard Screw Threads, Bolts, Bolt Heads and Standards for Bar Iron*

it will be noted that

In 1870 the association recommended the formal adoption of the U. S. standard nuts.

In 1884, adopted Pratt and Whitney limit gauges for round iron to be used for Sellers' standard thread taps.

In 1891, reaffirmed formally the standards of 1870 and of 1884.

In 1892, adopted the standard U. S. Standard sizes of nuts and bolt heads, and urged on the members of the association a rigid adherence to the same.

In 1899, Briggs' standard wrought iron pipe threads were adopted for wrought iron pipe and couplings as standard.

On the general subject of

### *Boiler Construction*

the association has made a good many recommendations, namely:

In 1871 it recommended steam as better than hand riveting.

In 1872, recommended all holes in longitudinal seams to be drilled and made to match by reaming rather than by the use of a drift pin; also, that hollow stay bolts be used.

In 1881, recommended machine riveting, especially steam riveting.

In 1885, recommended making a clean metallic joint between surfaces to be calked with waste wet with a weak solution of sal ammoniac and hot water.

In 1885, that in hydraulic tests for locomotives, hot water twenty-five pounds above working pressure be used.

In 1889, recommended the double riveting of the foundation or mud rings on boilers.

In 1894, drew up specifications for boiler and fire-box steel.

In 1895, approved a report showing best methods of making a riveted joint and best designs therefor.

In 1899, approved a report on best method of applying stay bolts to boiler.

As bearing further on this subject, the association passed on the subject of the use of

### *Sling Stays.*

and decided :

In 1880 that in crown bar boilers it was essential to use sling stays from the crown bars to the outside shell of the boiler.

In 1894 it was recommended that in view of the greater breakage of flue sheets in radial stay boilers, due to the rigid strain of the crown sheets and placing of flues too close to the flange of the sheet, that flexible sling stays should be used to support the crown sheet at the front end.

In 1896 it was resolved as the sense of the meeting that a radial stay boiler was as safe as a crown bar boiler and more easily and economically kept clean and in repair.

Bearing on the general subject of boiler construction, some recommendations in regard to

### *Boiler Tubes or Flues.*

have been made.

In 1886 a committee reported on the best plan of removing, cleaning and resetting boiler tubes, and it was voted as the sense of the meeting that it was unnecessary to bead the front end of flues.

In 1889 a committee reported that it was almost the unanimous sentiment of the association that the water space around the fire box should be from four to five inches; that the water bridge between flues should be  $\frac{3}{4}$ -inches, with 2-inch flues, and that the flues should be set vertical, so as to allow better circulation.

In 1895 specifications and tests were offered and adopted for boiler tubes. (See also page 296, 1899.)

In 1895 (again) the question was discussed as to a uniform method of computing boiler tube heating surface. Three locomotive works and the Pennsylvania Railroad reported that they figured the heating surface by figuring the outside diameter of tubes, where one locomotive works figures the heating surface by figuring the inside diameter of tubes.

In 1896 a slight change was made in the standard size to suit standard gauge.

*Standard Tank and Car Axles.*

In 1879 the association adopted the  $3\frac{3}{4}$ -inch by 7-inch journal for cars and tender axles of 40,000 pounds capacity.

In 1881 this was reaffirmed.

In 1890, adopted the M. C. B. 60,000 pound axle with  $4\frac{1}{4}$ -inch by 8-inch journal for heavy tenders.

In 1891 these recommendations were reaffirmed as recommended practice.

*Side Rods.*

In 1882 the association favored the "I" beam section of side rod.

In 1884, approved formulæ offered by Mr. F. W. Dean for design of such sections.

In 1893, favored the manufacture of fluted or "I" beam side rods by machine work rather than by forging them out.

*Wire Gauges for Wire, Tubes and Sheet Metal.*

In 1882 the association adopted the Browne & Sharpe micrometer gauge, which was reaffirmed in 1891.

In 1895 adopted an elliptical notched decimal gauge. (See also page 291, 1899.)

*Gauge of Wheels on Axles for Standard Gauge Track.*

In 1884 the association adopted 4 feet  $5\frac{3}{8}$  inches as the standard width between backs of wheels for tender trucks and locomotive wheels with the limits of 4 feet  $5\frac{1}{4}$  inches, and 4 feet  $5\frac{1}{2}$  inches. These conform with the M. C. B. standard.

Under the general heading of

*Standard Diameters of Driving Wheels and the Question of Tires for Driving Wheels,*

the association has taken the following action:

In 1886 certain standard diameters of wheels and standard sections of tire were adopted, varying from 38-inch to 66-inch diameter, inclusive.

In 1887 a further report on this matter with the exact inside diameters of tires was adopted and the M. C. B. standard tire section also adopted.

In 1893 standard outlines for flanged and plain tires were adopted, and standard sizes of wheel centers from 70-inch to 90-inch were also adopted. (See also pages 293 and 294, 1899.)

The association has also discussed the question of

*Wear of Tires.*

In 1887 it decided that the manipulation of the sand and handling of the brakes by engineers had a great deal to do with the wear of tires.

In 1895 an elaborate report on the wear of driving-wheel tires was submitted, showing six different causes.

In 1896 the question of counterbalance was considered and its relation to driving-wheel tires pointed out.

In 1896 (again) a report was submitted, pointing out the best design for reciprocating parts in order to reduce the weight of counterbalance as much as possible.

In 1894 a report on tire treatment made the following recommendations:

Page 206. Retaining rings are necessary on wheel centers above 62 inches diameter.

Page 207. Do not run tires with retaining rings any thinner than without them.

Page 207. Use same shrinkage with retaining rings as without.

Page 205. Drawing of Mansell ring fastening.

Page 209. Minimum thickness of tires considered safe: Passenger, 1 1/2 inches, last turning; freight and switching, 1 1/4 inches, last turning. Weight on drivers not to be considered.

Page 211. Greatest permissible depth of wear of tires: 1/4-inch on road engines, 3/8-inch for switch engines, but business conditions must govern.

Page 216. Depth of flange permissible: Road engine, 1 1/2 inches; switch, 1 5/8 inches.

Drawings of instruments for measuring wear of tire and flange.

Under the general heading of

*Relative Proportions of Cylinder to Boilers and Grate Area,*

the association has made several recommendations.

In 1887 a formula for the proper proportions of locomotive cylinders was offered. (See page 43.)

In 1888 recommendations giving limits for these proportions were offered and approved.

In 1897 a report was made, giving valuable data as to the proper ratios of heating surface, grate area and cylinder volume for passenger and freight service, burning anthracite or bituminous coal.

On the general subject of a

*More Economical Combustion,*

the association has taken the following action:

In 1881 comparatively high exhaust nozzles were recommended as the best practice.

In 1888 the conclusion of a committee reporting on the subject of extension fronts, brick arches, etc., concluded that brick arches were an excellent thing, but should not come closer than one inch from the side sheet or two inches from the flue sheet; that ninety pounds of coal per square foot of grate area per hour was about the maximum economical rate of combustion.

In 1890 another committee on brick arches stated that the evidence was overwhelming in favor of the brick arch and extension front end. Angle irons and studs for brick arches were preferred to circulating pipes.

In 1896 and 1897 a committee offered a very complete report on the proper height of exhaust nozzle and form of stack, recommending a tapered choke stack.

In 1899 the association decided by vote that it was not desirable to use bars in the exhaust nozzle.

#### *Testing Laboratories for Railways.*

In 1891 a very complete report was submitted on the subject of testing laboratories for railways, showing their proper organization and province.

#### *Testing Materials.*

In 1892 the association accepted a report making six conclusions, the most important of which was that steel should not be worked at a temperature between normal and a perceptible red heat known as "blue heat."

In 1896 the association again decided that it was of great importance in flanging steel that it should not be worked below a cherry red heat.

Under the general heading of

#### *Treatment of Employes,*

the association has taken the following action:

In 1886 a resolution was passed that the association deprecates giving testimonials or recommendatory letters for publication, and enjoins all to restrict matters of this nature to letters of inquiry.

In 1891 a report was submitted giving advice to employers as to the best method of examining engineers and firemen, including suggestions on the education of firemen.

In 1898 a report was submitted on the subject of apprentice boys and a code of rules adopted by the association to govern their promotion.

#### *Compound Locomotives.*

In 1893 the association decided that the compound is suitable for freight service, but that its availability in passenger service was undetermined.

In 1899 the association decided that a by-pass valve to relieve the vacuum in a low pressure cylinder when drifting was very important.

#### *Standards for Boiler Attachments.*

In 1893 the association listened to a report making eight recommendations looking to increased safety, and adopted a resolution that the water

glass, although a convenience and an additional precaution against low water, was not absolutely necessary to the safe running of locomotives.

*Tonnage Rating for Locomotives and Ton-Mile Basis for Statistics.*

In 1898 the association considered favorably a report on tonnage rating, and in 1899 adopted a resolution that it was the sense of the meeting that the ton-mile basis for motive power statistics is the more practical and encourages economical methods of operating, etc, etc.

*Chilled Cast Iron vs. Steel Tired Wheels for Cars and Locomotives.*

In 1888 the association approved specifications submitted by a committee for the manufacture of chilled wheels, giving a test, form of contract and service guarantee.

In 1899, in a report on the relative merits of cast wheels and steel tired wheels for locomotive and passenger cars, a recommendation (see page 127) was made as to the best method of keeping a record of the mileage of wheels.

*Best Metal for Locomotive Cylinders and Cylinder Bushings.*

In 1896 the association accepted a report on cylinder bushings, making five distinct recommendations.

In 1897 it accepted a report of a committee making four recommendations in regard to best metal to be used for cylinders, valves and valve seats.

*Locomotive Statistics.*

In 1872 the association adopted a report fixing an arbitrary mileage to be computed for switch engines at six miles per hour of actual service, for local freight engines 6 per cent for switching, and also that new engines to replace vacant numbers should be charged to repairs, except any excess in cost over the old ones.

*Miscellaneous Subjects.*

In 1896 the association adopted a rule in regard to the minimum thickness of flange in locomotive truck wheels, that they should be the same for both iron and steel wheels and 1 inch thick measured  $\frac{3}{4}$ -inch from top of flange. (See page 327.)

The Air Brake and Signal Instruction Book was adopted in 1898.

Fusible plugs in locomotive boilers were agreed to be not necessary in 1899.

Standards for locomotive tests were approved by the association in 1894.

Shaking grates for anthracite coal were recommended in 1897, page 144.

A form of fastening for locomotive cylinders was recommended in 1898, pages 160-187.

A committee concluded, in 1897, that common sheet iron painted is a more economical locomotive jacket than planished iron.

Piecework in locomotive repair shops was recommended by a committee in 1897.

A committee concluded, in 1897, that air motors are of more general use around a shop than either steam or electric motors.

A committee made recommendations, in 1898, about insulating cylinders, saddles and exposed parts of firebox sheets.

Suggestions were made by a committee, in 1899, on the best methods of preventing trouble from impurities in locomotive boiler feed waters, e. g., by filtration or precipitation before it is put in the locomotive.

In 1871 a committee reported that case-hardened iron was preferable to steel, for working parts of locomotives.

A tapered reamer was recommended as standard by Prof. Coleman Sellers in 1883. (See also page 28, 1890.)

In 1888 a resolution was passed that a step on the pilot was necessary for the convenience of brakemen making couplings.

In 1896 a committee submitted conclusions (pages 245-257, 1896), on the subject of hub liners.

In discussion of report on steam pipe joints (in locomotive front ends) in 1896, cast iron rings were said to be much preferable to brass rings.

A rule for design of balanced slide valves was recommended in 1896, page 184.

## “SUGGESTIONS FROM THE CHAIR.”

EXTRACTS FROM THE PRESIDENTIAL ADDRESSES AT SARATOGA.

BY PRESIDENT SCHROYER.

### *Membership.*

Since our last meeting we have gained but slightly in membership, while the cars represented by us have reached the grand total of 1,356,861, an increase during the past year of 8,730 cars; this increase, however, in the number of cars does not in any manner represent the increase in the tonnage capacity which is represented by this number. If I may judge of the equipment of other companies by that of the company which I represent, the increase in the tonnage or hauling capacity is represented by the hundreds rather than the units indicated by these figures.

The subject of basis of representation in our association has been called to my attention several times by representative members of large interests, who were of the opinion that the basis should be changed from 1,000 cars with eight-wheeled trucks entitled to one vote, to a tonnage

capacity, which would very materially increase the power of some of the lines over what is now represented.

In this connection, I wish to call your attention to what I consider a mistaken idea on the part of some of the companies now enjoying the privileges and advantages derived from membership in this association, in the withdrawal of their representative members and the appointment of active members, thereby saving a small amount in fees paid and at the same time enjoying fully the benefits and advantages of the association.

The M. C. B. Association so nearly represents the entire railway interests of the country that, in compiling figures, the totals reported by our members are considered as official data from which to compile statistics.

#### *Automatic Couplers.*

We have, today, a representation here in cars of 1,348,131, and there were on the first day of January last 1,191,189 cars equipped with automatic couplers, leaving a balance yet to be so equipped of 156,942 cars, and I am glad to say that practically this entire number has been fitted up since that time; where it has not been done, it is due to the fact that the cars were or are out of the possession of the owners; but the utmost endeavors are now being exercised on the part of all railway companies and car owners to have their cars properly equipped before expiration of the limit of time designated in the national law requiring this work to be done.

I also wish to call your special attention at this time to a matter of the utmost importance, in so far as the question of safety in the operation of these coupling and uncoupling devices is concerned, and for your information I will quote two paragraphs from the 13th Annual Report of the Interstate Commerce Commission (1899) issued under date of January 15, 1900, reading as follows, viz.:

“A very large number of cars have been found where the appliances for opening the couplers, especially the unlocking machinery, were so out of order and unworkable that, though the cars were actually provided with automatic couplers, they could not be uncoupled without the trainmen going between the cars, and in some cases being obliged to resort to mechanical assistance in order to get the cars apart. Such a coupler is not automatic in the sense contemplated by the law. Its use subjects the men to risks and dangers which are obviously greater than those which existed when the old link and pin coupler was employed.

“In view of the conditions disclosed by the inspector's report, it seems vital that the uncoupling attachments shall be kept in perfect

working order, and there should also be general uniformity in the construction, application and operation of such attachments. In a hazardous employment the man does his work with greatest safety who has least need to think how the act is to be done. If he does it always in the same manner he does it mechanically and unerringly. The uncoupling attachments used with automatic couplers do not all operate alike, and some of them are characterized as confusing by the trainmen. The Master Car Builders' Association, which has done so much good in establishing standards of uniformity, appears to have fully considered this matter. In 1897 and 1898 that association recommended a practice as to the application of uncoupling levers and attachments which we suggest should be followed. The details of such practice, with some additions to show the operating positions of uncoupling levers when used with various kinds of master car builders' couplers, are shown by diagrams in the same appendix.

\* \* \* "It is important for the safe performance of his work, much of which is done in the darkness of the night, and often in storms, that the trainman should be able to determine by the position of the lever whether the coupler is in the locked or unlocked position. He can do this, with uniform construction and application of the uncoupling levers, if the attachments are kept in repair."

From this, you will note the importance that is attached by our national legislature to the question of proper condition and the desirability of the adoption of uniform coupling and uncoupling apparatus for our freight car equipment. The adoption of such apparatus was consummated last year, but we observe with regret that there is a great lack of uniformity and failure on the part of many companies to comply with the recommended standards of this association in this respect. It has been suggested that the M. C. B. Association adopt rules permitting the rejection of a car at interchange point that is not properly equipped with unlocking apparatus and safety devices, as recommended by the standards of this association, and I am of the opinion that the same recommendation would apply equally as well to all the standards adopted by this body.

#### *Air Brakes.*

In the case of our committee on triple valves, at the last meeting a motion was carried, increasing that committee from three to five members, which was done by the appointment of Mr. J. O. Pattee of the Great Northern Company, and Mr. William McIntosh of the Central Railroad of New Jersey, as the additional members of this committee. We were hopeful, when this action was taken, that the results of their labors would be such as to indicate to this association —

First. Whether the practice recommended by this association for triple valve requirements was correct ; if not, wherein our practice was wrong.

Second. Wherein these recommendations and requirements should be modified and improved.

I regret to say, however, that no progress has been made through the efforts of this committee, because of failure or refusal of one of the air brake companies to submit their brakes for practical or other tests. There is no appliance that is added to our equipment today of which so much is required as of our air brake. The vital part of our brake apparatus is the triple valve, hence this committee has been called the Committee on Triple Valve Tests.

#### *Brake Shoes.*

I have been approached many times during the past year with requests from manufacturers to introduce into our service new designs of brake shoes, some of which have been covered by patents while others have not, being still in the experimental stages. I consider that the question of the life of a brake shoe tells only one side of the story—that the other side of the story must be demonstrated through the medium of our Brake Shoe Test Committee, and I note by their report this year that none of the many brake shoes which manufacturers are endeavoring to introduce today have passed through their hands for testing and approval. I have invariably made it a point to state to these parties that before anything could be done by us in this direction their brake shoes must pass through the hands of this committee for investigation and testing, for approval and recommendation as to whether the merit claimed for them was such as to justify the railway companies in introducing them into their service.

#### BY PRESIDENT McCONNELL.

The past year has been the most remarkable in the history of this country. Manufacturing concerns of all kinds have been prosperous. Steel and iron mills have been unable to supply the demands. Railways have shown an increase in earnings, and many railways did not own sufficient equipment to handle the increased tonnage. The advance in the cost of material used in new and repair work has been more rapid than in any previous year. An average increase of 40 per cent in ten months of 1899 shows the immense demand. Locomotive builders

have been unable to handle all the work offered them in the required time.

### *Locomotive Building.*

During the year 1899, 2,196 locomotives were built in the United States, costing about \$25,000,000. One thousand seven hundred and sixteen were delivered to American railroads. Four hundred and eighty were shipped to foreign countries, 70 per cent of the foreign orders being sent to Europe, Asia and Africa, 30 per cent to Mexico, Canada, South America and the West Indies. Of the entire output of American locomotives, 21 4-10 per cent were foreign orders. The American locomotive is making friends in all parts of the world. England and France purchased our locomotives. While England, to a certain extent, has adhered to its own designs, France has accepted the American locomotive with few modifications.

### *Large Locomotives.*

The year 1899 has been a year of large locomotives. Reports for the year show four types of freight locomotives having a weight of 218,000, 225,000, 230,000 and 232,000 pounds respectively, with a weight on drivers of 193,000, 198,000, 202,000 and 208,000 pounds; heating surface 3,203 square feet, 3,322 square feet, 3,500 square feet and 4,105 square feet. One with cylinders 23 by 32 inches, two with cylinders 23 by 30 inches, and one compound with cylinders 18 and 30 by 30 inches. Locomotive tenders were built with water capacity of 7,000 gallons. A number of roads have made 5,000 gallon tanks their standard, while others have adopted a 6,000 gallon tank.

### *The Use of Cast Steel*

In locomotive construction has increased very largely. Cast steel for frames finds many advocates in the mechanical departments of railways as well as among locomotive builders. A number of engines were constructed this year, as well as last year, with cast steel frames. Steel castings have displaced cast iron to a great extent for driving wheel centers, driving boxes and cylinder heads. With the improved method of steel making and increase in number of steel foundries, a more extensive use of steel may be looked for. The difficulty of obtaining steel castings in the past has, to a certain extent, limited the amount used in the last year. During the year 1899 a number of engines were constructed, showing an increase of 33 per cent in the use of steel castings over three years ago.

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*Some General Features.*

Nickel steel has not come into very general use. Mechanical departments are advancing cautiously in this direction. It has been used to a limited extent for driving axles, crank pins and piston rods.

The use of piston valves has increased in the last year. On simple engines improved forms have been introduced, and having passed the experimental stage, we may look to see them advance rapidly in favor.

The past year has shown the most rapid advance in weight on driving wheels, tractive power, and increased heating surface of our locomotives.

The tendency is all in the direction of increased tonnage in freight trains. Large sums of money are being spent by trunk lines in cutting down grades and reducing curvature, in order to reduce the cost per ton mile for handling freight. The constant tendency of a decline in freight rates can only be offset by the increased power of the locomotive. In passenger service the same development of the locomotive has taken place as with the freight engine. A few years ago 80,000 pounds weight on the driving wheels of an eight-wheel locomotive was considered excessive. It has now reached 94,000 pounds on an eight-wheel locomotive. In passenger service ten-wheel locomotives are being built with 130,000 pounds weight on the driving wheels, and a heating surface of 2,500 square feet. The passenger service throughout the country has increased in the weight of trains as well as in speed.

With the large locomotives in service, when compared on a mileage basis, the cost per mile for fuel, repairs and lubrication shows an increase. Compared with several years ago on the tonnage basis, the cost per ton mile for repairs, fuel, oil and other supplies is largely in favor of the recent locomotive.

The compound locomotive is gradually gaining in favor. During the year 1899, 330 engines of this class were built in the United States.

*Shop Practice.*

The improvements during the year have not all been confined to locomotives. Shop practices have advanced to a marked degree. New shops are now largely supplied with electricity for driving machinery, and it is displacing the stationary engine and line shafting. New tools electrically driven are coming into general favor, and the economy of such machines cannot be questioned. Compressed air has found its way

into all shops, both large and small. The air compressor is of as much value in the railway shop today as the stationary engine. The manufacturers of compressed air tools have brought out new designs, and by their use the work is performed more economically. The modern shops are supplied with both electricity and compressed air. Both have their advantages, and neither can displace the other on certain lines of work. For driving machinery, electricity is more economical and superior to the old line shafting and stationary engine. For small tools, compressed air is superior to electricity and more economical.

I desire, also, to call your attention to a subject which is probably receiving more attention throughout the country than any other subject before the association at this time—the advantage of the

*Ton Mile Basis for Motive Power Statistics.*

The question of a uniform performance sheet for all roads has been under discussion before by this association. A number of roads throughout the country have abandoned the performance sheet on the mileage basis. There being no uniformity in making up these reports as a means of comparison, except from year to year on the same road, they were of no value. The system adopted of keeping the records on the tonnage basis varies almost as widely at the present time as the old system of reports on the mileage basis. Until there is a uniform system adopted by all roads, no correct comparison can be made between the different companies. It is the practice now with some roads, in showing the number of ton miles, to add the weight of the locomotive and caboose. Other roads show the actual ton miles in the train and do not consider the weight of the engine or caboose, and allow nothing but actual mileage between terminals. Some reports are made up in the office of the auditor of the road, while others are made by the superintendent of motive power. It is to be hoped at this session a uniform system can be agreed upon that all roads can adopt.

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The Railway Master Blacksmiths' Association has, especially in the past few years, proved itself to be a distinct agent for good in the general advancement of the service of railroading. Its work has attracted the attention and the indorsement of the Master Car Builders' and Master Mechanics' Associations. Every one knows, possibly, how important the work of the blacksmith shop is in getting out cars and locomotives, but it is only through the associational work of the master blacksmiths that it has been shown up distinctly where the chance for improvement in practice lies—just as similar work by the master car builders and the master mechanics has done. The Master Blacksmiths' Association will hold its next annual convention in Detroit, Mich., September 18 to 20. There is a good programme laid out, and there are to be some new features in connection with this meeting, which are expected to make it the most interesting and profitable one yet held.

## POWER TRANSMISSION BY SHAFTING VS. ELECTRICITY.\*

In absence of definite instructions, your committee will endeavor to present this subject in a manner which will be chiefly explanatory of the features of the electrical side. It is thought that this method of treatment will be useful to the members, inasmuch as electric transmission of power is a new departure in mechanics. No apology, therefore, appears to be necessary for the inclusion of a few elementary definitions and for some suggestions upon the most suitable apparatus for shop plants.

A comparison of the relative advantages of electric and shafting driving for shop use may be made under the following general headings:

1. Relative economy in cost of power itself.
2. Relative convenience of operation and installation.
3. Relative effect upon shop output and cost of labor.

Referring in detail to the scope of these considerations:

1. **ECONOMY.**—This has been taken to comprehend only the relative cost of operating the two systems, including expense for fuel, attendance, repairs, interest on investment and depreciation. It is the reason most generally advanced for the installation of electric power, but can only be the controlling one where the cost of power is a large proportion of the shop running expenses.

In order to compare the relative efficiencies of engine and electric transmission, it will be necessary to subdivide the character of shop plants somewhat. To do this completely would lead to endless complication, but for present purposes the typical plants are:

1. Shop plant in which each building has its own power plant.
2. Shop plant in which all buildings are furnished with power from a central source.

The manner of connection from the prime mover to the tools may be assumed, for an extreme comparison, in either of two ways, namely: (a) shafting method; (b) individual tool driving method.

Taking the first condition, the average efficiency from engine to tools for steam engine transmission is shown elsewhere to be 50 per cent; for electric transmission, under condition "a," the shafting losses will be reduced by splitting up long lines and by avoiding cross-belted, so that they will not exceed 20 per cent, or an efficiency of 80 per cent; and in the electrical elements, as before shown, the efficiency from engine to shafting is 65 per cent; therefore, the final transmission efficiency will be  $80 \times 65 = 52$  per cent, as against 50 per cent in the purely mechanical method; or, practically, a stand-off. Under condition "b," much less shafting will be employed, and the electrical portion

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\* Report presented to Master Mechanics' Convention at Saratoga, June, 1900, by Geo. Gibbs, F. Mertsheimer, Wm. Renshaw, W. A. Nettleton and R. A. Smart, committee.

may also show a better all-day efficiency, under certain conditions, by the shutting down of idle machines—say, a shafting efficiency of 90 per cent and an electrical efficiency of 66 per cent, or a resultant of 60 per cent—showing a small gain for the electrical method.

Taking the second condition and assuming an unfavorable condition for shafting transmission, as in case of a shop having each building with its own boiler plant and one or more engines, and compare this with a case of a central power plant for electric transmission to all buildings, the possible fuel saving in the latter arrangement will result first, from some small saving in power required for each individual building, as before shown, and second, from some very considerable saving due to the better efficiency of a large engine and boiler plant over that of several small ones. In extreme cases, where large condensing engines displace small non-condensing ones, and in large stations having a uniform load, the fuel saving may readily approximate  $33\frac{1}{3}$  per cent, as is shown in an actual case cited elsewhere.

ATTENDANCE.—The item of attendance will next be considered. It is made up of three classes of labor—engineers and firemen; care of shafting and belting; electrical repairs. In an electric system the costs can be reduced by consolidating the engine and boiler plants and by the elimination of large and heavy belts, large shaft bearings and the consequent danger from overheating, reducing labor probably one-half; but a new item of expense in care of electric machinery will be introduced, which will about offset the other items, leaving the whole attendance bill practically unaffected by the introduction of electric shop power in plants of any considerable size.

REPAIRS.—As to repairs of shafting and belting it is difficult to obtain accurate data, the record of these items being seldom kept separately in shop accounts. The records of one large establishment have, however, been examined by your committee and the saving found in these items, under the electric driving system, is found to be more than sufficient to pay for all repairs to motors and lines. Thus the conclusion seems justified that the repair item will not be materially different under either system of driving.

INTEREST.—The remaining items of power cost are depreciation and interest on investment. It is difficult to institute a fair basis of comparison between the first cost of an electric and a steam transmission plant, for the reason that the results sought to be accomplished by the former provide additional shop facilities, and are therefore not rightly chargeable in a substitution sense. Considering, however, the case of simple substitution in a single shop, where the power plant and arrangement and number of tools is retained as before, electric driving is certain to involve a largely increased first outlay—approximately double that for shafting method. But in a modern shop plant other considerations are the guiding ones in selection of the power system, such as the possibility of labor-saving devices, cranes, etc., and the greater cost of the

electric system becomes a rightful charge against the advantages so obtained.

Dropping, therefore, any attempt to draw a strict comparison between first costs, it may be said that in estimating the total cost of power machinery it is usual to include an allowance for interest and for a sinking fund, with which to replace the plant when its utility is no longer on an equality with best practice. These items are generally figured together at 10 per cent on first cost, a sum amounting roughly to one-fourth of the total running expenses of the power system.

CONVENIENCE AND SHOP OUTPUT.—These considerations are so closely inter-dependent that they can best be referred to together.

The ordinary shop plant with steam power transmission, both in the arrangement of building and of machines, is the slave to the limitations of this system; it must be laid out so that the shafting and engine connection is as direct and simple as possible; the machines must be compactly arranged in parallel lines, and the ceilings and columns designed with special reference to shafting supports. In other words, the tools must be installed with first reference to the application of power and not, as should be the case, with reference to handling the work to best advantage. Handling operations are of necessity largely by manual methods, and the shop buildings, even, must be located with first view to getting the power to them with the least awkwardness and expense.

While generalizing in this manner, your committee has not lost sight of the fact that handling and transferring machinery may be operated by other means than electricity, but it is equally true that devices of this nature are of limited practical application, and the broad fact remains that electricity is to be credited with ushering in a new era of labor-saving shop devices.

Electrical transmission places no restriction on the location of the machines, and each shop may be planned with a view to handling its product with least waste of labor and with the greatest convenience of access to the tools. These may even be transported from place to place to the work; further, the partial or entire absence of overhead line-shafting insures better lighting of the shop and conduces to cleanliness. These factors promote cheerfulness and an improvement in both quantity and quality of output.

The clear head room permits the universal application of various forms of traveling cranes for serving the tools and for conveying operations, furnishing the most efficient means yet developed for increasing shop economy, and, as a means of communication between buildings, electric cranes and transfer tables have advantages over appliances of the same nature driven by steam and air.

SPECIAL APPLIANCES.—In these, electricity shares a large field with compressed air. It must be admitted that air devices have up to the present time received most attention at the hands of the railway mechanic; a fact in large part due to the lack of practical knowledge of the electrical specialist and to the greater cheapness of air tools. With,

however, the general introduction of electric shop power plants and the better acquaintance of practical men with the agency, an extensive application of electric labor-saving devices is certain to result.

**FLEXIBILITY.**—The extension of a shop building or the tool equipment under the shafting system is generally a matter of much difficulty, and the attempt to add to such a plant often results in inconvenient crowding of the tools or to an overloading or complication of the shafting system, a fact which fully accounts for the extremely poor efficiency sometimes quoted for shafting transmission. In an electric system, on the other hand, great flexibility in extension is secured, as new buildings may be placed in any convenient position and additions made to the driving system without affecting the intermediate links.

**SPEED CONTROL.**—The ease of speed control between wide limits of certain types of electric motors is a valuable feature and will result in more frequently securing a greater adaptability of the tool to the work than is possible where a change in speed involves stopping the tool and shifting belts and gearing.

**INCREASE IN OUTPUT.**—This constitutes, in the opinion of your committee, the chief claim of electric transmission to the attention of shop managers, and it follows from the previously mentioned facts, as, by the use of electric handling devices, the tool is quickly served with its work and the product placed in the most favorable position for operating upon and idle time cut down, and, by independent driving, the capacity is increased by reason of the perfect control of speed possible.

#### *Power Required to Drive Machine Tools.*

Data for power required for shafting and for certain tools may be found scattered through the transactions of various engineering societies, especially in the papers of Professor Benjamin, in the proceedings of the American Society Mechanical Engineers, 1896 and 1897, which give valuable figures; but the amount of exact information attainable anywhere is not very considerable. In the nature of things, figures for frictional losses in shafting must be exceedingly variable, and under the plan of connecting the shop power system to one main driving engine, there is no ready means of analyzing the figure of engine indicated horse power to determine the consumption of any particular section of shaft or of a single tool.

With the introduction of electric driving, however, the subject is becoming better understood, as it is a simple matter to connect a test motor to a shaft or tool and thus obtain figures from which to design a power plant for maximum efficiency.

**ELECTRIC EFFICIENCY.**—An electric transmission plant varies in efficiency as follows:

Generators . . . . .	86 to 90 per cent.
Transmission lines . . . . .	90 to 95 per cent.
Motors . . . . .	78 to 90 per cent.
Total final efficiency . . . . .	62 to 77 per cent.

The above are figures for full loads on the different elements and the variation arises from the difference in size of units employed and in line losses assumed. At partial loads the machine efficiencies will drop, but the line efficiency will increase, so that the resultant will be nearly independent of the load. In fact, it is generally possible to shut down many of the separate motors when operating the plant at partial load, and the efficiency of transmission may thus actually increase under such conditions. In an average size of railway shop plant a resultant all-day efficiency of 65 per cent from the engine to the motor pulley may be assumed.

SHAFTING EFFICIENCY.—The average friction horse-power in heavy machinery shops to drive belts and shafting, from engine to tool pulleys, as given by various authorities, varies from 40 to 55 per cent of the total power used, and perhaps the round figure of 50 per cent is as near the correct general average as the data will permit. Considering a separate shaft only, with compactly arranged tools, a better efficiency than the above can be assumed, and your committee concludes, from a number of experiments with electrically driven line shafts, that 20 per cent fairly represents the average loss in shaft and counter-shaft bearings and belts on the tools, or an efficiency of 80 per cent.

Some authorities attempt to express the actual horse-power lost in friction per 100-foot length of shafting and per counter-shaft and per belt; but while figures of this kind would be useful if approximately correct even, your committee has been unable to check them closely enough to feel warranted in quoting them.

As a rough guide in laying down shop power plants, it would appear that the horse-power of generating station required per man for railway shops will average about .4 horse-power.

Table No. 1 gives a few examples from tests of the power required to drive typical railway shop tools, both for iron and woodworking. The greater number of these results for metal working tools were taken from tests at the Baldwin Locomotive Works, and for woodworking tools from Pennsylvania Railroad Company's tests.

### *Suggestions Upon the Manner of Installing an Electric Transmission Plant.*

SYSTEM.—Both direct and polyphase alternating current systems are applicable for shop use, and each system has its advocates among electrical engineers.

For long distance transmission, say one mile or more, alternating transmission is almost a necessity; for shorter distances, and in cases of isolated plants in compactly grouped railway shops, the direct current system can be employed without any practical disadvantages in waste of power in transmission lines.

Mechanically, the induction type of alternating motor has great advantages in its simplicity and the absence of rubbing contacts. When it is said that probably 90 per cent of all direct current motor repairs

TABLE I.—POWER REQUIRED FOR RAILWAY SHOP TOOLS.

TOOL.	NATURE OF WORK.	HORSE-POWER REQUIRED			REMARKS.
		Empty.	Light Load.	Full Load.	
70-in. wheel lathe.	Wheel center.	....	4.4	7.9	Light cut.
		....	4.7	5.8	
Horizontal lathe.	32-in. wheel center.	1.5	5.2	6.2	1/2-in. deep cut.
		....	4.3	7.1	
Large double frame planer.	56 in. wheel center.	11.0	...	21.6	1/2-in. deep cut.
		2.3	5.0	10.3	
Slotted, 18-in. stroke	Two frames.	1.5	2.1	6.5	1/2-in. deep cut.
		3.4	4.2	7.4	
Slotted, 12-in. stroke	Wrought iron; 6 in. thick	3.4	...	11.3	Heavy cut.
		....	1.94	2.9	
36-in. planer.	Frames.	.97	1.94	2.9	1/2-in. deep cut.
		....	1.92	2.2	
Drill press.	1-in. drill, wrought iron	.97	1.94	2.85	1/2-in. deep cut.
		....	1.94	2.85	
Boiler-plate shears	1 1/2-in. drill, wrought iron	3.5	6.0	19.0	Heavy cut.
		4.5	14.4	19.8	
Boiler-plate rolls	2 1/4-in. drill, wrought iron	4.5	14.4	19.8	Heavy cut.
		1.2	...	13.0	
Jib crane, 10 ton, 10-h.p. motor	1 1/8-in. plate steel	1.2	...	13.0	Heavy cut.
		1.2	...	11.0	
Jib crane, 6 ton, 8-h.p. motor	1 1/8-in. by 10 ft. 6 in long, steel.	1.2	...	11.0	Heavy cut.
		1.2	...	11.6	
Traveling crane, 5-ton.	Lifting 10 tons	11.9	...	19.3	Heavy cut.
		3.4	...	...	
Planer	Lifting and carrying 4 tons	....	...	...	Heavy cut.
		....	...	7.4	
Shafting	Empty	....	...	14.0	Heavy cut.
		15.0	...	...	
Planer and siding machine	Empty	....	...	20.0	Heavy cut.
		....	...	26.0	
24-in. planer	4 milling machines.	....	...	30.0	Heavy cut.
		....	...	34.0	
Molding machine	2 lathes	....	...	32.0	Heavy cut.
		....	...	11.0	
Daniel 30-in. head planer	1 buff wheel	8.0	...	8.5	Heavy cut.
		0.5	...	8.8	
Large tenoning machine	6-in. oak flooring	3.0	...	2.5	Heavy cut.
		1.5	...	7.0	
Circular rip saw, 28 in. diam.	12-in. yellow pine	1.5	...	20.0	Heavy cut.
		1.5	...	6.0	
Band saw blade, 1 1/2 in. wide.	6 1/2-in. yellow pine carlin	1.5	...	6.0	Heavy cut.
		1.5	...	6.0	

are to commutators and brushes, the importance of this statement is clear. A further advantage in the induction motor is the strong mechanical design of the revolving element. This is built up of heavy copper bars firmly bolted to a cast center. The direct current motor,

on the other hand, is a complicated assemblage of small wires, made additionally weak by the necessities of installation.

The disadvantages of the alternating current motor are its high speed and the fact that it is essentially a constant speed machine. For driving line shafting, a constant speed motor is entirely satisfactory, but for independent tool driving a variable speed motor has unquestionable advantages.

If the alternating system is to be adopted, it is important to specify that the motors shall be of the "induction" type, as this is the only variety which is at all applicable for shop uses.

A further element of importance in the alternating system is that of "frequency" or number of alternations of the current per minute. It is difficult to give a positive recommendation as to the proper frequency without qualifications. Realizing, however, the importance of standardizing apparatus, your committee venture to suggest the specification of "3,000 alternations per minute" for adoption in railway shop plants. Alternating motors of this frequency are now in general use and have the very great advantage of fairly slow speed.

**VOLTAGE.**—Direct current generators are built for 125, 250 and 550 volts pressure, which, allowing for ordinary losses in lines, corresponds to motor pressures of 110, 220 and 500 volts respectively.

The 220-volt direct current motor is practically the standard for shop purposes; the 550-volt motor is used for railway purposes, but this pressure is undesirably high for shop use. Incandescent lamps may be obtained for 220-volt circuits, or the more common 110-volt lamp may be used on such circuits by connecting two of them in series. A 250-volt generator, together with 220-volt motors, are therefore recommended for shop plants.

Alternating current motors are wound for either 220 or 440, and for similar reasons to the above, the 220-volt system is recommended.

**TYPE AND SIZE OF GENERATOR.**—As between the direct connected and belted machines the relative advantages may be thus stated: The direct connected generator is more compact and more solid in construction, especially in small machines, due to the greater size of its parts. It is therefore more durable and somewhat more efficient on account of elimination of frictional losses in belting.

The belted generator has an advantage of cheapness in first cost, due to its higher speed, which means more output for the same amount of material; and the further fact, often of importance, its ready applicability to existing engine plants.

For generators of 75 horse-power or less, the belted machine answers every practical purpose, but above this size the purchase of direct connected machine will be found an economy in all new plants.

In planning the installation of a transmission plant with small beginnings for running, say, one electric traveling crane, transfer table, turntable outfit and a few portable tools, a 75 or 100 horse-power belted generator will be found a convenient unit size. It may be installed

cheaply by belting from counter-shaft at the main shop engine, but it is altogether better to provide a separate engine, for the reasons that the electric drive may be needed twenty-four hours in the day for special work (such as roundhouse turntable), and it makes a good emergency power plant for portions of the shops working overtime. It may be also used at nights to light the roundhouse and other buildings. When the transmission plant outgrows the capacity of this generator, it may still be used as a "spare" or for overtime work.

In laying out a complete system of electric transmission to displace engine and shafting transmission, careful attention should, of course, be given to selection of unit sizes. Little advice can be given off-hand for such a case, as the determination of average and maximum loads is the basis of all calculations. In large plants, say of 500 horse-power or over, there should be two, and possibly three, units of the direct connected type, and selected so that the engines shall run as far as possible at economical loads, and that one unit may be out of service for repairs.

Calculation of generator capacity required can be made approximately from published data on power required to run machine tools. It is usual to install motors having a considerably larger nominal capacity than figured requirements, so that generator capacity need never be as great as the added capacities of motors attached. In fact, the generator load in an ordinary shop seldom runs above 50 per cent of that of the combined motor capacity, and in shops having a large motor load the effect on generator of running a traveling crane, a transfer table and turntable need not be considered, as the momentary overload capacity of the machine will be ample to take care of such requirements.

**RATING OF GENERATORS.**—Generators are sold with a guarantee to deliver their rated capacity, when driven at a certain speed, indefinitely, with a maximum temperature rise, due to electrical losses, of an amount supposed not to be injurious to insulation. This rise should not exceed 40 degrees centigrade above the temperature of the surrounding air. They are also guaranteed to carry an overload of 25 to 50 per cent for two hours, and short period overloads of 100 per cent without injurious heating. These guarantees have led to an objectionable but common practice of figuring the engine size on the overload capacities; that is, it is quite customary to couple a generator to an engine having its economical rated capacity equal to the 50 per cent overload capacity of the generator. The consequence is that load is piled on the generator as long as the engine will pull it without seriously dropping off in speed, and an expensive generator is finally ruined for lack of the common-sense precaution which would be furnished by a properly adjusted engine unit.

**MOTORS.**—If the direct current system be adopted, a wide range of selection in motor types is possible.

For line shafting, motors should be of the shunt type.

For individual tool driving, the shunt motor is also in most common use; but the compound-wound variable speed motor is recommended as

a desirable substitute. In fact, it is the belief of your committee that one of the great advantages of electric driving is in the possibility of simple speed regulation for large tools, and the attention of the electrical companies should be called to the importance of filling this requirement in their line of standard motors.

Motors are preferably of "open" construction; that is, with the ends of field frame uncovered. Where exposed to the wet, or to mechanical injury from articles falling into it, the closed type of motor may be employed, but this type is not desirable where it can be avoided, on account of its lack of ventilation, which means overheating unless the motor is of relatively large size for the work to be done.

For traveling cranes, hoists, transfer tables, locomotive turntables and boiler shop plate rolls, which start under load, run at variable speed, stop and reverse, the series-wound motor is the best, and is preferably of the enclosed style, which allows of more universal connection in any position, by gearing or otherwise, than the open type, and the question of heating is not so serious, on account of intermittent running.

For alternating motors, the same considerations as for the "direct" apply; but, as elsewhere explained, variable speed running in this type for tool-driving motors is not practicable. For crane work, however, the induction motor is successfully applied by attaching special controlling devices.

In selecting motors, the importance of keeping down the number of sizes should be had in mind. This should be done at the expense of some increase in first cost and in spite of some waste of power due to reduced efficiency of underloaded motors, especially as their reliability is thereby enhanced. Competition among the makers of cheaper grades of motors has resulted in giving ratings dangerously close to the maximum safe working limit, and, with all motors, a reduction in the working load greatly increases their durability.

In deciding upon the make of motor to be purchased there is the same range for selection as found in other lines of machinery; but as an electric motor is a somewhat delicate machine, it is important to select only those made by reliable manufacturers. Such can be had of several companies, but they are not the lowest in first cost, and, in absence of definite information, it is generally safest to avoid very cheap machines. Even the best manufacturers make motors with different ratings as to speed and heating limits, and the lowest speed and lowest heating limit motors should be selected. The latter should not exceed  $40^{\circ}$  centigrade rise above external temperature at continuous full load run. The speed should be the so-called "slow speed" variety. Table No. 2 gives about the proper speed for each of the standard sizes of shunt motors. It also gives the approximate selling prices of the list, based upon the highest grade machines; price includes motor, with pulley, base-frame and belt tightener, and starting box.

A corresponding list of "medium speed" motors may be obtained, the speed for a given power being about 50 per cent higher than given

in table, the prices being about 20 per cent less on smaller and 35 per cent less on larger sizes.

TABLE NO. 2.—SPEED AND PRICES OF SLOW SPEED DIRECT CURRENT MULTIPOLAR MOTORS.

RATED OUTPUT, H.-P.	SPEED, R. P. M.	PRICE.	PRICE PER H.-P.
2	1,200	\$ 135	\$67
3½	1,050	190	55
5	950	240	48
7½	850	310	41
10	750	400	40
15	650	500	33
20	600	600	30
30	575	850	28
40	550	1,050	26
50	550	1,200	24

MANNER OF TOOL DRIVING.—This varies in accordance with the motor arrangement and may be by

- (a) The group system.
- (b) The individual system.

The selection of one or the other system depends upon the size of the tools and the consideration of intermittent or continuous running. In general, where the tools require less than 3 horse-power each, it is best to drive them in groups from short line shafts, which, as a rule, should not require more than 25 horse-power per shaft group. Where, however, 3 horse-power or over is required, or where variable speed or intermittent running is desirable, each tool should have its own motor.

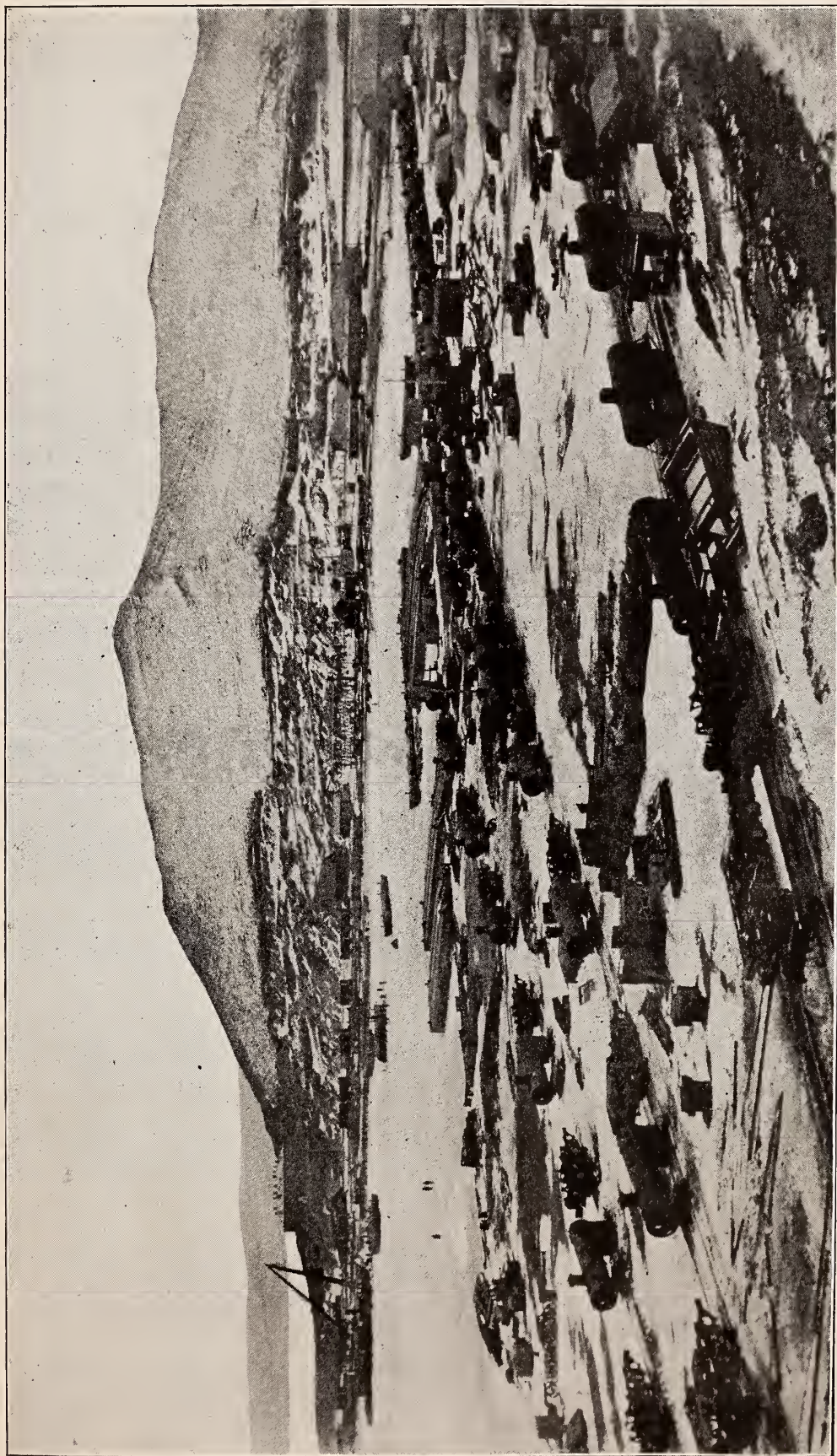
In the group system the motor may be either belted to or direct-connected on the end of the line shaft, accordingly as space or plant cost permits.

In individual driving either belted or geared motors are employed. The belted arrangement is somewhat clumsy, but reduces shock and prolongs the life of the motor, and is, in the opinion of your committee, the better arrangement for general use.

#### *Conclusions.*

1. In a small shop, consisting practically of one building, having an equipment of small tools for light work only, electric transmission will not be found a paying investment. In such a shop, however, an electric lighting dynamo will be a convenience, and may be utilized to run a few labor-saving electric tools, such as a cylinder boring outfit, a turntable motor, etc.

2. In an extensive railway shop plant, the installation of a central power station and electric transmission will always be found advisable, as it will not only result in the most economical system in respect to operation, but will make possible far more important shop economies, namely, an increase in quantity and quality of output and a reduction in cost of handling the same.



LOCOMOTIVES FOR THE CHINESE EASTERN RAILWAY IN PROCESS OF ERECTION IN WINTER, SHOWING BAY FROZEN NEAR VLADIVOSTOCK.  
(SEE PAGE 454).

## ERECTING LOCOMOTIVES IN SIBERIA IN WINTER.

The illustration on page 453 represents a winter scene on Golden Horn Bay, at the town of Yeagershelt, on the eastern coast of Siberia, near Vladivostock. The Chinese Eastern Railway has established a receiving station at this point, and a portion of the locomotives, imported for the equipment of the road, are here installed.

The view shows a number of locomotives built by the Baldwin Locomotive Works, and gives an idea of the manner in which the work of erecting the locomotives is carried on after they are discharged from the vessel. It will be noted that the bay is frozen and the ground is covered with snow and ice. There are, apparently, no buildings of any description in which the work can be done, and it is necessary to assemble the various parts in the open air. In some few instances the boilers of the locomotives are mounted on the driving wheels and the cylinders are in place, but in most cases the parts have not yet been assembled.

The process of erecting these locomotives in the winter season is attended with many difficulties, owing to the severe climate and lack of proper facilities for prosecuting the work and for protecting the workmen from the weather. For these facts and our illustration we are indebted to the courtesy of the Baldwin Locomotive Works.

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## THE CAR FOREMEN'S ASSOCIATION OF CHICAGO.

### JULY MEETING.

The regular meeting of the Car Foremen's Association of Chicago, was held in Room 1741, Monadnock Building, Chicago, Thursday evening, July 12. Meeting called to order at 8:00 p. m. by President Morris. Among those present were the following:

Ashcroft, Norman	Cather, C. C.	Harvey, H. H.	Morris, T. R.
Blohm, Theo.	Depue, Jas.	Johannes, A.	Murray, D.
Bates, G. M.	Etten, L.	Kroff, F. C.	Olsen, L.
Bannes, A.	Guthenberg, B.	Keebler, C. F.	Perry, A. R.
Bell, W. R.	Gruhlke, Edw.	Kline, Aaron	Prickett, Jas.
Bundy, C. L.	Groobey, Geo.	Kuhlman, H. V.	Rieckhoff, C.
Cook, W. C.	Grieb, J. C.	Mercatoris, M.	Roof, C. S.
Cardwell, J. R.	Hughes, Chas.	McAlpine, A. R.	Swift, C. E.

Spohnholtz, C	Schultz, Aug.	Thomson, Geo.	Williams, Thos.
Showers, G. W.	Skilling, J. K.	Wolfe, Chas.	Wentsel, Geo.
Stimson, O. M.	Senger, J. W.	Wessell, W. W.	Wensley, W. H.
Saum, C. L.	Shaw, M.	Weschler, H.	Williamson, H.
Sharp, W. E.	Saum, G. N.	Wharton, R.	Woods, E. S.

President Morris: The committee on center plates and center pins that was appointed three or four months ago, of which Mr. Sharp is chairman, is now ready to make its report. We will be pleased to hear from Mr. Sharp.

Mr. Sharp: There is not very much of a report to make on this subject; we can simply thresh over the old straw. When the committee was first appointed we started by making tests and inspection, but were delayed, as you all know, by the original chairman failing to find time to carry forward the work. The remainder of the committee beg to report as follows:

**REPORT OF COMMITTEE ON BEST FORM OF CENTER PLATES.**

*To the Members of the Car Foremen's Association :*

Your committee, appointed to investigate and report the cause of so frequent failures of the center pins, and the best form of center plate to be used, beg to report as follows:

In making this investigation, the following form was used:

Date..... 1900.

Car Number.	Kind of Center Plate.	Kind of Truck.	Clearance on Side Bearings	How broken—sq. break or bend.	Cause.
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....

REMARKS: (Please give all information possible.)

.....  
 .....  
 .....

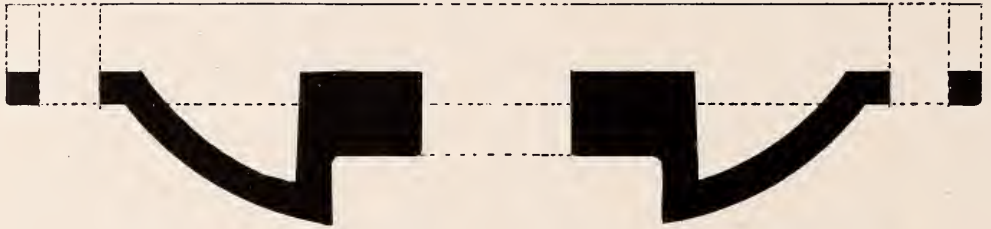
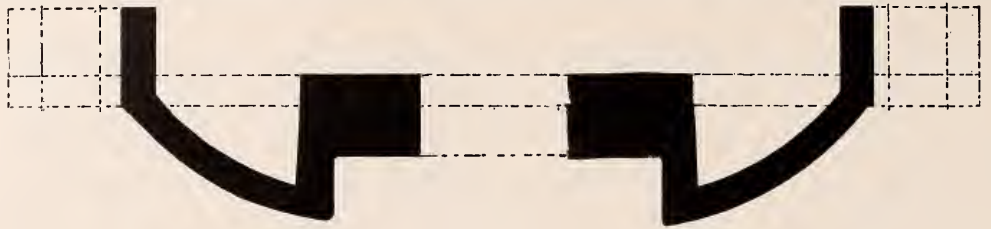
Kingbolt tested showed .....

.....

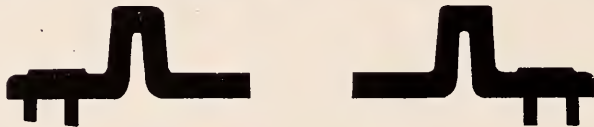
We did not find any marked difference between cars equipped with swing motion and cars equipped with rigid trucks.

Your committee is of the opinion that the cause of the broken center pins is due principally to the following:

- Poor iron in center pins,
- Center pins with key way between transom bars, and
- Narrow single iron body transoms.



CENTER PLATE No. 1.



CENTER PLATE No. 2.



CENTER PLATE No. 3.

In the latter case, we refer particularly to a class of cars with iron transoms 8 inches wide and of light capacity.

We find but a small percentage of broken center pins on cars of more modern design and capacity ranging from 50,000 to 100,000 pounds.

As to the proper design of center plate, your committee submit here sectional views of some of the different styles of center plates in use, each of which, it is reported, gives good results: but your committee would recommend the use of dish shaped center plate, view No. 1, same to be made of malleable iron with boss  $1\frac{1}{2}$  inches high on bottom plate, with wrought iron center pin  $1\frac{3}{4}$  inches in diameter.

Signed, W. E. SHARP,  
F. C. KROFF,  
Committee.

I might say that, in the sectional views on the blackboard, we endeavored to show the contour lines of the center plate and to show the bearing surface and the boss.

President Morris: Have any of the members any experiences to give us in regard to broken center plates? When the subject was up before, it was intended that each member should be given a list of questions to answer, so that we should be able to have some data to base a report on, but on account of the original chairman of the committee being unable to attend to the work, it was dragged along until Mr. Sharp volunteered to take hold of it.

Mr. Stimson (S. R. L.): I agree fully with the report of the committee, that the dished form of center plate, as shown in Plate No. 1, with the boss in the center to protect the center pin from shearing, is undoubtedly the preferable design. It is, as I understand it, practically the Pullman standard center plate, such as they are using under all their sleepers.

President Morris: If I remember right, there were quite a number of objections to this style of center plate when the subject was up before. I think there were some very strong remarks made at that time, and if there are any of those speakers here we would like to hear from them again.

Mr. Wensley (C. & E.): Since this subject first came up I have kept tab on the center pins for two months. During the month of May I think we had 38 center pins put in. Thirty-six of them were on swing motion trucks, the other two on rigid trucks, and all were on iron transoms. They were all cut off square, and I came to the conclusion that it was not the center plate at all that was causing the breakage, but the iron transoms. Most of the iron in the center pins is  $1\frac{3}{4}$  inches or 2 inches. In one or two that we examined closely I found the iron not very good; it was kind of burnt and brittle; but I came to the conclusion that the iron transom bolts became loose, allowing the transom to

swing backward and forward a little, until the pin breaks in two. The center plates were of all designs—some dished.

Mr. Bates (C., B. & Q.): I do not quite agree with Mr. Wensley in regard to these center pins being cut off on account of the iron transoms. On our road we have nothing but iron transoms and we find the broken kingbolts on the small cars that have the dished center plate, something similar to No. 1. Then again, we have lots of cars that have center plates something similar to No. 3, and we find that no center pins break in those cars at all, and it is my opinion that a deep center plate, as outlined in No. 3, is the proper thing to use.

Mr. Cardwell (A. C. O. Co.): I agree with the committee that center plate No. 1 is the best. It has always been satisfactory in our service.

Mr. McAlpine (B. S. C. Co.): Did the committee make any tests of the relative strength of the iron and steel center pins?

Mr. Sharp: We did. We made several tests of center pins—pieces that we found broken. We found a number of center pins broken off up in the body transom, 3 inches above the top center plate, and some further up, which shows conclusively that it is not the shearing effect that takes place between the two plates. The shearing can take place either above or below, as the style of plate and bolster may affect it. We found, in the majority of cases where we tested the pins, it was poor iron, and we believe the majority of the breakages are due to poor iron.

Mr. Harvey (C., B. & Q.): I can corroborate what Mr. Bates says. On our road we use, on all the old light cars we have, a plate something like No. 1, except that the boss in the center is not so high. On the later cars of larger capacity we use a plate something like No. 3, and I have yet to see a single center pin broken with that style of plate. We have a very deep plate, I should think fully  $1\frac{1}{2}$  inches deep, and there is simply no way that the pin can be broken; but with the other we have all kinds of trouble with broken center pins. I do not like plate No. 1 nearly so well as No. 3, and do not think we will get so good results with it. At one of our master mechanics' meetings, about three years ago, they went into this subject very extensively, and at that time they changed the design of the center plates. They also made a standard key center pin instead of a head center pin. Since then we have had no trouble with cars equipped with that style of center plates.

Mr. Sharp: Does Mr. Harvey mean that his light capacity cars were the only ones equipped with the No. 1 center plate?

Mr. Harvey: Yes, sir; mostly.

Mr. Sharp: In our investigation we found a majority of the broken center pins on cars of light capacity. We did not go into the matter deep enough to see what was the exact cause of it.

Mr. Wharton (C. & N. W.): As far as I notice, we have three classes of center plates—a center plate something similar to No. 1 on our stock cars; a cast iron center plate something similar to No. 3, only the surface on the bottom of the upper plate goes into it rather tapering, (and we find a great many broken kingbolts on the No. 3 plan); and a class of center plate in which the kingbolt is put in first. We call it a blind kingbolt. The head of the kingbolt sets on top of the center plate and the center plate is bolted up afterward. It is very seldom we find one broken on that class of cars. On the No. 3 plate we find hundreds of them broken. We usually find them broken between the two castings—very seldom broken at the transom. We use a key kingbolt which sets on the top plate of the transom.

Mr. Stimson: I move that the committee's report be accepted and the committee discharged.

Carried.

Secretary Kline: The following have made application for membership: W. R. Bell, Inland Steel Works; W. H. Evans, B. & O. Railway; A. G. Utt, Swift Ref. Line; E. S. Woods, Kindl Truck Co.

President Morris: The first question on our program for discussion is in regard to removing, repairing and replacing American continuous drawbar rods and keys.

#### **LABOR CHARGE ON CONTINUOUS DRAWBAR RODS AND KEYS.**

Mr. Roof (S. R. L.): In regard to the question as to the proper charge for labor in removing, repairing and applying American continuous drawbar rods and keys, I notice it is the custom of the various roads to differ in their charge for repairs and replacing the same, and if we could get down to one set charge on all the roads entering Chicago, I believe it would be a wise thing. I have had considerable to do with the removal of both rods and keys, as quite a number of our cars are equipped with this equipment, and I think that two hours' labor for one American continuous rod, or four for the two rods, and one hour for applying a key, would be a proper charge. The carry iron will not have to be taken down; the pocket and springs are in place; there is nothing of that kind to do at all—simply to knock out the key and apply another. Therefore, under these circumstances, I think one hour a reasonable charge for the key and two hours each for the rods.

Mr. Wensley (C. & E.): We have had considerable trouble with side rods. We charge two hours' labor for a cross key and four hours' labor for a side rod, when we have to take it out and weld it. I think four hours' labor for an American side rod is not too much, as by the time you take it out of the car, take it to the blacksmith shop and get it welded and then put back in the car, more than four hours' labor will be consumed.

Mr. Prickett (C. & E. I.): My friend back there wants to get rich, I think. Two hours for taking out and welding an American continuous rod and one hour for applying a key is, I think, sufficient, unless your rod is broken on both ends; then I charge three hours, making out a bill for two hours for one rod and three hours for welding a rod at both ends. I never charge over an hour's time for applying a key. Lots of times it can be done in fifteen minutes. We have no trouble in driving the keys out, and most of our cars are equipped with American side rods.

Mr. McAlpine: At the recent annual convention of the Master Car Builders' Association, at Saratoga last month, there was a rule added covering this point, which makes a labor charge of two hours for either a key or a rod. This rule will take effect September 2.

Mr. Grieb (C., M. & St. P.): I would like to inquire whether that provision is not intended to cover carsmiths' labor only. As I understand it, it does not include the blacksmith labor, and it seems proper to add something additional for the blacksmith's time.

Mr. McAlpine: The reading of the rule is as follows: "Labor charge for replacing or renewing any or all of the following items at the same end of car: Coupler, draft spring, one or more followers, American continuous draft key, etc." It does not say anything about welding.

President Morris: Was there anything in the discussion that would lead a person to think that was the labor of applying only?

Mr. McAlpine: There was no discussion on the subject. The rule was introduced by Mr. Hennessey, of the Milwaukee road. Perhaps Mr. Grieb can tell us what his idea was.

Mr. Grieb: I would say in reply, that it was because of this that I made the above remark. Our shop people thought about an hour would be right for that. I think we ought to settle this question in some definite shape. If it is to be understood that a labor allowance of two hours is all that can be charged, or if not, I think it would be in order for the Car Foremen's Association to make a recommendation as to what they think is right. I move that the proper charge for the replace-

ment of a continuous rod be two hours, subject to an additional charge of one hour for blacksmith labor, in case of repairs.

Mr. Stimson: I will offer an amendment to that motion, that, inasmuch as the Master Car Builders' Association has decided that two hours' labor is sufficient for the repairs and replacement of an American continuous rod, that we agree with the Master Car Builders' Association in that respect, that two hours is sufficient time.

Mr. Cather (I. C.): So far as the Master Car Builders' recommendation and their rule for allowing two hours for the application of one or all of the parts that go to make up a drawbar complete is concerned, I would say that that seems to have been the rule for some years past, with the exception, perhaps, that the continuous rod and key have been added to it; but there certainly has not been any recommendation that these parts should be welded or straightened or repaired in any sense of the word, for that same two hours' labor. Now, it is a fact that, for some years, two hours has been the prescribed rule for applying a draft stem and a drawbar pocket; yet it has been a common practice, and no one has ever questioned it, that when you weld one of those parts, additional labor has been charged, and unless the M. C. B. Association says distinctly that two hours covers the repairing and replacing of the rod, I think it is proper to charge additional labor for the welding.

Mr. Grieb: This combination rule, if I may so call it, was introduced for the sole purpose of avoiding a practice which has come into vogue, viz.: doubling up on the labor charges in renewing adjacent parts at the same end of a car and at the same time. We have had bills presented to us where they have charged two hours for replacing a drawbar and adding an additional labor charge for replacing the pocket, etc. The purpose of this rule was to make it understood that if any more than one item of drawbar and its attachment was replaced at the same time, the labor charge, as far as carsmith's labor is concerned, was not to exceed two hours. It did not contemplate excluding the blacksmith's labor for repairs, straightening or welding, and such matters as that.

Mr. Roof: I do not understand the logic of this question at all, in charging blacksmith's labor. If we are paying blacksmith's price for that piece, we expect to get it at manufactured price, including the labor, without adding an additional charge for labor. Now, if the rod is broken, and they see fit, they can apply a new rod and charge us manufactured price. We are paying manufactured price, and I do not think it hardly right or just to charge additional labor of one hour for welding that up.

Mr. Cather: In one sense, so far as material is concerned, the

remark just made is right and true of the majority of cases, but it would hardly be right to a car owner to bill him for a continuous rod complete, weighing anywhere from 150 to 300 pounds, as the case may be, when the simple welding of three or four pounds of iron and a few hours' labor would make the other rod good. Then, again, the rod that you remove is welded and applied to another car, where it is a clean break and the material can be welded. When you buy a draft stem you pay for material and labor when you pay three cents per pound; but when you break that thing, you certainly do not want to pay for that material again.

Mr. Roof: Bills coming in for repairs to American continuous rods range in charge from seven to as high as thirty-five pounds for rods repaired.

Mr. Wensley: We repair quite a few of those rods and invariably we find them broken right off in the link, and in making the repairs we cut it off in the shank, take a wrought iron link and hammer that down and put a new link on. If the end weighs twelve pounds, we charge for that amount of material and charge for labor welding the rod. If they are broken in the center, we do not use any material—simply make a straight weld.

Mr. Stimson: Following out what the gentleman who has just taken his seat says, we find that we are charged, almost invariably, for repairing these rods with from seven to thirty pounds iron at three cents per pound, and labor charge from two to three and a half hours for applying the rod. In our own shop we are able to do the work at not to exceed two hours, and if the companies doing the work bill for the amount of iron which they use (and the larger number of bills which we receive do have from seven to thirty-five pounds of iron at three cents per pound) I am quite satisfied that that price will cover all the blacksmith labor, and if they are allowed two hours in addition to the three cents per pound for the material consumed, it should be a fair and just charge.

Mr. Showers (C. C. C. Co.): In regard to the original question, it seems to me it would not be right to go on record stating that there should be an additional labor charge for blacksmith's work for the American continuous rod. Take, for instance, such work as riveting sleeves to the drawbar. The drawbar is taken out, taken to the blacksmith shop where the rivets are taken out, and it requires more labor to do this work than to weld an American continuous rod, and if we take hold of one, I think it no more than right to go on record in regard to

the other. Then again, where wrought iron is charged at three cents per pound it is supposed to be in its finished condition, ready to go into the car, and such being the case why should it be necessary in the case of American continuous rods to make an extra charge for blacksmith's work.

Mr. Bundy (S. R. L.): As the Master Car Builders' Association has allowed two hours time for the continuous side rod, I think this charge is about right, and I think the charge should cover the rod manufactured and ready to put into the car. I believe two hours time is sufficient to take out a continuous side rod and have it repaired and applied. Again, I think one hour sufficient time for the key. It may be occasionally, as Mr. Wensley says, you will have a little hard luck in getting the key out, but in general I think one hour is sufficient.

Mr. Mercatoris (C. & E.): It takes from two to four men to weld a rod properly, and I never saw a continuous rod welded without using some iron. You take that rod out of the car—you cannot take it out short of twenty-five minutes—then take the rod to the blacksmith shop and have it welded by the blacksmith. You cannot hire a good blacksmith anywhere for less than \$2.50 a day, and then it will take at least two men to help him weld the rod, and they cannot do the work short of a half hour, and I think four hours little enough for that work.

Mr. Stimson: I wish to correct a wrong impression which I seem to have given. It would appear to me that wherever we are charged 35 pounds of wrought iron that the company had applied a link on both ends of the rod, and that would account for the 3½ hours labor. In other instances where we are charged 1½ hours labor and 17 pounds of iron, it would appear we had been charged with one link. If the lesser quantity, or 7 pounds, it would appear that that material was used to weld the rod to a proper length, so that in this way we might account for the quantity of iron charged, varying from 7 to 35 pounds.

Mr. Mercatoris: I understood that he could do the work in a very short time in his shop. That may all be very true. There are several shops in Chicago so equipped that the work can be done very easily, but take it out along the line there are many places where they have no facilities for doing this work, and it is necessarily more expensive.

Mr. Cather: I would like to ask this question of some practical car man—some one that does the work. Is it not a fact that an arch bar can be taken to the blacksmith shop and welded as easily as the American continuous draft rod, 35 feet long, or somewhere in that neighborhood?

Mr. Wensley: I would say that I prefer two side rods to one arch bar.

Mr. Showers: While it is easier to weld an arch bar, he has not got it lined up. It is more work to get it lined up ready to apply to the car than it is to weld it.

Mr. Sharp: I would like to emphasize what Mr. Grieb has said about the gentleman who presented this rule. Mr. Hennessey was talking of this amendment to the rules before he presented it to the convention, and it was to cut out the additional labor charge, where repairs had been made to a drawbar and drawbar spring at one end of the car, and it was to exclude the additional labor charge of two hours for the follower or any other attachment, and I do not think it entered into the minds of any of the members when that rule was passed on, that this extra work was going to be cut out on an American continuous drawbar rod, yet it would seem the rule as it reads will cover it, and it seems to me we are commencing too early to revise the rules for 1902.

President Morris: The motion of Mr. Grieb is before the house. The motion is that an additional charge of one hour for blacksmith labor be charged, in addition to the two hours that the M. C. B. rules have allowed.

Carried.

#### **LOST TRUCK SPRINGS AND BROKEN HANGERS.**

President Morris: Question No. 2 is in regard to loss of truck springs when hanger is broken.

Mr. Bundy: I believe that a charge for defects of this kind, where the hanger is broken and the spring plank broken and the spring gone, a charge of ten hours ought to cover the entire work on the car, replacing the spring and all. I do not think there should be any extra labor charge for applying the spring. As I understand, that is the point under discussion, as to whether there should be labor charged for applying the spring.

President Morris: I believe it is a question of the spring; not the labor, but the spring itself.

Mr. Bundy: Then I think it is a case where a charge for spring would be improper. I do not think, if the spring is lost, there should be any charge made for the spring, taking the ground that the spring is in good order. Very likely the first thing broken is the truck hanger, which let the spring plank drop down and lost the truck spring, and I think there should be no charge for the spring.

Mr. Wentsel (Belt): I think that they should not charge for the spring, as the spring must have been lost when the hanger was broken. We never make any charge for the spring if it is lost.

Mr. Cather: I find that, in cases of that kind, almost invariably where the truck spring is missing and classified as such on the repair stub, and the spring plank broken, and any other part of the truck rigging broken, that missing material is always billed. We have never objected to these bills from the fact that the M. C. B. rules allow a material charge for most missing material, except on cars offered in interchange, but from information furnished from practical car men on our own road, it is almost an impossibility to ever utilize such springs again. It may be picked up by section men, but it finds its way to the scrap pile ninety-nine times out of one hundred. Of course, the spring may be good and may not be, but I think the practical man at the repair points and terminals never knows whether it is good or not. There are so many different classes of springs it would be a very difficult matter for any company to use that spring on the class of cars from which it was lost. I am not prepared to say whether it is right or wrong, but it is the custom.

President Morris: Was there not a recent arbitration decision in regard to that?

Mr. Wensley: The decision just covered the hanger and spring plank. It did not say anything about the missing truck spring.

Mr. Showers: I am of the opinion that in accordance with the rules we are working under, there is no way of avoiding charge for the spring. The owner is responsible for the spring, yet I am of the opinion that if the spring is in good condition the owner should not pay for it.

Mr. Cather: I do not want it to be understood that springs are charged if in good condition, but if a car is found at the terminals, or brought in off the road and springs are gone, the men put in others and charge for them.

Mr. McAlpine: I have here an abstract of the late decision. Case 581 covers that ground. It says: "The committee is of the opinion that the breakage of a spring plank and bolster, and the loss of a truck spring, is the natural result of a broken hanger, and should not be considered as consequential damage, as in a case of derailment damage. Arbitration case No. 528 decides that damaged parts (resulting from defects not considered unfair usage) cannot be considered as consequential damage, unless same forms combination defects. The bill is correct and should be paid." They decide that the loss of the spring is fair usage and it was proper to charge for it.

Mr. Sharp: I cannot see where this question differs from the one recently decided here about a drawbar and its parts when lost. I do

not think that it is always the case that the spring is broken when the spring hanger breaks and the plank breaks, and I think you will find that in the majority of cases the spring was merely lost and was afterward picked up and went to the storeroom. I think in that case it is wrong to charge the car owner for the spring and allow him scrap prices for the lost spring, which would afterward be used in making repairs to another car. Unless it can be shown that the spring is broken, no bill should be rendered.

Mr. Cather: In order to settle this question, and confirming the arbitration decision, I would make a motion that it is the sense of this meeting that in case of missing truck springs in fair usage a material charge is proper.

Carried.

#### REFILLING JOURNAL BEARINGS.

President Morris: Question No. 3 relates to refilling journal bearings.

Mr. Grieb: It seems to me that this question, which relates to the practicability of refilling journal bearings and the price to be charged for such bearings, does not admit of much argument. I guess everybody will agree that it is practicable, under certain conditions, to refill shell bearings. I do not see any grounds for objections to them as long as the bearings are not worn excessively at the ends. Our bearings are so designed as to get the entire service from the babbitt metal, so if that portion is renewed the bearing may be as good as new. In the matter of charging for such brasses, it seems to me if we remove a bearing from a foreign car, and simply take that bearing and refill it, we ought to be satisfied if we are compensated for the expense of refilling it and returning it to the car. We can do this for considerable less expense to the car owner than if we applied a new brass. If I remember right, the net charge for a filled brass is 65 cents. In cases I have just mentioned it would be about 35 cents. I do not find, however, that this practice is very much in vogue. We get our cars home from a foreign road with repair card on for brass applied, and we find that there have been no new bearings applied, and there is every evidence to show that our own bearings are refilled and applied. It seems to me a little hard when we get only babbitt metal.

Mr. Cather: The only experience I have had with filled bearings is in the matter of billing and paying for them. We find that at some of our shops they refill the shell. We have some few cars running with shell bearings under them, and very few, but there does not seem to

be any question as to the practicability of using filled shell bearings. But as to the charge for them, it seems to me that a good shell refilled is just as good as it first was. A filled shell is a filled shell. If it is worn out, then it is worn out. As I understand, when a brass is worn out the babbitt metal is removed and the shells are refilled and become a filled shell bearing for which the M. C. B. rules allow a certain price. If a road applies a filled shell bearing on account of one worn out, the rules provide a price for both the application and the removal. Brasses are frequently removed from destroyed cars and wrecked cars, and of course those filled shell bearings are used again.

Mr. Showers: I would like to ask Mr. Cather a question. Do the rules provide a price for refilled shell bearings, or is there any difference between a refilled and a filled bearing?

Mr. Cather: I should certainly say that a refilled bearing is a filled bearing, otherwise wherein is the benefit of the shell?

Mr. Showers: Taking that matter into consideration, it may be practical to use a filled shell bearing or it may be practical to refill shell bearings, but in some of the decisions of the arbitration committee they have specified that it is not practical to replace an old journal bearing on a new journal, no matter how little it is worn, unless it absolutely fits the journal. You may apply a new filled bearing and in a few weeks remove the wheel and put in a new journal; it is a little larger than the one taken out; you get scrap credit for the brass taken out and perhaps a refilled brass is applied. Inasmuch as the M. C. B. rules have never specified what the charge should be for a refilled bearing, I do not think it is their intention that a refilled bearing should be used on a foreign car. As to whether it is practical to refill them, I do not care to say. However, we never, since my time with the Canda Company, about fifteen years, have applied a filled bearing to one of our cars, yet in ninety-nine bills out of every one hundred we are given credit for filled bearings removed, and a great many of them have been in the car but a few days, leaving us under the impression that they were badly worn shells that had been refilled and applied.

President Morris: I will say, in regard to this question as to whether a journal bearing can be refilled, that it is given too much prominence. The fact that they are refilled answers that. The question is principally in regard to the price that should be charged for a refilled bearing. The argument has been, so far, that a refilled bearing is practically as good as a new filled bearing.

**BRAKES TORN OFF.**

President Morris: Question No. 4 is in regard to brakes torn off.

Mr. Bates: There seems to be a difference of opinion as to the meaning of the term "brakes torn off." Some roads claim it is an owners' defect, while others take the opposite view, and a discussion on the subject may, perhaps, lead to a uniform understanding. Personally, I interpret the term "brakes torn off" as unfair usage, as the brakes cannot be torn off in any other way than by striking some obstruction on the track. I think you will all agree with me that this cannot be considered fair usage, hence owners cannot be charged for repairing the brakes. On the other hand, if the brakes are lost on account of hangers breaking, it is proper to charge the owners labor for replacing the missing parts, also material charge for the broken parts.

Mr. Sharp: I read that question over two or three times, but did not just catch the meaning of the question as to what is understood by the term "brakes torn off." I think we all understand by brakes torn off that the car met with some unfair usage, and that the owner of the car is not responsible.

President Morris: I believe the committee, when they decided on this question for discussion tonight, had in mind a number of cases where owners had been charged for brakes torn off and it so stated on the back of the repair stub. That is the reason it was brought up.

Mr. Prickett: I do not think that the owners should pay for brakes if they are torn off. I had a car on my repair track this morning. It had inside connected brakes. The two fulcrums were broken, the bottom rod, lever and the lever guide were gone. I had to go to the blacksmith shop and have a new head welded on. I made the repairs, put a repair card on and made a slip out and sent it in. What they will do with it at the main office I do not know. It does not look to me as if we ought to be responsible for it. The M. C. B. rules say that the brakes should be hung  $2\frac{1}{2}$  inches above the rail, although I do not know whether that brake was so hung or not.

Mr. Bundy: I do not think it would be fair to charge the owners where the brake is torn off. I believe if the brakes are too low, or do not clear the rail  $2\frac{1}{2}$  inches, the party handling the car has the privilege of setting that car on the repair track and charging the owner for the repairs, but if he neglects to do that and runs the car and the brakes are torn off on account of being too low, by striking some obstruction, I do not think there should be a charge for it.

Mr. Cather: The question does not state whether or not the beam

was properly hung the required distance above the rail, but assuming that it was, the question still stands is "brakes torn off" chargeable to the owners? I certainly think not. A car running over an obstruction on the track and pulling the brakes off, or damaging the car in any way, is not fair usage. Neither should a labor charge, under such circumstances, be made. The rules allow a labor charge of two hours for replacing a brake beam and connections complete when those things are lost off. It does not say when they are "torn off," and if labor charge is permissible it is proper to charge for the whole. We would not pay a bill if we could avoid it, under any such circumstances; nor do I know that we have made a bill, under such circumstances, either for labor or material.

Mr. Showers: I am a good deal of the same opinion that Mr. Cather is. If the brake rigging, or any part of it, is lost from the car, it is provided for in the rules, but as to brakes being torn off, I am of the opinion that no charge whatever should be made, for they are certainly torn off by some unfair usage, either by some obstruction on the track, or parts of the car giving way, and, as a rule, it can be easily discovered whether the brakes are torn off or lost off.

Mr. Wentzel: I think that if the brake is torn off it should not be charged to the owners. Of course, sometimes the hanger breaks and lets the brake beam come down and be torn off, where there are no safety chains; but as a general rule you will find that the safety chains will hold the beam up.

Mr. Kroff (P., Ft. W. & C.): I think brakes that are not  $2\frac{1}{2}$  inches above the top of the rail, and are torn off, are chargeable to the owner, due to fair usage. The rules say the brakes should be  $2\frac{1}{2}$  inches above the top of the rail, and if they hit a crossing on account of being too low and a portion of the brakes are torn off, I think it is properly chargeable to the owner.

President Morris: I think, Mr. Kroff, those repairs should be made before the brakes get torn off. If they are less than  $2\frac{1}{2}$  inches above the rail, repairs should be made and owners charged; but if the car is allowed to run in that condition the road possessing it should pay for the repairs.

Mr. Cardwell: I move that where brakes are torn off, no charge at all should be made against the car owner.

Carried.

The meeting here adjourned.

# SYSTEMS AND EFFICIENCY OF ELECTRIC TRANSMISSION IN FACTORIES AND MILLS.\*

BY WILLIAM S. ALDRICH.

[Concluded from page 356.]

## *Efficiency of Transmission at Variable Loads.*

It has usually been the custom to compare the relative efficiencies of mechanical and electrical transmission without any reference to the loads, or to the proportional part of the full load on the system. It is well known that almost all examples of mechanical friction, as in steam engines, shafting, etc., show that the power lost in friction is practically constant, within all ordinary ranges of loads and at uniform speeds. This being the case, the efficiency of any mechanical system, as an engine driving shafting, rapidly falls off below full load. This is shown in Fig. 1. The engine is assumed to be about 275 horse power, and to have a mechanical efficiency at full load of about 90 per cent. The curves for the several classes of machinery, *A B C D E F*, show similar falling off of the mechanical efficiency of power transmission by shafting. They are plotted from average values of the percentage of total

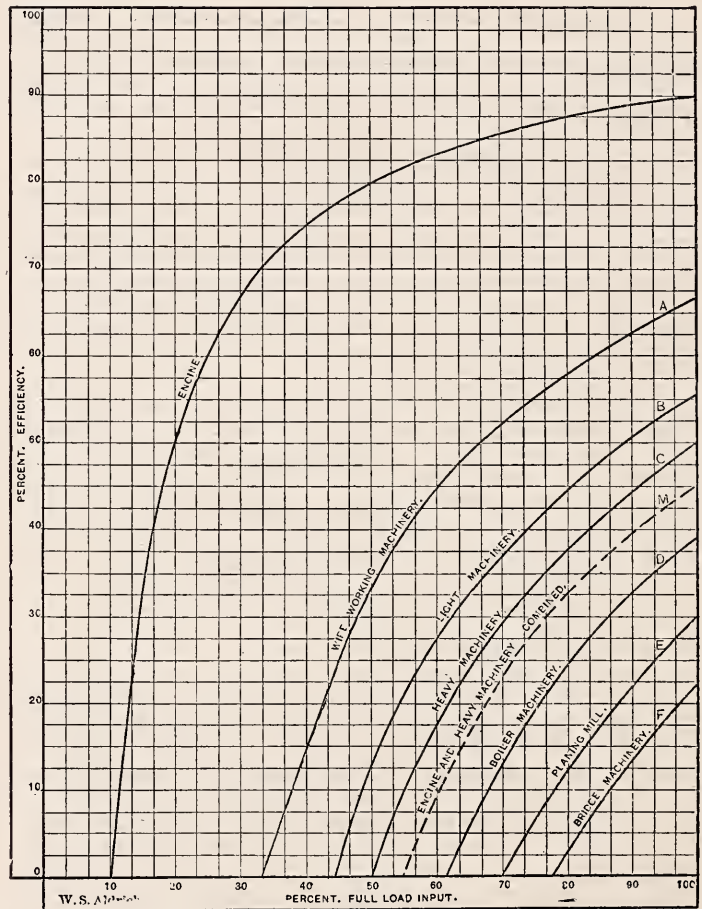


FIG. 1.—CURVES SHOWING THE VARIATIONS OF MECHANICAL EFFICIENCY OF THE ENGINE AND OF THE SHAFTING TRANSMISSION, AT VARIOUS PROPORTIONAL PARTS OF THE FULL LOAD INDICATED HORSE-POWER SUPPLIED TO THE SYSTEM.

\* Abstract of paper presented at the Cincinnati meeting of the American Society of Mechanical Engineers.

power lost in such friction for shafting transmissions, as given by Prof. C.H. Benjamin in a recent paper presented to the Society. The resulting or combined efficiency of an engine driving heavy machinery, is shown in curve *M*. It is to be especially noted what little power there is left for useful work, at light loads. While at full load or 100 per cent load there is 45 per cent available for useful work, at three-quarters load (75 per cent) there is only 28 per cent available for work, and at a load of 55 per cent of the full load there is nothing left for work, all power being consumed in overcoming the combined friction of the engine and the transmission machinery.

In the electric transmission of power for similar manufacturing purposes, the distances are so short that there is really no necessity for considering any of the so-called line losses which figure so prominently in long-distance electric transmission. The transformations of energy in the electric system from steam power into electric, thence to mechanical power, are accompanied with inherent losses, which are shown in Figs. 2 and 3. In Fig. 2 it will be noted that electric motors have the characteristic feature of

high maintained efficiencies at part load. The several curves shown are for various sizes of motors of the same type of commercial machines. Of course, such motors may be designed to have maximum efficiencies at lighter or heavier loads than those shown in the diagram.

Three cases of electric transmission are shown in Fig. 3, as follows: two 100 horse power motors, four 50 horse power motors, and twenty

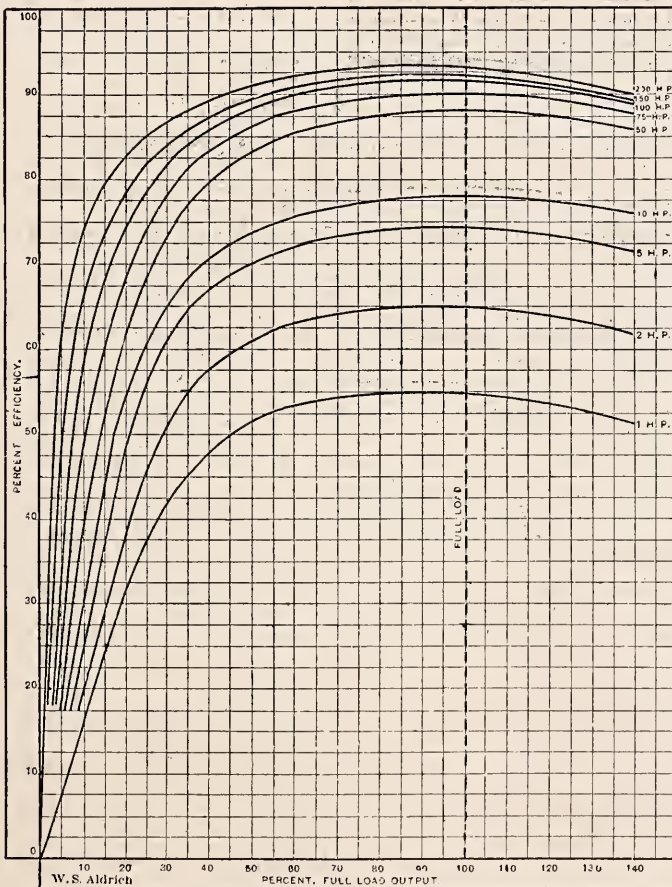


FIG. 2.—EFFICIENCY CURVES OF ELECTRIC MOTORS, OF THE SAME TYPE BUT OF DIFFERENT SIZES, FROM 1 TO 200 HORSE-POWER.

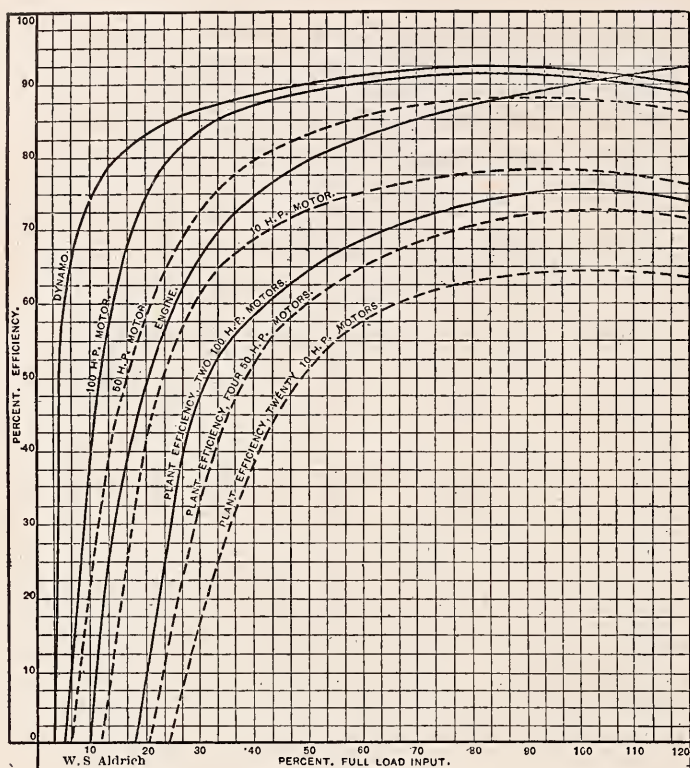


FIG. 3.—EFFICIENCY CURVES OF GIVEN ENGINE AND DYNAMO SUPPLYING POWER FOR ELECTRIC MOTORS OF DIFFERENT SIZES, WITH COMBINED EFFICIENCY OF ELECTRIC TRANSMISSION, AT VARIOUS PROPORTIONAL PARTS OF THE FULL LOAD INDICATED HORSE-POWER SUPPLIED TO THE SYSTEM.

that at full load (100 per cent), 63 per cent of the power applied at the engine is available for useful work; at three-quarter (75 per cent) load, 62 per cent of the power is available; at half load (50 per cent), 51 per cent of the power is available; while at somewhat less than one-quarter load all of the power applied is required to supply the losses in the engine, dynamo and motors. This may be compared with curve *M*, of Fig. 1, showing the combined efficiency of engine and shafting in the mechanical system. For 10 horse power motors, would, in general, represent the average (normal) rating of direct-connected electric motors for such service as that designated as "heavy machinery." In fact, the 10 horse power motor curve of Fig. 2 is quite conservative, and in many cases such an efficiency curve might easily be brought nearer the 50 horse power curve than the 5 horse power curve.

It is, therefore, not so much a question of what the friction horse power, (or its per cent of the total) may be at any load, such as the normal, as it is a question how the total or combined efficiency of the system is going to vary with the load. The best performance of the mechanical system of transmission by shafting and belts is at full load. The best performance of the electric system may be maintained from 75 per cent

10 horse power motors. The steam engine generating plant required in each case, at normal load rating, will be of 265 indicated horsepower, 275 indicated horsepower, and 315 indicated horsepower, respectively. Some interesting features of the electric system are shown in this diagram. In what is probably an extreme case, with only small 10 horse power motors in service, and these given quite a low rating, it will be seen

to 125 per cent of the full load—from three-quarter load to 25 per cent overload.

These differences become more vital when it is borne in mind that very few factories and mills are operated at full load all day. For machine shop practice, for instance, an average of about half time for the actual work would be rather liberal. In many shops several machine tools will not be worked much more than one-third of the time. The losses at these light loads are exceedingly expensive for the mechanical system of transmission, but scarcely require consideration in the electric system. In fact, by proper selection of dynamo and motors, a combined efficiency at half load may be obtained equal to that at full load. The all-day efficiency of the electric system may thus be made very high. This is quite independent of the load factor, or the ratio of the average to the maximum load during the day. The load factors may be the same for both the mechanical and the electric system, as shown by load curves, while in the mechanical system, for instance, at three-quarter load only 28 per cent of the total power supplied will be available for useful work; in the electric system 62 per cent will be so available, as may be seen by comparing curve M, Fig. 2, with the plant efficiency curve for twenty 10 horse power motors, of Fig. 3.

#### *Systems of Electric Distribution for Factories.*

In choosing a system of electric transmission for manufacturing work, it is not necessarily best to have that one system which will the most readily lend itself to all of the work to be performed, for light, heat and power service. A composite system may prove best suited, even in such short-distance transmission. That is, lighting service will, in general, be more satisfactory, and need not be more expensive, if supplied independently of the power service. Direct and alternating currents are equally adapted for factory transmission, and by simple or multi-circuit systems of distribution; that is, by two, three, or four-wire systems, as the case may require. Preferably, all distribution should be direct; that is, without the use of storage batteries, rotary converters, or transformers, except for certain lines of work in which it may be necessary to use one or the other of these indirect systems of distribution.

Higher efficiencies may be obtained with synchronous motors than with induction motors of the same output. In fact, such motors realize the ideal conditions of motor working in which the motor attains almost the same efficiency as the generator. Both induction and synchronous

motors have usually higher efficiencies than direct current motors of same size, as is shown in Fig. 6.

*Combined Induction and Synchronous Motor Working.*

The ideal conditions in a factory installation no doubt would be secured where both induction and synchronous motors were used, the former for small machines and direct driving, the latter for operating a set or group of machines. The synchronous motors would be started up just before beginning the work of the day, have at all times a light constant load, and might easily be so regulated as to produce an almost balanced system in combination with the induction motors. In such a system of transmission the lagging currents of the induction motors would be offset by the leading currents of the synchronous motors, if the latter were operated to produce such leading currents. The whole system would be operated practically throughout quite a range of load variations, as if it were a simple direct current system. The advantage of such a condition is apparent: it means least installation for any given output, or greatest output for any given capacity of generating plant. The group method of electric driving is much better adapted for small machines, up to and including two-horse power capacity, and especially where such machines are in almost constant service. Above this size,

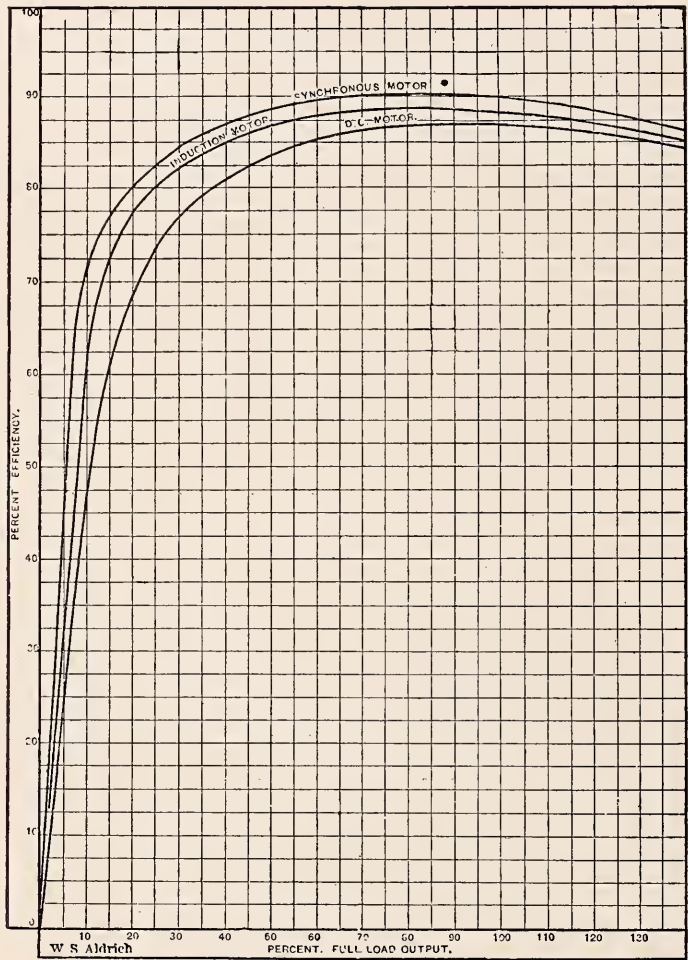


FIG. 6.—COMPARATIVE CURVES OF EFFICIENCIES OF SYNCHRONOUS, INDUCTION, AND DIRECT-CURRENT MOTORS OF THE SAME SIZE.

The advantage of such a condition is apparent: it means least installation for any given output, or greatest output for any given capacity of generating plant. The group method of electric driving is much better adapted for small machines, up to and including two-horse power capacity, and especially where such machines are in almost constant service. Above this size,

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individual motor driving becomes more and more efficient, particularly if the machines are operated only a fraction of the day.

*Economies Effected by Electric Transmission.*

It might naturally be expected that the greatest saving would be noticed in those factories designated in the earlier part of the paper, as engaged in heavy machine work, where the loss in shafting and belting amounts to over 50 per cent of the total power developed at the engine. On the other hand, many small industries have introduced electric driving to marked advantage. A few cases may be cited. No doubt many similar cases may be added by members of the Society from their own experience with electric driving.

Case I.—Electric driving reduced the cost one-half over the former method, for engineer, coal and water.

Case II.—Fuel account, by electric driving, reduced to one-fifth of what it formerly was by shafting and belting.

Case III.—Cost of power 44 per cent lower than what it was by shafts and belts.

Case IV.—Gross saving about 30 per cent with direct coupled motors, and 22 per cent with geared or belted motors.

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## COMMUNICATION.

### STAYBOLT INSPECTION.

GALETON, PA., July 17, 1900.

*To the Editor of the Railway Master Mechanic:*

In the April number of the RAILWAY MASTER MECHANIC I noticed an article on "Some points about staybolt inspection," the writer claiming that an "expert" can detect partially broken staybolts "by the vibration of the sheet taken off by the fingers." If there is a place on record where this has been practically demonstrated, I have yet to see it.

It is a very common occurrence for an inspector to locate partially broken bolts from his general knowledge of the conditions of a boiler, but not, however, with the assistance of the hammer.

The "expert" must detect a broken bolt in order that he may have a sure thing to work from. From his knowledge of the boiler, he knows that no stay bolts were ever renewed in that part of the boiler where he

has detected the broken one, so he reasonably assumes that those next to it are partially broken.

Take, for instance, an old boiler where there is no doubt as to the bolts being defective, and on each row of bolts renew every other bolt, being careful, in riveting the end, to have them conform with those of the old ones. Now, have the "expert" examine and report in what condition he finds them (he, of course, being in ignorance as to the length of time the boiler was in service and the number of bolts renewed). After he has submitted his report, inform him that the boiler has been in service so long; that so many bolts have been renewed; the condition in which they were found, and their location in the boiler, and he will immediately describe to you, very accurately, the condition of the old bolts, and will have no use for a hammer to do it. Compare this with his former report, and note the difference.

Here are a few obstacles which confronted him in his first examination: Frame pad may have a bearing close to the head of one stay-bolt, while, on the next, the bearing may be two or more inches from the head, or the head may rest firmly on the pad, or the frame may have a bearing on the pads on one side of the boiler, while on the opposite side there is a clearance; some of the staybolts may not go through the plates at the proper angles; all of which are common occurrences and often baffle the skill of an inspector who is trying to detect broken bolts; yet the writer claims that if there are any partially broken ones in the boiler they can be found.

A few years ago the officials of the Pennsylvania Railroad Company had the inspectors from the different shops on their line examine the staybolts in a certain boiler. A careful record was taken of the work of each man, after which the firebox was removed. These inspectors (some very good ones) would not jeopardize their reputations by attempting to detect "partially broken" bolts. They were only too glad to successfully locate the broken ones; and so with the "expert," if he can detect *all* the broken ones, his place is at the head of the class.

GEO. M. REARICK.

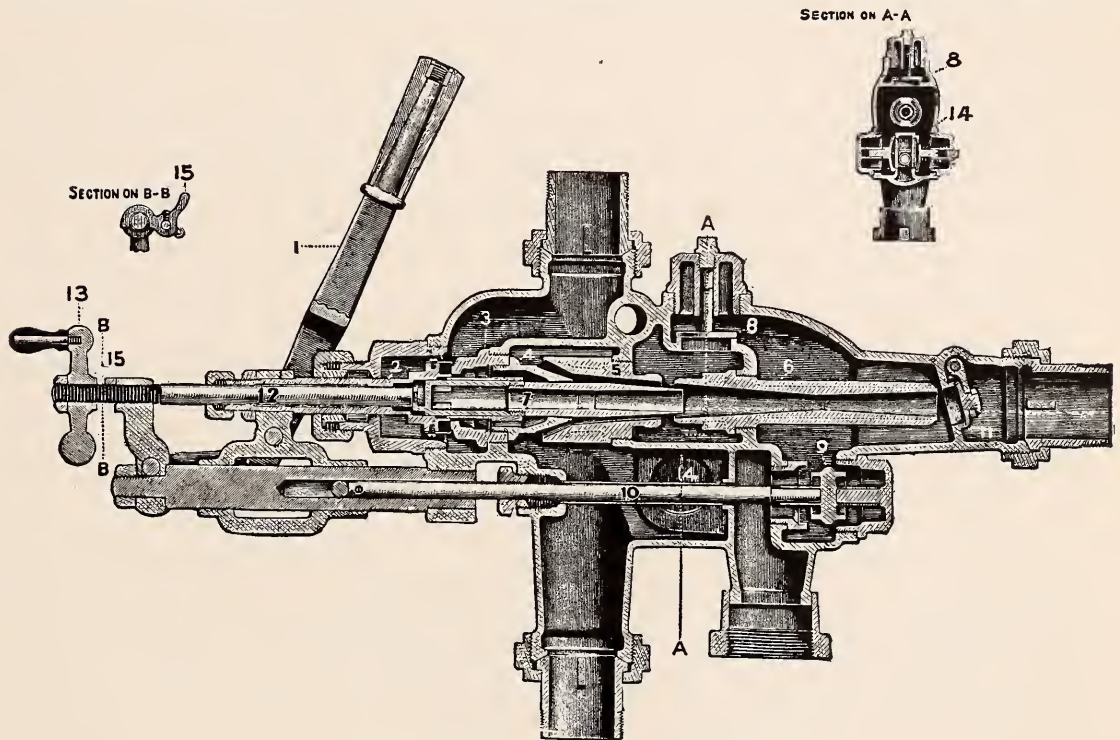
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### THE LUNKENHEIMER INJECTOR.

A new injector has been placed upon the market by The Lunkenheimer Company, of Cincinnati, Ohio. This injector has been tested under a variety of conditions of severe service, and its makers claim that these tests establish fully its efficiency and durability. It is said that it can start promptly, under most conditions, at all pressures from 30 to 250 pounds; that it will work without adjustment of steam or water from 40 to 250 pounds and higher, and that the capacity can be reduced over 50 per cent at all points. The regulation of water delivery is so effected that when the water discharge is reduced the steam consumption is reduced in direct proportion—a novel feature, and one resulting in lower temperature of discharged water.

Our engraving shows the arrangement of internal parts quite clearly. The operation of the injector is substantially as follows: In starting, the lever, 1, is drawn back slightly. This movement draws the steam valve, 2, back and unseats same partially,

which admits the lifting steam through the cap 3 and huddler 4, out around the steam tube, 7, into the water-lifting tube, 5, opening the valve 8, and exhausting partially through the valve, 4, and also through the tube, 6, and out through the overflow valve, 9, into the atmosphere. The steam thus exhausted exerts a strong draft in the suction branch, discharges the air, and the water is "lifted." When water appears at the overflow, the lever, 1, is drawn all the way back. This movement uncovers the ports in the movable steam tube, admitting the jet of forcing steam, which drives the water through the forcer combining tube, 6. By the same movement of the lever, 1, the rod, 10, is withdrawn and the valve, 9, is seated by the increasing pressure in the delivery chamber. The valve, 8, is also seated by the pressure on top of same, and all water is forced through the tube, 6, overcomes the boiler pressure on line check valve, 11, and passes into the feed pipe. The amount of water delivered is regulated by the movable steam tube, 7. This tube moves longitudinally through the other tubes in the machine, and is actuated by the threaded stem, 12, and crank, 13. To deliver the maximum amount of water the tube is withdrawn to its limit. This admits the maximum amount of steam around the out-



THE LUNKENHEIMER INJECTOR.

side of the tube to lift the water, and also to the interior of same to force the jet into the boiler. The withdrawal of tube, 7, also increases the passageway around same and through tubes, 5 and 6. When it is desired to reduce the capacity, the crank, 13, is turned from left to right, which forces the tube, 7, into the openings in tubes, 4, 5 and 6. The effect of this is: First, to cut off the amount of forcing steam passing through the ports in the end of tube 7, as same is moved into the tubular extension of the huddler, 4; second, it decreases the passage of lifting steam around the tube, 7, and through the huddler, 4, due to the tapering diameter of the tube, 7, approaching the fixed internal diameter of the huddler, 4; third, the passageways through the tubes, 5 and 6, are decreased as the tube, 7, is passed into same.

An auxiliary water valve, 14, is situated at the side of the machine and controls the port between the suction branch and the intermediate chamber of the injector, as is shown in the section A, A. The function of this valve is to make the injector self-adjusting and unaffected by variations of steam pressure. At certain pressures the water lifting tube does not deliver a sufficient quantity of water to condense the steam, and at such times the vacuum formed in the chamber causes the valve, 14, to open and admit the additional amount of water required.

A heater attachment is provided that has been found very efficient in railway service. This is shown numbered as 15, on the section B, B. Where it is necessary to have a heater attachment to keep the tank connections open in cold weather, the device

referred to is very satisfactory. In using the injector as a heater, the latch, 15, is pressed down, which throws it out of engagement with the spindle, 12; then the latter is screwed in as far as the crank handle will allow, and then the lever is drawn back. With the steam tube screwed in as described, very little steam will be discharged into the suction pipe; but if it is desired to increase the same, the crank handle is screwed out, which will admit more steam.

A notable feature of this injector is that the water regulator can be manipulated freely to grade the capacity, as it will not disturb the certainty of operation. Another strong claim is that it will, in short lifts, work water as hot as 135°, at all pressures up to 250 pounds.

## PERSONAL MENTION.

Mr. G. D. Brooke has been appointed master mechanic and master car builder of Iowa Central, with headquarters at Marshalltown, Iowa. Mr. Brooke has long been known as a leader among the mechanical railway men of the northwest, having been for the past nine years master mechanic of the St. Paul & Duluth.

Mr. J. R. Rand, president of the Rand Drill Co., died July 18, aged 63 years. His death closely follows that of his brother, Addison C. Rand, who passed away March 9.

Mr. H. Monkhouse has been appointed superintendent of motive power of the Chicago, Indianapolis & Louisville, vice W. P. Coburn, deceased.

Mr. C. F. West, acting master mechanic of the Baltimore & Lehigh, has been appointed master mechanic of that road.

Mr. C. W. Weller, master mechanic Central Branch Union Pacific (Missouri Pacific), has resigned, and the office is abolished. C. M. Marshall, hitherto foreman locomotive repairs, succeeds Mr. Weller, with the title of division foreman, with office at Atchison, Kansas.

Mr. T. M. Gibb, division master mechanic of the Colorado & Southern, at Trinidad, Colo., has resigned. He is succeeded by J. M. Fowle.

Mr. A. Lipschutz has been appointed assistant mechanical engineer of the Great Northern.

Mr. T. Trenlean has been appointed master car builder of the Grand Trunk at London, Ont., vice S. King, resigned to go to the Intercolonial.

Mr. Daniel H. Deeter has been appointed division master mechanic of the Philadelphia & Reading, at Philadelphia, vice H. Delaney, resigned.

Mr. W. W. Layman has been appointed acting master mechanic of the Ohio River, vice E. La Lime, deceased.

On the Chicago & Northwestern J. F. Fleischer, division master mechanic at Eagle Grove, Iowa, has been transferred to Kaukauna, Wis., succeeding A. W. McLean; F. G. Benjamin, foreman at Boone, Iowa, succeeds Mr. Fleischer as master mechanic at Eagle Grove; S. C. Graham, foreman at Lake City, Iowa, is appointed division master mechanic at Belle Plaine.

Mr. J. B. Bronson has been appointed master mechanic of the Erie & Wyoming Valley, at Dunmore, Pa., vice D. E. Barton, resigned.

Mr. E. A. Richardson, general foreman P. W. & B. shops, at Washington has been appointed master mechanic of the Chicago & Alton shops at Bloomington, Ill.

Mr. C. Graham, Jr., master mechanic of the Lackawanna road, at Buffalo, has resigned; Fred. W. Williams, master mechanic of the same road, at Syracuse, succeeds him; R. P. Schilling succeeds Mr. Williams at Syracuse.

Mr. J. H. McGoff has been appointed master mechanic of the St. Paul & Duluth division of the Northern Pacific.

On the Pennsylvania Railroad system, Mr. R. N. Durborrow, superintendent of motive power of the P. W. & B., has been transferred to the new Buffalo & Allegheny division, with the same title, and with office at Buffalo; Mr. Alexander Kearney, master mechanic at the West Philadelphia shops, succeeds Mr. Durborrow on the P. W. & B.; Mr. Jas. T. Wallis, assistant master mechanic at the Altoona shops, is appointed assistant engineer of motive power on the lines east of Pittsburg and Erie, with office at Altoona.

Mr. H. T. Herr has been appointed division master mechanic of the Chicago Great Western, with office at Des Moines, Iowa.

# RAILWAY MASTER MECHANIC

WALTER D. CROSMAN, EDITOR.

WILLIAM E. MAGRAW, MANAGER.

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## SOME OLD-TIME CHICAGO LOCOMOTIVES.

BY GEO. B. SNOW.

The illustration of the Chicago & Northwestern engine "Missouri," in your June number, as an example of the style of engine built in 1865, reminds me of the time, ten years earlier, when I first visited Chicago. Then, all locomotives running into that city burned wood instead of coal. Then, the concomitant of every water tank on the line of a railway was a large pile of cordwood, the sticks being sawed once in two; and while the tender was filling with water, all the available help belonging to the station and train were occupied in throwing wood and heaping it on the tender. This load would last an engine, if working hard, about an hour. Passenger engines usually ran about thirty miles, and freight engines about ten miles, with one tender full of wood.

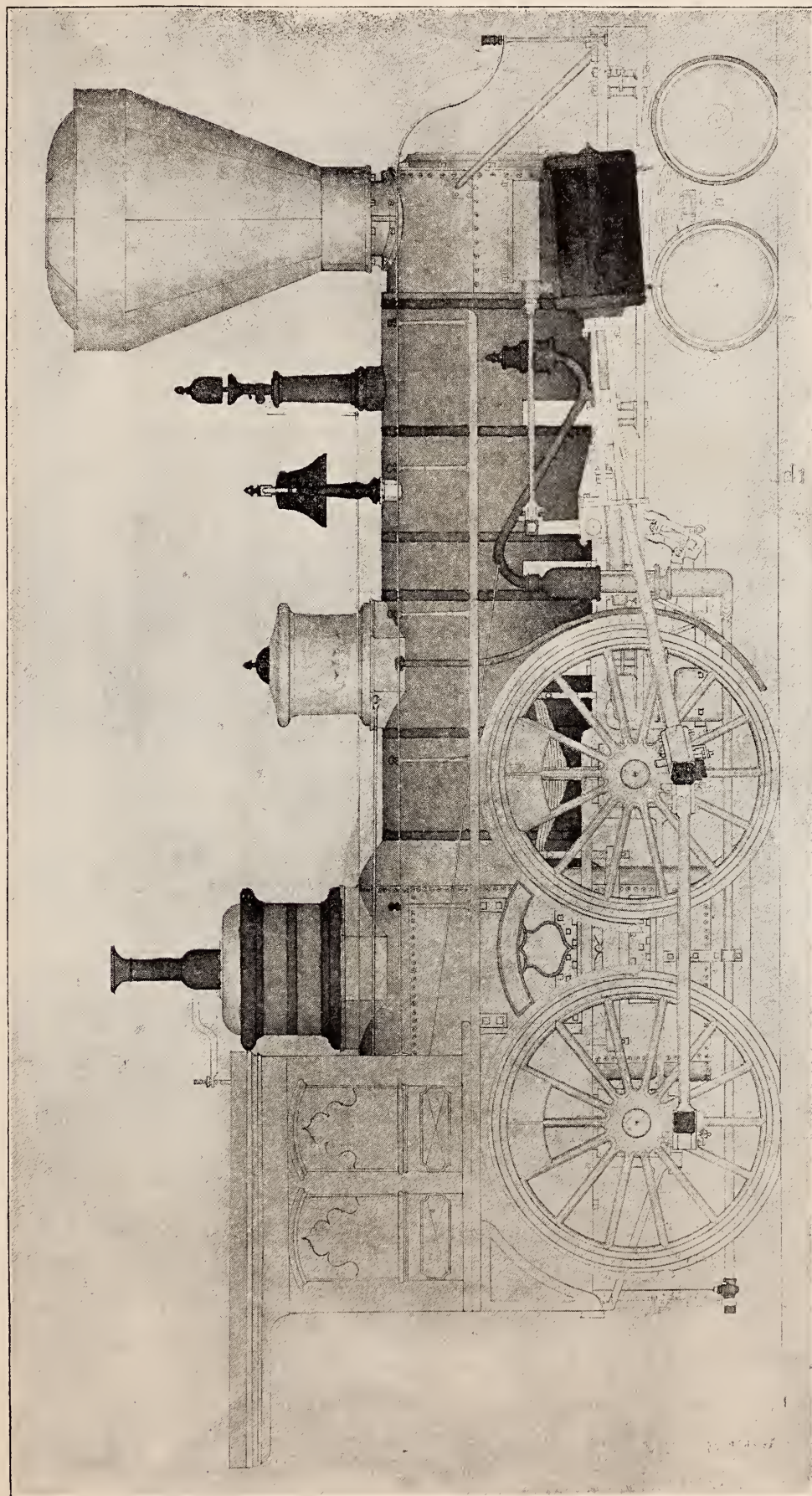
The fire door was placed as near the crown sheet as it could be, and, when running, the firebox was kept full of wood, or up to the level of the door at any rate. If the engine was working hard, the wood would burn about as fast as it could be handled; and, if running against a strong head wind, a passenger engine would sometimes consume the wood so fast that the fire door would be open for mile after mile, the fireman throwing in wood as fast as he could handle it.

This was in the old days, before the grade in Chicago was raised. The matter of raising the grade was, however, then contemplated, and the new buildings would have the ground floor three or four feet higher than the older ones, the sidewalks being laid to correspond. So, in passing along the business streets, one would be obliged to go up or down half a dozen steps, possibly half a dozen times, in the length of a block. Clark street, Lake street, and other business streets, were not paved, but were laid with plank, underneath which was usually a layer of soft black mud, ready to squirt up between the planks as a wagon

ran over them, and decorate the clothes of the incautious pedestrian. The sidewalks were also plank. La Salle street, south of the Court House square, had not even the plank; and I remember seeing a milk wagon stalled in the mire and abandoned, in the spring of 1856, only a block from the court house, in this street.

There was no Chicago & Northwestern Railway at this date, this corporation being formed by the consolidation of three others which were in existence in 1855 and 1856—the Galena & Chicago Union, the Chicago & Milwaukee, and the Chicago, St. Paul & Fond du Lac. Of these, the Galena & Chicago Union was the most prosperous. It was chartered in 1836, and as Galena was then more of a business center than Chicago, its name was given precedence in the title of the corporation. But it was not until November 20, 1848, that the road was finally opened for business. Its first engine, the "Pioneer," which was exhibited in the Chicago World's Fair of 1893, was brought to Chicago by the brig "Buffalo," and landed in October, 1848. On November 20, the road was formally opened by a grand excursion to its terminus, which was then at the Des Plaines river, about ten miles from Chicago. The first equipment consisted of the above named locomotive, five flat cars and one box car. A wagon load of wheat was loaded onto one of the cars, and brought to Chicago on the return trip, being the first shipment of the vast produce of the northwest to reach Chicago by rail. The road was extended to Freeport in 1853, where it connected with the Illinois Central, and reached the Mississippi river at Dubuque. In 1853, the Dixon Airline was commenced, which extended from Turner Junction, about 30 miles west of Chicago, to Savannah, on the Mississippi.

The Galena & Chicago Union Railroad had a rather miscellaneous lot of locomotives. The older ones were, I think, built by the Norris Locomotive Works, of Philadelphia. These were small, and, in 1855, were used as switch engines. Some of the road engines were from the Rogers Locomotive Works, and others from the Schenectady Locomotive Works, of which Walter McQueen was superintendent. These engines were among the first in which the cylinder saddle was employed. The Rogers and Norris engines had a D-shaped smokebox, the cylinders being bolted to the frame and the flat sides of the D. The McQueen fastening was peculiar. The cylinders had a flange which was fastened to the frame and saddle, and another reaching to the sides of the round smokebox. Then there was a large diagonal bolt on



AN EARLY WESTERN LOCOMOTIVE.  
[See Mr. Snow's article on "Some Old-time Chicago Locomotives," page 482.]

either side, in front, reaching from the cylinder flange on the smokebox to the bottom of the saddle, near its middle. Mr. McQueen employed the double taper stack, which has only lately come into general use.

Two of the passenger engines were named the "Walter McQueen" and the "John Ebbert," the latter after the master mechanic of the road. Both rejoiced in considerable extra decorative brass work, to do honor to their names. I am able to send you a drawing which gives a fairly good representation of these engines, though it was made from an engine belonging to another road.

Some of these McQueen engines were named after Indian chiefs. I remember the Kee-ho-tah, Shaw-bee-ney, Wabashaw, and Saug-a-nash. The latter was a freight engine, with 17-inch cylinders, and was a monster for that time.

There were also a few engines, built in Chicago by the Scovill Brothers. I cannot locate their shop, for it was closed in 1855; but I believe it was in the neighborhood of Canal and Adams streets. One of the Scovills was foreman in the repair shops of the Chicago & Alton, in Bloomington, in 1860.

The first engine which they built was named the "Enterprise." Others were named the "Como," "Kansas," and "Garden City," the latter belonging to the Chicago, Burlington & Quincy Railroad. The shop of the Galena & Chicago Union was on Kinzie street, at the corner of Halsted street. Mr. Ebbert, the master mechanic, believed in heating the feed water; and the stacks of many of the engines were full of vertical water pipes, surrounding the chimney pipe, he having a patent water heater of this construction.

The Chicago & Milwaukee Railroad was originally owned by two corporations—one in Wisconsin, the other in Illinois. In 1855 the Milwaukee end was not completed, and for a time passengers were transferred to a scow and ferried across the marsh south of Milwaukee, which was afterward crossed by trestle work. The equipment of the northern end of the road was composed of Rogers engines. The first engines owned at the Chicago end were four in number, built by the Cuyahoga Locomotive Works, of Cleveland, Ohio. Locomotive building had been undergoing a process of evolution; the correct thing in the early '40s being a D-shaped firebox, the flat side of the D forming the flue sheet, the whole surmounted by a hemispherical dome. By 1850, the wagon top boiler had come into vogue, with its rectangular firebox. The valve motion had also had its transformations, and the flat hooks had been supplanted by the V hooks, and these, in turn, by the link.

With the hook motion, cut-off valves were a necessity, and these sometimes were made to ride upon the main valves, sometimes placed in a separate steam chest, sometimes fixed to half-stroke, and again were variable—the latter representing the last refinement of the old style of valve motion in its competition with the link. These Cuyahoga engines of the Chicago & Milwaukee Railroad had the V hook motion with variable cut-off, the cut-off valves riding the main valves; and were probably the last of this type to be used on western roads.

After a short time, two passenger engines were added to the Cuyahogas, these being built by Wm. Mason, of Taunton, Mass. These were the most shapely of any locomotives then in use in Chicago. They had no domes, but had perforated dry-pipes, running the whole length of the boilers, the throttles being in the smoke arch. These engines were, I believe, the first to come to Chicago having a splice in the frame in front of the forward pedestals, a feature of locomotive construction which is now almost universal. I believe they had 16 x 22-inch cylinders and 6-foot drivers.

Not very long after these Mason engines were put to work, a trial was made on them of the Loughridge patent brake, which was intended to be controlled by the engineer. The Westinghouse brake was not yet known, but this one was a step in the same direction. A transverse shaft was placed under the deck, having upon it a reel, and a grooved wheel on the right side, the groove being in line with the flange of the driving wheel. It was operated by a lever, which extended through the deck alongside the reverse lever. By pulling the lever, the wheel was pressed against the flange of the driver, and a chain, which was connected to the tender brake, was wound up on the reel. Connections were made from the tender to the car behind it, and so on through the train, and the engineer was supposed to have perfect control of all the brakes. But if the connections were too short, too much strain was brought upon the chain, and it would break. So the affair was unreliable, and was soon abandoned.

In 1855, the branch of the Chicago & Northwestern which runs to Janesville and Fond du Lac was only built as far as Woodstock, and was owned by a corporation known as the Illinois & Wisconsin Railroad Company. It was 6 foot gauge. Some of the engines (there were but few of them) were built by Wm. Swinburne, of Paterson, N. J. Another short section of the road was finished, from Fond du Lac south, only a few miles long, and on this there was but one engine. This

company collapsed in 1855, and was succeeded by another, known as the Chicago, St. Paul & Fond du Lac Railroad. The gauge was then changed to the standard gauge, and the old engines sold to the New York & Erie Railroad. One of them, the "Illinois," became the "186" on the Erie road, and finally exploded her boiler in the yard at Hornellsville, in the year 1862, being used at that time as a switch engine. The accident happened in the night, and fortunately no one was hurt.

The engine from the Fond du Lac end of the road, the "Fountain City," became the "194" on the Erie. This was a very handsome inside cylinder engine, with 6 foot drivers, and ran a passenger train between Buffalo and Hornellsville for a number of years.

The locomotives forming the original equipment of the Chicago, St. Paul & Fond du Lac Railroad were built by the Hinkley Locomotive Works, of Boston, Mass. The most striking peculiarity of these engines was the riveted frame. It was made up of a rectangular bar of iron, with two wide vertical side plates riveted to it, so that its section was an inverted U. The pedestal jaws were of cast iron, and were riveted between the free parts of the side plates. The engines were all eight-wheel, outside connected 15 x 24 inch cylinders, (which, it will be observed, are the dimensions of Mr. Cushing's "Missouri"), the freight engines having 5 foot wheels and the passenger engines 5 foot 6 inches and 6 foot wheels. S. F. Johnson was chief engineer and superintendent, being succeeded by Geo. L. Dunlap, and Jones Patrick was master mechanic. The road was extended to Janesville, and from there north, meeting that portion of the line previously constructed from Fond du Lac south, but connection was not made until 1859.

The shop was a little west of the North branch, about a quarter of a mile north from Kinzie street, the passenger station being at the northwestern corner of the intersection of Kinzie street and the North branch, and adjoining that of the Chicago & Milwaukee Railroad. The Chicago & Milwaukee shop was at the corner of Chicago avenue and the North branch.

The Chicago, St. Paul & Fond du Lac shop, a relic of the Illinois & Wisconsin Railroad, was a large wooden building, rather high, wide enough for four tracks, and long enough to accommodate two engines, with their tenders, on each track. The west track was only long enough for an engine without its tender, and was used for jacking up and repairing, the remainder of the space being occupied by one 16 inch engine

lathe, one drill lathe, one planer, and the vise benches, which formed the shop equipment. Power was furnished from a very small and very old locomotive, known as the "John Bull," said to have been built in England. Larger shops were afterward built nearer the North branch and farther west.

Late in the year 1856, Mr. Charles Minot, who was then superintendent of the New York & Erie Railroad, visited Chicago, and became the guest of Mr. Dunlap. A special train was made up to show Mr. Minot the road, which was only completed as far as Janesville. It left Chicago on the morning of Dec. 2, 1856, proposing to make the run to Janesville and return the same day. The weather was windy and rainy. When the train reached Crystal Lake it was held to meet the regular passenger train south; but after waiting until late in the afternoon, the special train again took the road, as the regular train had not arrived. There was no telegraph line, no train dispatching, nor any means of knowing where the other train was; so the only way was to go on until it was found. By this time the rain had turned into snow. No provision had been made for this, and the result was that when the train was within a mile of Woodstock it was stalled in a snowdrift. This was after dark, and Mr. Dunlap and his party had the pleasure of walking into Woodstock, carrying a shovel and digging down to the track at intervals so as not to lose their way.

The next morning the weather was clear, the engine was dug out by the section men, and as it was fortunately rather warm no damage was done. The engine was taken into Woodstock, turned around, and the return trip commenced. It seemed as though all the snow in the country had left the fields to get on to this one railroad track, and little cuts not more than five or six feet deep were piled with snow up to the top of the cars. These all had to be shoveled out by hand, and progress southward was consequently rather slow. The "Butler," which was to take the Monday morning train north from Chicago, following the special train, was off the track in Dunton cut, and it taxed the resources of all the available help that the company had in Chicago to get her on again. The upshot of it was that Mr. Minot did not see Chicago until late Friday afternoon, and, in the meantime, he had to subsist upon what food the farmers on the line had to offer, which was principally fried pork and potatoes. This trip seemed to satisfy Mr. Minot's curiosity as to western railroading, and it is doubtful if he ever made a second visit to Chicago.

Late in the year 1859 the track was laid through to Fond du Lac,

and extended to Oshkosh, and an excursion was planned to give the business men in those cities an opportunity to visit Chicago. The train reached a point a few miles south of Watertown, when the engine was derailed by some cattle with most disastrous consequences. Refreshments of the nature peculiar to stag parties had been served in the baggage car, and it was, in consequence, well occupied. The car behind it mounted its platform and pushed all the upper works off the floor of the car, making a promiscuous heap of passengers, baggage, baggage-man and a hot stove. Some fifteen or more lost their lives in the wreck, and a number were more or less injured.

In the matter of locomotive building, the writer is unable to say which city, Chicago or Milwaukee, was first in the race, not knowing when the Scoville Locomotive Works went into operation. But so far as Milwaukee is concerned, he is able, through the kindness of an old friend and resident of Milwaukee, to present the following :

In 1849, Wm. B. Walton and L. L. Lee built the "Menomonee Foundry and Machine Works," employing James Waters as superintendent. Mr. Waters had formerly been in the employ of the Portland Locomotive Works, of Portland, Me., and while so employed had made drawings of a locomotive then in process of construction. When, in 1851, his new employers decided to build locomotives, these drafts served a good purpose; for the "Menomonee," the first engine built by them, was a counterpart of this Portland engine. It was an inside cylinder passenger engine, with 6 foot drivers; not exactly the thing for road building. Then came the "Whitewater," with outside cylinders, but, unfortunately, a little too wide for the track. After this came the "Waukesha," "Palmyra," and others, which did good service. These engines were built for the Milwaukee & Mississippi Railroad, now the branch of the Chicago, Milwaukee & St. Paul running from Milwaukee to Prairie du Chien. Nos. 1 and 2 of the La Crosse & Milwaukee Railroad were built at this same shop. The designer of these latter engines, whoever he was, took alarm at the increase of lead given by the shifting link as it approaches the middle notch, and, to overcome it and make the lead as nearly equal as possible in all positions, he placed the rockshaft close to the steam chest, lengthening the eccentric rods as much as possible, and then set the eccentrics so that the lower end of the link was used for the forward motion. So the reverse lever was thrown backward when the engine was to go ahead.

The last three engines built by the Menomonee foundry were the "Hercules," "Columbus" and "Nebraska," built in 1856. These

were built for the Milwaukee & Watertown Railroad, now a part of the Chicago, Milwaukee & St. Paul system.

Wood-burning engines were fitted with brass flues, iron ones not coming into use until coal was the fuel. With the brass flues, turned cast iron ferrules were used to bush the firebox ends, to prevent leakage.

Engine trucks were made with but little distance between the wheels, and often had side bearings. A forked segment was used, passing downward over the center of the spring, a bolt passing through its ends and a transverse hole in the band of the spring. The engine frame rested upon the curved upper surface of the segment. Outside cylinders were, of course, inclined, so as to clear the truck wheels, until it occurred to some one to spread the wheels and make room for the cylinders between them. Steam pressures were usually from 100 to 120 pounds to the inch.

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## THE MASTER BLACKSMITHS' ASSOCIATION.

The National Railway Master Blacksmiths' Association will, as previously noted, hold its eighth annual convention at Detroit, Mich., September 18 to 20. Headquarters will be at the Cadillac house. The topics for consideration are:

Best Method of Making and Repairing Locomotive and Car Springs.

Formers and Tools for Producing Car and Locomotive Forgings.

What is the Best Fuel for Furnace Use?

Best Methods of Making Wrought Iron Axles.

How to Obtain the Best Results in the Manipulation of High Carbon Steel.

The Best Methods of Making and Repairing Locomotive Frames.

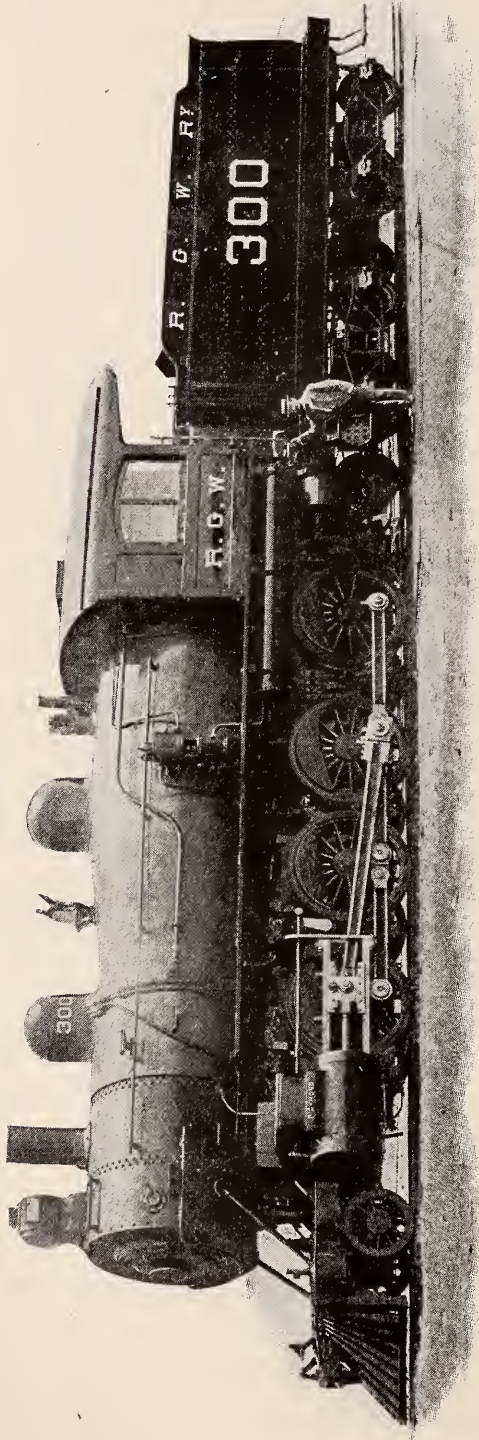
Piece Work—Its Advantages and Its Disadvantages.

Waste of Coal at Blacksmith Forge.

Cost of Producing Forgings From Scrap Compared with that of Merchant Iron.

Mr. H. F. J. Porter, of the Bethlehem Steel Co., will deliver a lecture before the association on the "Evolution of the Modern Shaft."

The secretary of the association, Mr. A. L. Woodworth, Lima, Ohio, informs us that an unusually successful convention is being looked forward to.



CONSOLIDATION LOCOMOTIVE—RIO GRANDE WESTERN RAILWAY.

Total weight—185,000 pounds; weight on drivers—168,400 pounds; cylinders—22x28 inches; drivers—56 inches; heating surface—2,873 square feet, of which 206 square feet is firebox, 2,667 square feet tube surface; grate area—34.7 square feet; fuel—bituminous coal; working steam pressure—185 pounds; boiler—74 inches; tank capacity—water 5,000 gallons; coal, 10 tons.

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## BRAKE SHOE TESTS.

At the last convention of the Master Car Builders' Association, the standing committee on tests of brake shoes was instructed to test such brake shoes which have made sufficient departure from those previously tested to affect their efficiency or durability, as should be presented to it by the railway companies who are members of the association, the committee to indicate such times during the year as it intends to make these tests.

The committee will make tests of brake shoes during the month of March, 1901, and if it is the desire of any of the railways represented in the association to have brake shoes tested, they should communicate with the chairman of the committee as early as possible, so that arrangements can be made for the tests. Address S. P. Bush, supt., M. P., C., M. & St. P. Railway, West Milwaukee, Wis. The full committee on brake shoe tests is as follows: S. P. Bush, chairman; Geo. Gibbs, R. P. C. Sanderson.

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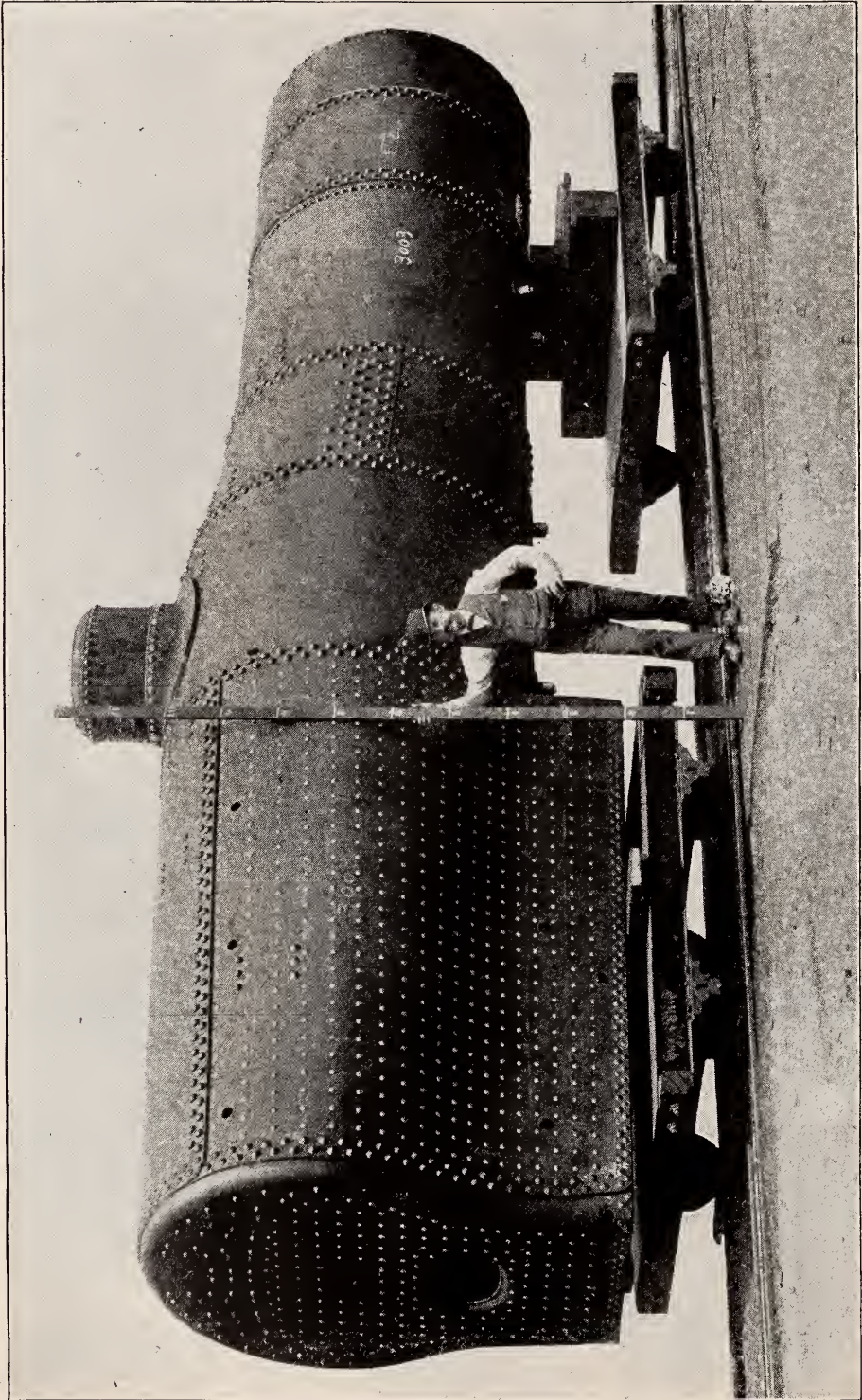
## CONSOLIDATION LOCOMOTIVE—RIO GRANDE WESTERN RAILWAY.

The Richmond Locomotive Works have recently turned out for the Rio Grande Western Railway eight heavy consolidation locomotives, a view of one of which we give on the opposite page. We also present on the next page an impressive view of one of the boilers.

These engines weigh 185,000 pounds, of which 168,400 pounds are on the drivers. They have 22 x 28 inch cylinders; 56 inch drivers (four of them, the other four having 50 inch drivers); radial stayed, extended wagon top boilers, 74 inches in diameter and designed to carry 185 pounds working pressure; heating surface of 2,873 square feet, of which 206 square feet is firebox and 2,667 square feet tube surface; and a grate area of 34.7 square feet. Bituminous coal is the fuel to be used.

The special equipment on these engines includes Jerome metallic piston rod and valve stem packing; Richardson balanced slide valves; cast steel driver centers and boxes; McKee Fuller cast iron truck wheel centers, and Ohio injectors.

The tank has a capacity of 5,000 gallons of water and 10 tons of coal.



BOILER FOR RIO GRANDE WESTERN LOCOMOTIVE.

# COMMUNICATION.

## A STUDY IN INDICATOR CARDS.

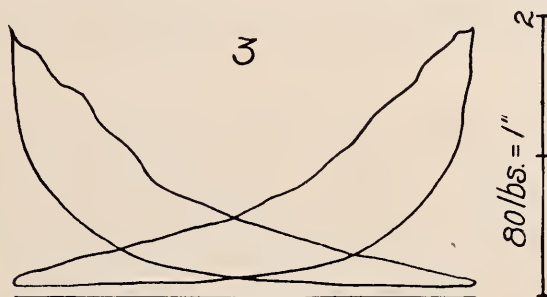
CHICAGO, August 20, 1900.

*To the Editor of the Railway Master Mechanic:*

In your June issue, on page 292, is an interesting article under the caption, "Rehabilitation of the Piston Valve."

In the article mentioned is this sentence: "The distribution" (of steam) "is good; at least fair."

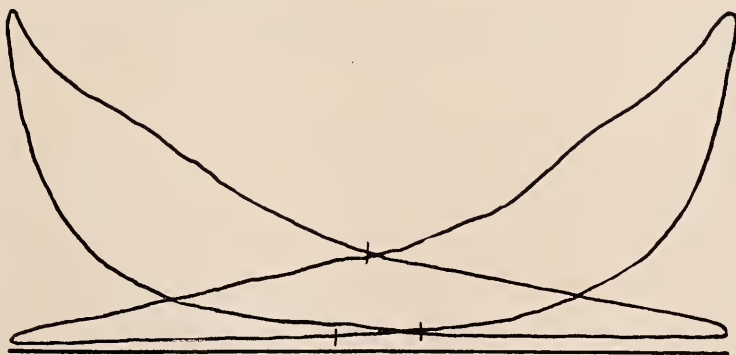
I wish you would kindly reproduce card No. 3, from page 293, which was taken at 5 1/2 inch cut-off from the 17 by 24 simple engine. A close examination of this card discloses the fact that the exhaust valve opens



CARD No. 3.

[Reproduced from June issue of Railway Master Mechanic.]

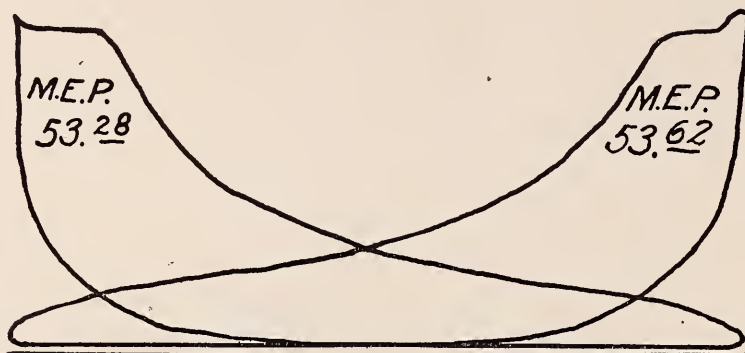
at 12 inches or one-half the stroke, and that compression begins at practically 43 1/3 per cent from the commencement of the stroke, or at 10 1/2 inches. This may be considered in locomotive practice a fair distribution of steam and may, perhaps, be considered good, predicated upon the average result obtained, but to the person who has had experience in stationary practice such results would not be considered fair, and still further from a good distribution of steam.



CARD A.

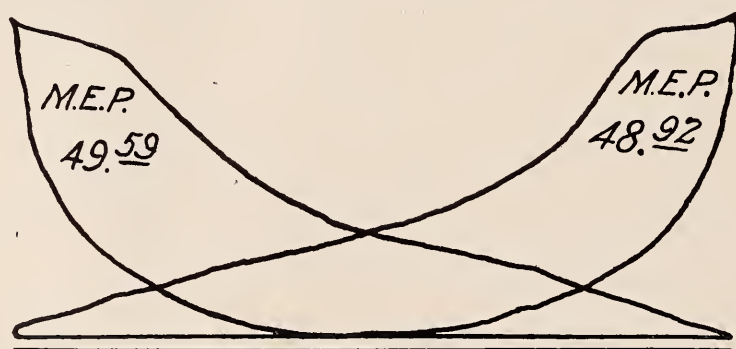
Attached tracing marked "A" is from a 19 by 26 locomotive at, so far as I can determine from information in my possession, about 7 inches

cut-off. An examination of this card will reveal the fact that the exhaust opens at about one-half stroke and compression closes, as in the case of the Santa Fe engine just above cited, at a little before one-half stroke.



CARD B.

I also enclose with this a card, B, taken from a locomotive which was equipped with the Allfree valve gear at 19.02 per cent cut-off, and I think the student of steam distribution will be repaid by a careful study of the facts disclosed, by comparing the three cards mentioned in this communication. The beneficent results from the use of the Allfree valve gear will, perhaps, be made more apparent if you will also reproduce in this article card C, which was taken from the same locomotive as the card B,



CARD C.

card C being taken at 20.35 per cent cut-off, link motion only. The initial pressure in cards B and C will be found to be identically the same, and yet with 1.33 per cent less volume of steam, under the effect of the Allfree valve gear, there is an actual gain in the mean effective pressure from the revolution, of 8.53 per cent on the less volume of steam as noted, and which is due simply to the fact that the correct distribution of steam to the cylinder is had through the Allfree valve gear.

IRA C. HUBBELL.

## HIGH STEAM PRESSURES AND BALANCED VALVES.

The following letter from Mr. John Player, superintendent of machinery of the Atchison, Topeka & Santa Fe Railway, appearing in a recent issue of the *Railroad Gazette*, supports the statements made by Mr. R. F. Hoffman in our pages, during the early months of the year, concerning the practicability of piston valves without packing rings:

“The articles you have recently published on the subject of piston valves, as applied to French and American locomotives, have been of peculiar interest to me. We have made extended tests with piston valves, both with and without packing rings, on this railway, and have reached the conclusion that piston valves are what we can best use. They are being used on the last ten consolidation engines built for this railway, and will be used on twenty passenger engines, which you mentioned some weeks ago as to be built soon.

“You published in the *Railroad Gazette* of June 16, 1899, Mr. R. F. Hoffman's report to me on the test of a four cylinder compound engine. Later, Mr. Hoffman wrote his observations for publication in the RAILWAY MASTER MECHANIC. I have found no reason to modify anything said in either instance. We have made painstaking experiments, especially with the piston valve without packing rings. My determination to try this form of valve on locomotives seemed to be justified by the wide and satisfactory use made of it in marine work. We came out of a trial of more than a year of continuous use of the valve without packing rings, convinced that there is in its operation cause for much astonishment to those who have not taken the trouble to test its fitness for this work.

“Valves without packing were used on the four cylinder tandem compound locomotive throughout its trial against the simple locomotive in the test earlier mentioned. The work was done in a mountainous country and under conditions which are admitted to be the most trying for a compound locomotive. Notwithstanding, the compound engine thus equipped made a saving of 18 per cent in fuel against the simple engine, which had carefully maintained D valves. Had there been any great loss of steam because of the plain piston valves it is difficult to see how this saving of fuel could have been made on the New Mexico division of this railway. There was no coddling of the compound locomotive. On the contrary, I issued instructions which were calculated to give the compound locomotive somewhat the worst of the operations. The

piston valves had been used constantly for more than four months when the performance which you have published was recorded.

“In view of these facts and of the wide publication they have received, I was somewhat surprised to read in your abstracts of convention proceedings that a plain piston valve must necessarily ‘either blow or jam.’ Our experience has been that by careful fitting it will do neither of these things, to the extent of causing any material loss or concern, and will work for a surprising length of time practically unworn.

“In our latest engines we are using packing rings on the piston valves. The introduction of valves without packing is, naturally, a change so radical as to be received incredulously at this time, when the pace of industry is so swift that there is scarcely time for necessary experiment of any kind. However, I shall not be astonished if the plug piston valve later comes into quite common use on locomotives. There is so much gained in simplicity and effectiveness, reduction of first cost and renewal by its use, that a much greater steam loss than I have ever known to be chargeable to it at its worst could quite well be sustained and leave a paying balance to its credit, as compared with the average slide valve, operating under the conditions which we have to meet. Then, too, one broken ring on a piston valve may cost more than a great many slight steam leaks. Rings do break.

“Giving due value to these several features, it seems to me that the piston valve, or more broadly, the balanced valve of whatever description, is a matter of too great importance to be passed over lightly. The effort to obtain better balanced valves is worthy of the most serious attention of us all. With the high and increasing steam pressures of today, the man who advances a thought to better control valve motion, however simple, however complex, should receive a most patient and earnest hearing.”

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## LONGER LOCOMOTIVE TUBES IN PROSPECT.

At the Saratoga convention of the Master Mechanics' Association there was an interesting discussion on the question as to whether the limit of length of 2 inch tubes had been reached in locomotive practice; we append extracts from this discussion:

Mr. S. M. Vauclain: It is my opinion that we have not yet reached the limit of the use of tubes 2 inches in diameter. In the defense of

this position, I wish to give you an idea of how 2 inch tubes have grown in the recent past. On consolidation locomotives it is necessary, in order to design a perfectly satisfactory locomotive, to use long tubes, and for the Baltimore & Ohio road 2 inch flues 14 feet 10½ inches have been used, and for the Lehigh Valley 2 inch tubes 15 feet 1 inch have been used. In 10 wheel engines this growth has been more decided. In the years back 2 inch tubes were 13 feet long. Then they went to 14 feet. Wabash Railroad, 14 feet 3 inches; Atlantic Coast Line, 14 feet 5 inches; Chicago & Great Western, 2 inch tubes, 15 feet; Fitchburg, 15 feet 1 inch; Chesapeake & Ohio, 15 feet; Chicago, Milwaukee & St. Paul, 15 feet; Chicago, Rock Island & Pacific, 2 inch tubes, 15 feet; but this type of engine, the 10 wheeler, does not admit of the longest tubes that can be used. For instance, for the Atlantic type of engine we have used tubes for the Lehigh Valley road 15 feet 1 inch, and on the engines for the Black Diamond Express, 15 feet 6 inches; St. Paul & Duluth, 15 feet; Central Railroad of New Jersey, 15 feet; Chicago, Milwaukee & St. Paul, 15 feet; Erie Railroad, 15 feet, and last, but not least, the Chicago, Burlington & Quincy, 2 inch tubes 16 feet in length. Sixteen foot tubes 2 inches in diameter are reasonable things to use, and why is it? Because our friends on the opposite side of the water have long used 2 inch tubes 15 feet and 16 feet. On the Griazi-Tsaritzin Railway you find 2 inch tubes 17 feet 5 inches in length and on the Balaklava Railway on small locomotives, tubes 15 feet 5 inches; and in some of the Russian locomotives they have 2 inch tubes 18 feet 1 inch in length. I have no hesitation whatever in making the prophecy that we will find 2 inch tubes in locomotive boilers in the near future 20 feet long. I do not wish to appear unreasonable, but there is a certain use that the additional length of these tubes can be put to, if a locomotive is properly designed, that will be of decided benefit and advantage to the locomotive. It is not my purpose to show you how to do it, because I think you will all be able soon to show us how to do it. The locomotive builder is usually driven to things of this kind; that is, he likes to be driven to it. He does not like to assume the position of being responsible for a 16 or 17 foot tube unless he has used them before, and knows they are all right. A progressive railway man will come in and say, "I see no objection to using tubes 16 feet or 17 feet long;" and when you come to reason the thing out, if you have a tube 15 feet long, and your engine does first class work, where will you do it any harm by adding 6 inches to the length of the

tube? Of course, there is a jumping-off place somewhere. They cannot be made 40 feet, but within the limit of the design of the locomotive, I think a 2 inch tube can be used up to 20 feet in length. In regard to the rigidity of the tube and the absence of vibration when it is in the boiler, I think we need not give that any consideration at this time. Tubes are fitted in locomotive boilers 15 feet long and 15 feet 6 inches long. In certain locomotives built recently the tubes are 16 feet  $7\frac{3}{4}$  inches long. We ship these locomotives without any water in them. If that does not afford a splendid opportunity for the tubes to vibrate, I want to know it. But when the locomotives are put in service with the tubes surrounded by water the danger of excessive vibration is reduced. Why do I think an iron tube 2 inches in diameter and 20 feet in length will give no trouble from vibration? Simply because we have used brass tubes, and I might add that the tubes in the foreign locomotives mentioned are composition tubes. They are not iron or steel tubes. Some of them are iron tubes with copper ends brazed on. The entire thing depends on the brazing of the 6 inch piece on the end of the tube. I doubt if any users of locomotives in this country would care to risk a brazed end on their tubes. There is no risk to run. It would be a novelty with us, but with locomotive builders abroad it is the practice of long standing and has been found reliable. If a brass tube 2 inches in diameter, 15 feet long or even 16 feet long will give no trouble, I can see no objection, so far as vibration is concerned and the damage to the tube and the leaking of the tubes, to the use of an iron tube 20 feet in length.

Mr. S. Higgins: In 1896 the Baldwin Locomotive Works constructed five engines of the Atlantic type with tubes 15 feet 1 inch in length, for our road. We were forced into this on account of the design of the running gear and we were doubtful whether they would run or not. They have been in service since that time on a division where we run the engines 400 miles every 24 hours. We have had better results with these long tubes 15 feet 1 inch, than with flues 14 feet and 14 feet 6 inches.

Mr. F. A. Delano: The C., B. & Q. has been making some experiments for some time, to determine how much they could diminish the diameter of the tubes or lengthen them. A number of years ago it was found that 2 inch tubes 12 feet 6 inches in mogul locomotives did much better than tubes  $2\frac{1}{4}$  inches. There was less trouble from leakage and stopping up. Within the last year we tried a locomotive of the same

class with tubes  $1\frac{3}{4}$  inches in diameter, 12 feet 6 inches long. The experiment resulted so satisfactorily, and the engine appeared, from all accounts, to be so noticeably better than other engines of the same class, that in getting up designs for the new engines we carried out the same ratio or very nearly the same ratio of diameter of tubes to length of tubes which we did in the  $1\frac{3}{4}$  diameter tubes. In some engines with 16 foot flues we are going to use 2 inch tubes. We have not had any of the 16 foot 2 inch diameter tubes in service long enough to know how they are going to turn out; but we have had 16 foot tubes  $2\frac{1}{4}$  inches in diameter, and have not had any trouble from their pulling through the sheets. I cannot see that decreasing the diameter would increase that trouble. Our experiment with  $1\frac{3}{4}$  inch tubes seems to show we have no more trouble from their stopping up. It would seem to me, in this connection, that one of two things ought to be done—either that the tube must be large enough in diameter so that the flame will not be cooled down below the point of ignition in passing through the tube, or else it should be made small down to the limit of smallness so that the heat of the gases would be extracted in passing through. With smaller tubes I think we can safely use a thinner gauge of metal in the tube, and therefore get our gases nearer to the water.

Mr. Vaucrain: We always increase the number of tubes in proportion to their diameter in order to get an equivalent heating surface. The smaller the diameter of the tube the greater the heating surface we can get in a given boiler. The length of the tube is determined merely by the liability of the tube to stop up, or any danger there might be from leaking. We found no danger from leaking in long tubes or any serious detriment to the life of the tubes. Some tubes 15 feet long in Atlantic type of engines delivered in 1894 and 1895, were removed last month and their condition showed that vibration did not affect them, nor did the length of the tube give us any serious trouble. We have used  $1\frac{1}{2}$  inch tubes on locomotives 10 feet 4 inches long. We have no hesitation in using  $1\frac{3}{4}$  inch tubes up to 12 feet; and we have used  $1\frac{1}{4}$  inch tubes up to 13 feet 6 inches.

Mr. R. Quayle: We have many locomotives on our line that have tubes 15 feet 2 inches in length and they have never given us any trouble in particular, except when they were first shipped by the locomotive works to us without water in the boiler, and we found they gave us trouble from leaking. We asked the builders to ship the next lot with the flues covered with water, and that stopped the trouble. These

engines have been in service for some years and give us no more trouble from stopping up or leakage than any other engine; and that was the reason we arrived at the conclusion to build these locomotives we are getting now with 16 foot tubes. I think we have not reached the limit of the length of the tube.

Mr. Delano: I want to say that in the engine with  $1\frac{3}{4}$  inch flues we found the increased heating surface of 10 per cent enabled us to increase the size of the nozzle tip about a quarter of an inch, so we estimate we could gain largely from that source, the gases passing through the tubes at a slower rate of speed.

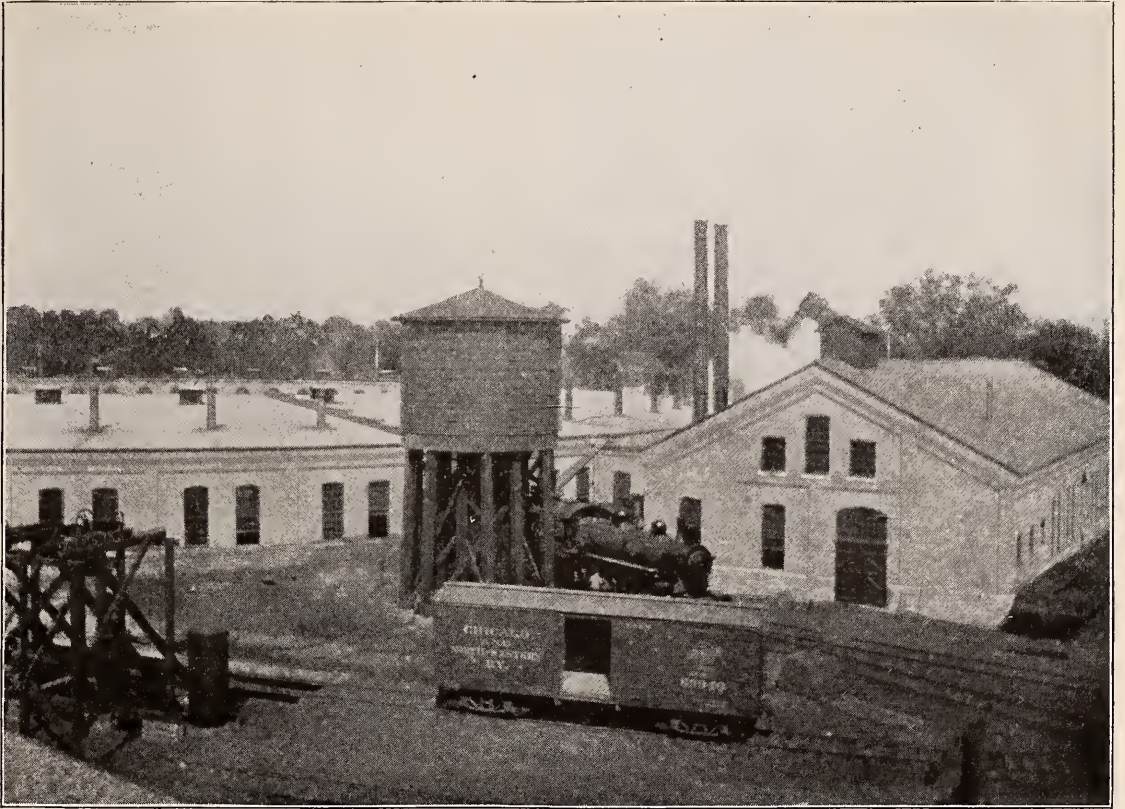
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## A REMARKABLE ROUNDHOUSE—CHICAGO & NORTHWESTERN RAILWAY.

The Chicago & Northwestern Railway some time ago completed its new roundhouse at Clinton, Iowa. It is a structure that reflects the highest credit upon all those concerned with its design and erection. We have not now available the drawings of this notable plant, but through the courtesy of Mr. R. Quayle, superintendent of motive power and machinery, we are enabled to present some facts concerning it, together with quite a number of perspective views, made from photographs, of various especially interesting details.

Hitherto the engines of the Iowa and Galena divisions were housed in an old 25-stall roundhouse, built 35 years ago. Inasmuch as at Clinton, which is an important division point on the Northwestern, there are often forty or fifty engines at one time, it was certain that many of them had to weather the situation as best they could. This lack of stall room and the increasing lengths of locomotives, necessitating vestibuling the house to close in on some of the new big ones, led to a plan to replace the roundhouse with a new and up-to-date house.

Work was commenced on the new roundhouse August 14, 1899, and it was finished and occupied May 14, 1900. The new house is a complete circle, and has 48 stalls—or, including entrance and exit, 50. The radius of the outside wall is 187 feet 6 inches; the radius of the inside wall, 106 feet, and the clearance between the walls inside the house, 81 feet 6 inches. The turntable, electrically operated, is 70 feet long, and is set on a solid rock foundation. The length of the largest engine and



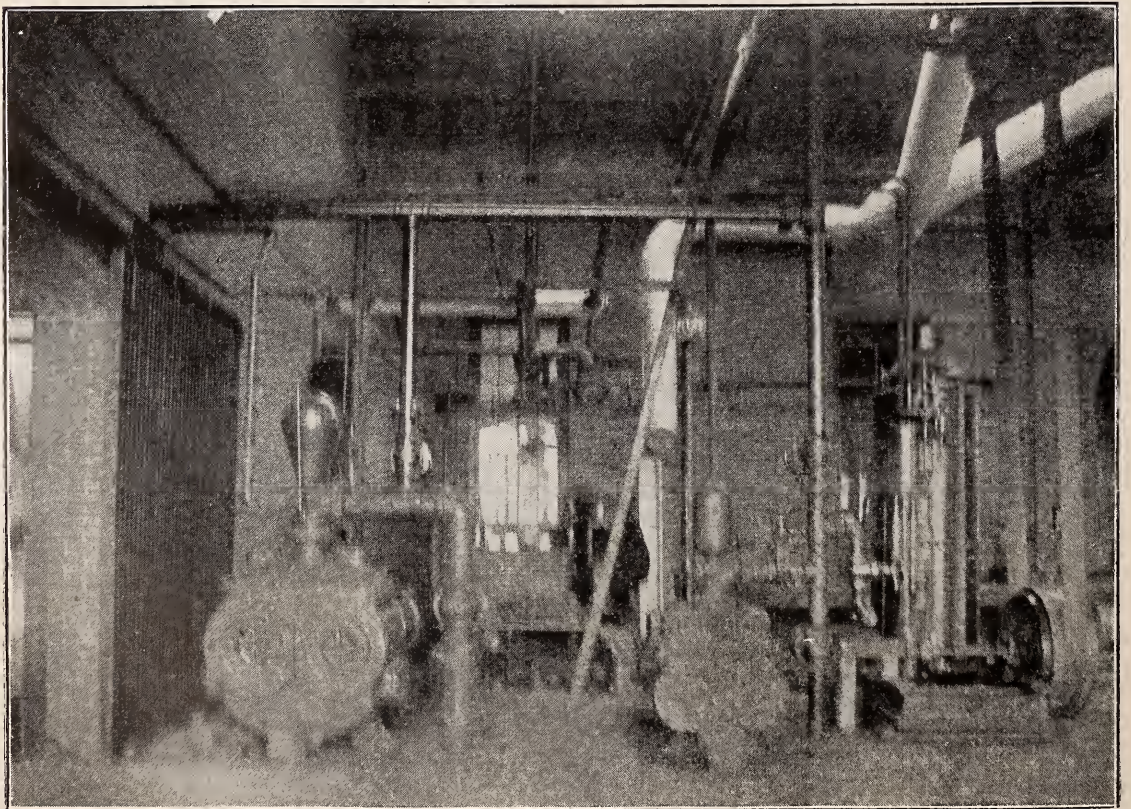
GO OUT TRACK ON EAST SIDE.



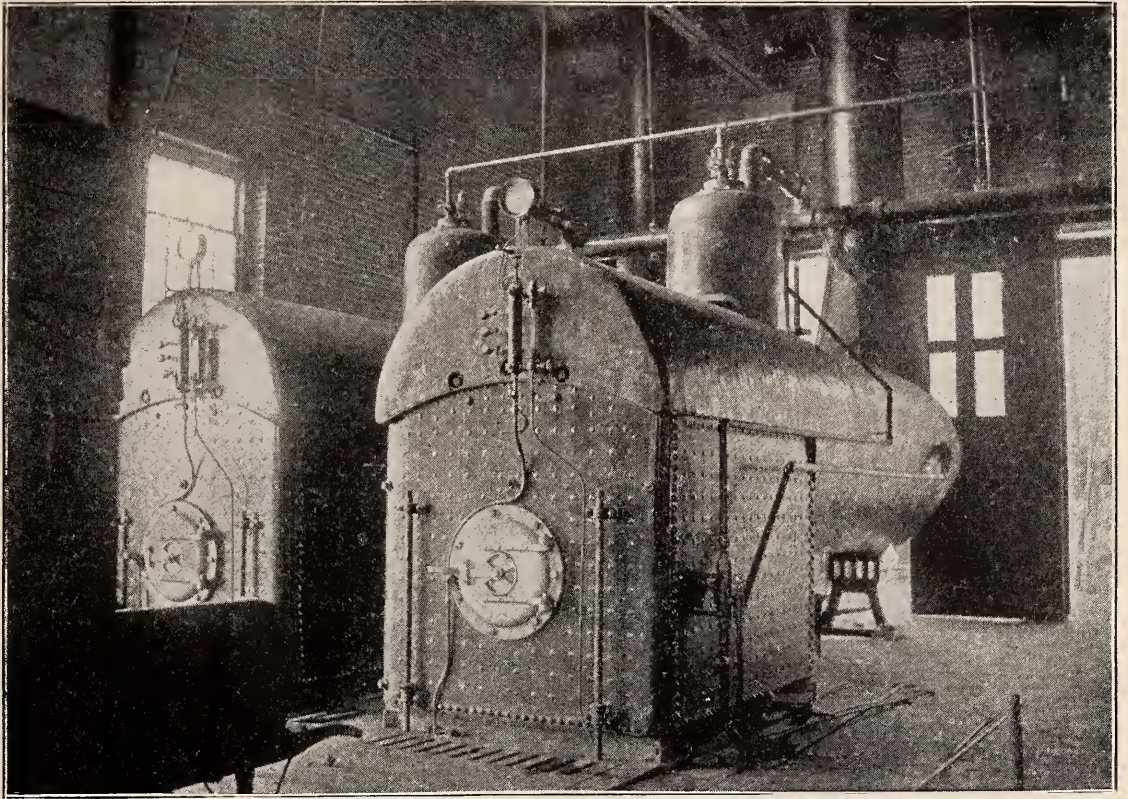
MACHINE SHOP, STOREHOUSE AND BOILER ROOM.



PART OF MACHINE SHOP.



WATER PUMP AND TEMPORARY STATIONARY ENGINE.



TWO STATIONARY BOILERS—100 H. P. EACH.



TOOL ROOM IN STOREHOUSE.



THE OIL ROOM.

tender is 62 feet 6½ inches. It is to be noted that there is ample clearance in the house in front of engine and back of tender.

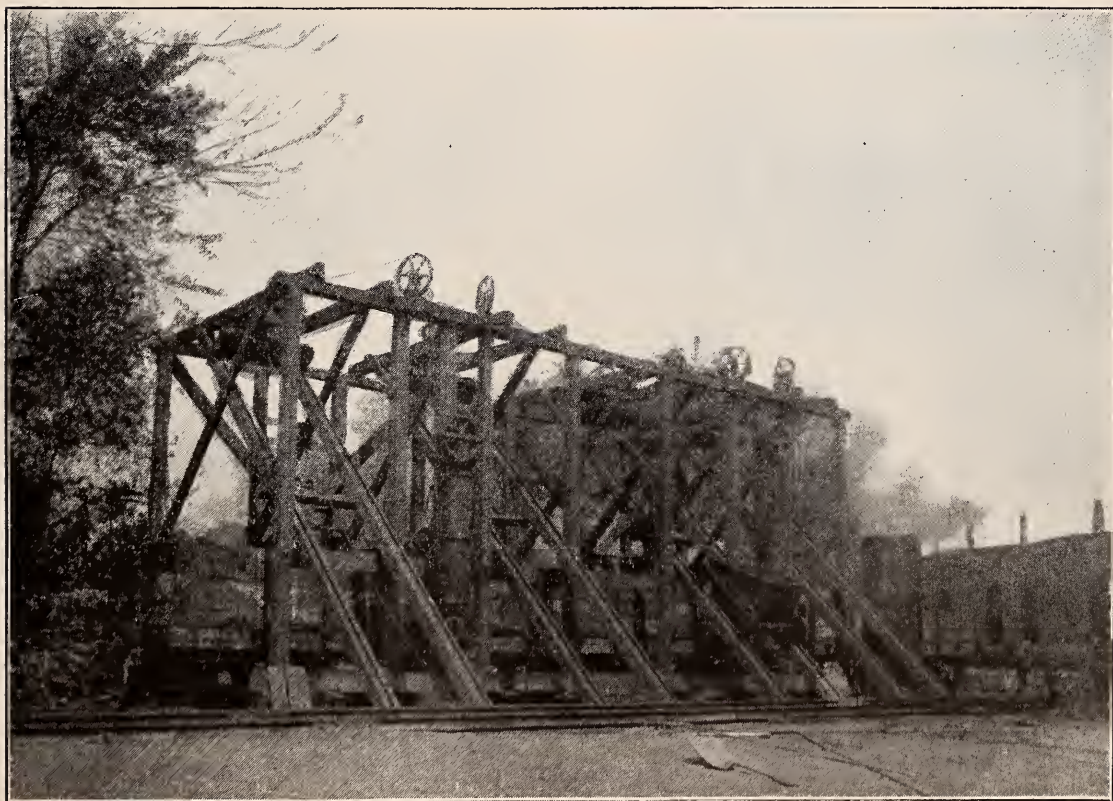
The drop pits for engine and driving truck wheels are cut out of the solid rock. A novel drop pit jack is used with great success, and we hope to describe this in a later issue. The question of material for the roundhouse floor was given careful consideration, and it was decided to use hard bricks laid on edge. The roundhouse, machine shop and store room are all heated throughout with the Sturtevant hot air system. The dimensions of the machine shop and store room are 60 feet by 140 feet. The oil room is a fireproof building, 33 feet by 35 feet, and is counted a model of its kind; this was built from the special design of Mr. Quayle. The oil tanks are 12 in number, and are placed under ground. The oil is raised to suitable faucets by air pressure, the old-fashioned pumping methods being discarded. We give a view of one corner of the oil room.

The water supply is obtained from an artesian well 1,175 feet deep. We give a view of the water pumps and the temporary stationary engine used. A 14 inch by 12 inch by 14 inch duplex pump draws the water

from the well, forcing it to the water tank. A smaller duplex pump—12 inches by 8 inches by 12 inches—is used for boiler washing, and a nozzle pressure of 100 pounds per square inch is obtained.

The machine shop, a view of a portion of the interior of which we give, is well fitted out with tools, all admirably suited to the requirements of the case. These tools are: One 28 inch screw cutting lathe, one 15 inch screw cutting lathe, one 30 inch by 30 inch by 9 foot planer, one 21 inch crank shaper, one 30 inch swing drill press, and one bolt cutter cutting from  $\frac{3}{8}$  inches to  $1\frac{1}{2}$  inches.

The ash hoist is a leading feature of this plant, and our perspective view affords an excellent idea of its general appearance. This was designed by Mr. G. R. Henderson, assistant superintendent of motive power and machinery of the Northwestern. It was early decided to abandon all old time expedients in the way of handling cinders, and Mr. Henderson addressed himself to the task of devising something that would be really adequate to the expeditious and economical handling of ashes and cinders for a large number of engines. The result is a plant that while very simple in construction yet does the work very cheaply and quickly, and with the attention of but one man. As will be seen by our engrav-



PNEUMATIC ASH HOIST AND CLINKER PIT.



THE BLACKSMITH SHOP.

ing, it consists essentially of a framework standing over a loading track which lies something over twenty feet away from the cinder pit. This framework carries pneumatically operated ash hoppers which run up and down on inclined ways. At the lower portion of their travel these hoppers lie at the bottom of the pit. The contents of the locomotive ash pan and front end are dropped directly into the hoppers. At pleasure the attendant turns a 3-way cock, and the bucket is hoisted rapidly through the agency of the pneumatic cylinder and wire rope shown. When the bucket reaches the top it automatically dumps itself into the cinder car. Upon its return trip its drop door is automatically closed. Certain clever arrangements of the air valves insure that the hoppers reach the end of their journeys, both up and down, in a very gentle manner, through a species of air cushioning. There are two operating cylinders and four hoppers, thus serving the entire length of the sixty foot pit.

We present views of other features—the tool room, the boilers, and the neat little blacksmith shop. Our exterior views, one showing the machine shop in full length and the other the end of the shop, the tank

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and most of the full circle of the roundhouse, afford a fair idea of the general appearance of this model plant.

We should note that a great measure of credit for the work on this plant belongs to Mr. W. D. Walden, superintendent of bridges and buildings of the Northwestern. From the time of breaking ground until the engines and men moved in, just nine months intervened, and Mr. Walden, who is seventy-five years old, had direct charge of this work during this time, pushing it to completion with the ardor and energy of a man of far fewer years.

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## TON-MILEAGE FOR MOTIVE POWER STATISTICS.

[C. H. Quereau, in the *Railroad Gazette*.]

There are so many points in connection with this subject on which opinions differ radically, that it seems wise to confine the present study chiefly to the following: "Should the tonnage of the engine be included in the ton-mileage?"

### *Cost.*

I am strongly inclined to believe that an important reason for advocating an operating department basis for judging the efficiency of the motive power department, both by the management and motive power officers, is the belief that two sets of ton-mileage figures, one for determining the efficiency of the operating department and the other adapted to the needs of the motive power department, would double the cost. A knowledge of the facts will dispel this belief.

In all probability the ton-mileage compiled for the operating department will show that for the train back of the engine. This being true, the expense for adding the ton-mileage of the whole train will be so small that it cannot be figured with certainty. This is true because the ton-mileage of any engine for each district is always the same, and the additional expense will be covered by that necessary to set the figures down and add them to the previously determined ton-mileage back of the tender. For instance, if a 100-ton engine handles a train over a 120-mile district, the constant ton-mileage for every engine of the same class over this district will always be 12,000 ton-miles, whatever the tonnage of the balance of the train. On one road the constants for the

engines are added in the car accountant's office, taken from a table showing them for all classes in all districts. The ton-mileage handled in this office for the year ending June 30, 1900, was 4,689,533,115. The car accountant writes: "We find it somewhat difficult to say just how much extra it costs us to compute ton-mileage of way cars and engines, but believe \$6.00 per month will about cover it."

On another line these constants for the engines are added, in the office of the superintendent of motive power, to the figures giving the ton-mileage for the balance of the train, furnished by the car accountant. The superintendent of motive power writes: "This is about one day's work a month for our statement clerk." Concerning the same matter, another superintendent of motive power says: "I am not in a position to give you the cost, but it must be nominal, inasmuch as no special labor is involved."

In view of these facts, it seems fair to conclude that the cost of ton-mileage figures for the motive power department, including that of the engines, should add not more than \$75.00 or \$100 per year to the cost of obtaining them for the operating department; which should not be prohibitive.

#### *The Operating Department View.*

As far as I can learn from the reported discussion, there appear to have been but two special reasons offered for not including the weight of the engine in the ton-mileage. First, the motive power official should study the efficiency of his department from the standpoint of an operating officer, because he, with the management, is interested in "knowing what an engine does behind the tender." Second, the locomotive should not receive credit for the work expended in hauling itself, because, if so credited, superiority of design will not be shown.

I cannot agree with the proposition that the motive power officers should judge of the efficiency of their work from the operating department point of view. It occurs to me that the problem of designing the most economical engines, and keeping them at their maximum efficiency for the least money, is quite different from that of securing the greatest work from them while in service on the road. As I understand it, the statistics of the motive power department are intended as a basis by which to determine whether the best types of engines are in use, and if the money appropriated for their maintenance and supplies is judiciously spent, while the operating statistics are used for determining whether the engines "are hauling what they are supposed to haul." The ton-

mile basis for both departments harmonizes these interests, which is one of the controlling reasons for its adoption in place of the engine-mile basis, which makes them antagonistic, but it does not necessarily follow that the ton-mileage for both should be the same.

I believe it is a fair proposition that the ton-mileage for motive power statistics should show all the work done by the money expended, as the money spent per unit of work is the basis by which this department is judged. On the other hand, the operating department is judged by the amount of work done per train or per car, and usually not on the basis of cost per unit of work done. These facts seem to me to warrant the conclusion that the ton-mileage used by each department should be different.

I believe that an analysis of the conditions under which the motive power department works, closer than was made either in the committee's report or the discussion of it, will prove interesting.

On prairie roads the use of double-headers and pusher or helper engines is comparatively small, and the weight of the engine on a freight train is but 10 per cent, or less, of the total weight. Under such circumstances it may make little difference whether the weight of the engine is included in the ton-mileage or not, though I am of the opinion that it is a just credit, and should be included if motive power expenses are to be accurately judged. There are a number of lines and divisions where the grades are heavy; the use of pusher engines and three engines to each freight train, and two engines for all passenger trains having more than five cars, is necessary to economical operation and is the normal practice, and under these conditions the weight of the motive power is 30 per cent of the total weight of the freight trains when the engines are loaded to their full capacity and the speed is eight miles an hour up the grades. It will be evident that when the speed of the trains is higher the weight of the load must necessarily be lighter and the weight of the engine a larger per cent of the total.

I am personally acquainted with a number of districts, of considerable length, where the light engine-mileage is fully 30 per cent of the total, because of the large number of engines in pusher and helper service; and it is in these districts where the weight of the motive power averages more than 30 per cent of the total weight of the trains. It follows that under these conditions at least 30 per cent of the work done by the engines is absorbed in moving themselves. It seems to me hardly a fair proposition that under these conditions it is just to compare the effi-

ciency of the motive power management with that of the districts where pusher and helper engines are comparatively rare, and one engine to a train the rule, on the basis of the work done behind the tender, even though the management wants this information for the purpose of determining the cost of operating such districts. That there is a considerable number of roads operating under these disadvantages will require but a few moments' consideration to prove.

Should the recommended practice that only the ton-mileage of the train behind the tender be considered be approved, I am thoroughly persuaded that there is a considerable number of roads operating mountain divisions that cannot see the justice of the recommendation and will decline to follow it. If this is a just conclusion, will it not be wiser to propose as recommended practice to include the weight of the entire train for motive power statistics, and by so doing have an equitable rule for lines with light and those with heavy grades? I am encouraged to make this suggestion because one of the staunchest advocates of the "behind the tender" plan, whose opinions I greatly respect, and who is responsible for the motive power expenditures on a road noted for its light grades, when speaking of the influence of including the tonnage of the engine on a comparison of the fuel records, said: "I think, in analyzing the figures and seeing how much it amounts to, to put the weight of the engine in these ton-mile figures does not amount to 1 per cent difference."

In the same discussion my friend says, "unless it be on some mountain divisions where the weight of the engine is a large percentage of the total train," admitting that under such circumstances the ton-mileage of the engine is a just credit to the motive power department. Accepting this conclusion as correct for mountain roads, remembering that the addition of the engine ton-mileage for prairie roads will not change the comparative results more than 1 per cent, and that the cost for including the engine and way car ton-mileage on a line computing more than four and a half billion ton-miles does not exceed \$75.00 per year, I feel I am justified in concluding that the ton-mileage of the entire train is a fair basis by which to judge motive power efficiency, that the additional cost for this basis as compared with that which does not include the engine ton-mileage is not prohibitive, and that the adoption of the recommendation will be more general than if the engine ton-mileage is not included.

*Influence on Design.*

As to the claim that the engine ton-mileage should not be included because if this is done, superiority of engine design will fall short of its due reward—the argument was made by a very able designer as follows: “I believe if we can produce an engine with the same tractive power of lighter weight, the engine is entitled to the benefit of the extra ton-miles it will haul, whereas if we include the weight of the tender there would be no extra credit to that design.” A discussion of the argument will show that there is not as much in it as appears on the surface.

The term engine is used so as to include the locomotive proper and the tender. In so far as the locomotive proper is concerned, I believe I am justified in saying that the weight on the drivers determines its maximum tractive power; that the steam pressure and cylinders are so proportioned that their power is a certain per cent of the weight on the drivers; that this per cent, or tractive coefficient, is seldom below 22 or above 26; that the influence of this narrow margin of variation can hardly be found in the statistics, whether the weight of the engine proper is included in the ton-mileage or not.

Again, the conditions on mountain grades, as compared with prairie lines, should not be lost sight of. On prairie roads the cylinder power may be a larger per cent of the weight on the drivers than on heavy grades, because under the first named conditions the maximum tractive power is seldom needed after the train is once under way. But on mountain roads the maximum tractive power of freight engines is used most of the time while going up grade, so that under these circumstances there is virtually no opportunity for superiority of design to produce a lighter engine capable of handling more tonnage, since the tonnage is determined by the weight on the drivers, assuming that the boiler capacity is sufficient. It occurs to me that the following statement is a fair one:

In so far as the engine proper is concerned, there is little opportunity for superiority of design to affect the cost of fuel or repairs, when judged on the ton-mile basis, whether the tonnage of the engine is included or not, though there are a great many opportunities to lighten the weight of the frames and running gear so as to allow larger heating surface and boiler capacity, with the same weight on the drivers.

As to the tender, I believe that it will be granted that its capacity for coal and water is governed by the facilities for furnishing these;

that the present tendency is to increase its capacity so as to lengthen the time and distance between stops for coal and water; that therefore the capacity of the tender is almost entirely beyond the control of the designer. This being true, he can show his ability only in furnishing the lightest dead weight for a given capacity. Assume the weight of a tender, having a capacity of 10 tons of coal and 6,000 gallons of water, ready for service, to be 110,000 pounds. The coal and water will weigh 69,800 pounds, leaving 40,200 pounds as the light weight of the tender. A tender with these general proportions will answer for an engine having 20 x 26 inch cylinders, 63 inch driving wheels and carrying 200 pounds steam pressure. Such an engine should easily handle 1,500 tons of dead freight on a prairie road. If it does, the light weight of the tender, namely, 20.1 tons, amounts to but 1.3 per cent of the tonnage back of it; so that, assuming a designer with sufficient ability to accomplish the impossible task of designing a tender with a light weight of zero, he could favorably affect the fuel record but 1.3 per cent, an amount which a two-mile breeze would offset, and which we can hardly expect to find in our statistics. In view of these facts, it appears to me that we cannot afford to argue in favor of omitting the ton-mileage of our engines, in order that superior designing may not be lost sight of, when the greatest saving we can reasonably expect will be 15 or 20 per cent of the dead weight of the tenders only.

In my opinion, Mr. Rhodes, in discussing the committee report, struck the keynote as to the correct line of reasoning to follow in reaching a decision as to whether the engine tonnage should be included or not. When discussing the matter, he said: "I believe with the men operating the head end, that a great deal of economy can be produced by getting their co-operation, and to get their co-operation you must show them figures and results to entirely secure them with you, and you must show them that your figures are fair; that is to say, *that you are measuring these men properly*. I believe that if you leave out a portion of the tonnage that helps to consume the coal and the other materials used on the engine, you are not going to be able to put yourself in a position to say that you are entirely fair in your method of measuring." If it is important that motive power men are judged on a fair basis by their officers, it is at least equally important that motive power officers be judged fairly by their superiors. There is a special point to this argument on divisions and roads where 30 per cent of the engine mileage is made without even a way car.

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*Conclusions.*

I would sum up my argument in favor of including the weight of the entire train in the ton-mileage figures for the use of the motive power department as follows :

The efficiency of the motive power department is measured by the cost of maintenance and supplies per unit of work done. Therefore, the credit should include all the work done.

As to the objections to including the tonnage of the engine—the additional cost is so light that it can hardly be measured.

Inasmuch as the ability of the operating officer is justly measured by the amount of work performed per train and car unit, and not on the cost per unit of work done, and the motive power officer can be fairly judged only on the basis of cost per unit of work done, it follows that the efficiency of both departments cannot be correctly determined by the use of the same measure, and therefore the operating department basis cannot fairly be applied in estimating the efficiency of the motive power department.

While I fully appreciate the great influence of the mechanical engineer on the economy of the department and the effect of good and poor designs, I can hardly persuade myself that the basis by which the department as a whole is judged should be made such as to secure the best grounds for giving superior designs due credit so long as this basis is not a just one for the department as a whole.

There are a few other points in the discussion of the committee report which I wish to briefly review.

While that report advocates the use of the ton-mile basis for “all the items making up the cost of engine service” statement, it was not the intention to advocate the abandonment of the engine-mile basis entirely, but leave each line to settle for itself what items should have a supplementary report based on the engine mile. In the paragraph immediately following the table on the first page of the report these words will be found: “We believe it advantageous to also have a statement showing the cost of engine lubricating and illuminating oils on the engine-mile basis.”

As to the proper basis for roundhouse labor statistics, I believe this should be the number of engines handled through the roundhouse. This, for the same reason that I advocate including the weight of the engine and way car in the ton-mileage; namely, it gives the cost per unit of work performed.

## THE DAYTON LUBRICATING CENTER PLATE.

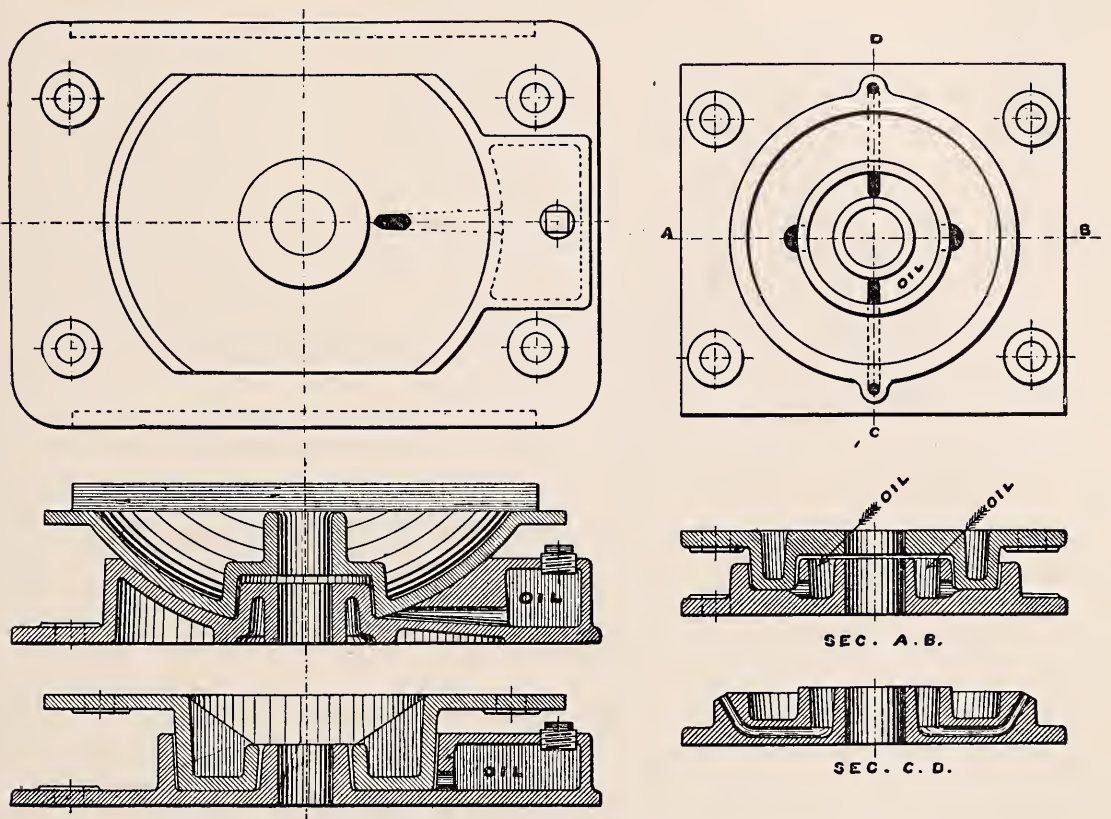
The Dayton lubricating center plate provides an oil pocket in the side of the lower center plate, which keeps the wearing surfaces constantly flooded with oil. It is made of malleable iron. The chamber is provided with a screw plug, and can be filled while the truck is under the car.

A test was made some weeks ago by the Dayton Malleable Iron Co., who make the center plate, to determine the comparative resistance between dry and lubricated center plates for railway cars. In making the test, service conditions were, as far as practical, duplicated; but it is not claimed that exactly the same results were obtained as are given by regular service. The center plates used were taken from stock, and were not finished, nor treated in any way, but used exactly as they came from the ratters. The lower plate was secured firmly by bolts to the floor, and the upper to a platform 8 feet 6 inches square, the plates being engaged as in service with the exception of the kingbolt, or center pin, which was not inserted. Castings to the aggregate weight of 20,000 pounds were loaded on the platform and distributed in a manner so as to keep the platform balanced and bring all the weight on the center plate.

The platform containing the load was revolved by means of a windlass, a pointer being attached to one corner, and the movement thereof was sufficient to cause this pointer to travel through an arc 6 inches in length. The movement was effected by means of a tackle block attached to the platform at a point directly above that where the flange of the wheel would come in contact with the rail; that is, 2 feet  $4\frac{1}{4}$  inches from the center line one way, and 2 feet 6 inches the other way. The other end of the tackle block was attached to one arm of a bell crank, and the other arm of this crank rested on an ordinary pair of platform scales. The pivot of the bell crank was secured to one of the posts of the warehouse, and the tackle block was pulled by means of a windlass in order to give a continued regular movement. The first load weighed was 2,000 pounds, and readings were taken as each additional 1,000 pounds were applied up to an aggregate weight of 20,000. The test was in this way made first, with plates dry, the load was then entirely removed, the platform lifted, and the lower plate and oil chamber filled with oil, after which the test was repeated under exactly similar conditions and with duplicate weights.

The results showed, as might have been expected, a remarkable dif-

ference in the pounds pull required to turn the platform, as between the dry and the self-oiled plates. For instance, with a weight of 2,000 pounds on the platform the pounds pull required to turn the platform was, with dry plates 150 to 225 pounds, with lubricated plates 40 to 47 pounds. With 15,000 pounds weight it required 600 pounds pull to start the platform with dry plates and 155 pounds to start with lubricated plates. As the angularity of the pull increased as the platform revolved, a greater amount of pull was required for turning it as the



THE DAYTON LUBRICATING CENTER PLATE.

travel increased. Accordingly, it was found that, with the 15,000 pound weight, the pull at the complete 6 inch travel was: 1,015 pounds dry, 195 pounds lubricated. With the full 20,000 pounds load the results were: to start, 850 pounds dry, 200 pounds lubricated; at full 6 inch travel 1,200 pounds dry, 275 pounds lubricated. The conductors of these tests figure that the results show that the friction on the lubricated plate is less than one-fourth that on a dry plate; that any reduction in this friction means a corresponding reduction in rail and flange wear, and, that, therefore the use of the Dayton lubricating plate will reduce flange wear and rail wear over 75 per cent.

## THE CAR FOREMEN'S ASSOCIATION OF CHICAGO.

### AUGUST MEETING.

The regular meeting of the Car Foremen's Association of Chicago, was held in Room 1741, Monadnock Building, Chicago, Thursday evening, August 9. President Morris called the meeting to order at 8:00 p.m. Among those present were the following:

Bush, S. P.	Grieb, J. C.	Kroff, F. C.	Prickett, J. A.
Cook, W. C.	Hedrick, E.	Kline, Aaron	Sharp, W. E.
Callahan, J. P.	Hansen, A. P.	Morris, T. R.	Stewart, H. A.
Depue, Jas.	Johannes, A.	March, Hugh	Schramm, Chas.
Evans, W. H.	Johnson, Geo.	Mattes, J.	Shaw, M.
Fitzgerald, M.	Kramer, Wm.	Nordquist, Chas.	Williams, T.
Groobey, Geo.	Krump, M.	Perry, A. R.	Wessell, W. W.
			Wirtz, L. C.

Secretary Kline: The following have made application for membership in the association:

Chas. Schramm, R. & O. Ry., Grand Central Station; L. C. Wirtz, A. C. L., Evergreen Park, Ill.

President Morris: These names have been approved by the executive committee, and will be enrolled as members.

### APPLYING DRAFT TIMBERS TO REFRIGERATOR CARS.

We now come to the discussion of the program. We have three questions to be attended to tonight. The first one is in regard to labor for applying draft timbers to refrigerator cars. It had been arranged for certain members to open the discussion on the different questions, but the gentleman who was to open this first question is not present.

Mr. Bush (C., M. & St. P.): I think it would be a good idea to hear from the private car lines and from the owners of refrigerator cars on that question.

Mr. Sharp (A. C. L.): I was in hopes we would hear the other side of this first. I do not know what brought up this question. Undoubtedly some person has found out that he could not apply the draft timbers in the specified time, otherwise there would be no reason for this discussion. I find, however, that we apply draft timbers in three hours; we do this by piece work, and we pay 60 cents for one draft timber, or \$1.00 for two, at the same end of car. We have our men

rated at 19 cents per hour, provided they were working day work, and upon checking over our time sheets I find that our men make more than their rate at this class of work, so that I think the time allowance under the rules, six hours or \$1.20, is extravagant.

Mr. Prickett (C. & E. I.): We have very few of those draft timbers to put in refrigerator cars. All that I have put in, to speak of, is in C. R. C. L. cars. I find that my men put them in, in the specified time, too, although there are some refrigerator cars that I think require a longer time; for instance, a car that has the ice tanks over the draft timber bolts in such a way that you cannot get the bolts out without moving the ice box. I do not think the time specified in the rules is sufficient for a car of that kind; there should be two hours more added on in such a case.

Mr. Marsh (C., N. Y. & B.): I think the rules cover the case amply. We pay only \$1.25 for a set, or \$2.50 for the car complete, and two good men will equip two cars in a day. As for the draft timber bolts not coming out, I never yet saw a refrigerator car that was not provided with caps over the draft timber bolts. This cap slips off and the draft timber bolts come out very readily.

Mr. Prickett: I had one on my repair track recently and the draft timber bolts would not come out, and you could not get them out until you removed the ice box.

Mr. Mattes (P., Ft. W. & C.): We are not putting very many timbers upon refrigerator cars. There are refrigerator cars where two men will work a half a day before they get the bolts in, even; but there are not very many of them. There are refrigerator cars where they have to remove the ice tanks, and after the timbers are put in the tanks have to be put back, and the drip pan has to be soldered; six hours for one timber or ten hours for two in a case of that kind is not enough.

Mr. Callahan (C., L. S. & E.): I think the price for refrigerator cars is about right; ten hours will cover it. On refrigerator cars the price is nearer right than for stock cars.

Mr. Krump (Wabash): There is quite a little difference in the draft timbers in refrigerator cars. We find draft timbers that extend the full length of the car; and some are short. We can put the short ones up quickest, of course. Still, with the long draft timbers we can put them up in the time allowed by the rules. We get the timbers from the factory ready framed, and put them right up. In most cars the timber bolts are not capped. I think this, too, takes a longer

amount of time than the allowance in the rules, but ordinarily I think the allowance in the rules is sufficient.

Mr. Bush (C., M. & St. P.): I have not had any actual experience in putting draft timbers in refrigerator cars, but some of the remarks I have heard here this evening remind me a good deal of a remark made at the convention this year. I happened to be a member of the committee on prices, and we were fixing the prices on car bodies. We came to the 100,000 pound capacity coal cars and we fixed a price on the 80,000 and 100,000 pound coal cars with wooden bodies; in considering the steel car we did not think it was used very much in interchange service at the present time and, as there was so much difference in the price and a comparatively small number of them in service so far, we thought we would not put a price on steel cars. When the report was read (Mr. McConnell read the report), and the price on the 100,000 pound cars was reached, somebody got up and wanted to know if the price was for wooden or steel cars. Mr. McConnell answered, saying he did not know the steel car could be destroyed. It would seem to me this would apply somewhat to draft timbers on refrigerator cars; but, from what I hear this evening, and from what I have thought up, I can see a reason for a difference of opinion, depending on the different classes of refrigerator cars that are in service. Where there is considerable tinsmith work to do, where the tanks, etc., have to be moved somewhat in order to get the bolts out, it certainly seems to me it would take longer to remove the draft timbers than on an ordinary car; also, it would seem to take longer to remove and apply the long draft timbers that run through the body transom than the short draft timbers with only three bolts. Now, many refrigerator cars, I know, have the short draft timbers and some of them have the long draft timbers. Since a majority of the refrigerator cars we have to repair (and those are owned as much by the railway companies as by the private car lines) are cars that take about nine hours for one draft timber, it was our idea that the price ought to be corrected. It seems to me that, inasmuch as so many ordinary cars—that is, box cars and stock cars—in operation today, have the long draft timbers, that there ought to be a difference in price for the long and short draft timbers, and, possibly, a difference in price for refrigerator cars. I think that, inasmuch as Chicago is such a center for the home of refrigerator cars, and inasmuch as the recommendations of this association carry so much weight nowadays with the Western Railway Club and the arbitration committee, that it would really pay to

appoint a committee to investigate this question a little more thoroughly, for the reason that the application of draft timbers to cars on repair tracks consists certainly of a very large portion of the work. I will move, therefore, before the subject is closed, to have a committee appointed to investigate the matter further and report at the next meeting.

President Morris: There seems to be one point that has not been covered, and that is, the rusting of the bolts. I have seen a great many cases where the draft timber had to be cut into pieces in order to get it down; in fact, the only way to get it down was to cut it up. The bolts were rusted in such a way that it was impossible to drive them out, and my experience has been that that has been the cause of its taking such a long time to remove the timbers.

Mr. Sharp: In reply to what has been said here about the tank question, which seems to have bothered some of the gentlemen present, in making these repairs, I will say that I have never seen one of those cars yet, although I do not deny they do exist. On the line with which I am, our tanks are so designed and arranged that they do not in any way interfere with the draft timber bolts. We have a cap on the pan right over each draft timber bolt, so that all you have to do is to pull the cap off, which is in the shape of an ordinary cup, and drive the bolt in—no soldering or anything of that kind is required to be done. I favor the suggestion of Mr. Bush, that a committee be appointed to go into this subject and arrive at the facts.

President Morris: I think it would be well to have a committee appointed. If there are no objections, I will postpone the naming of this committee, which will be duly notified to report at the next meeting.

Mr. Bush: Before we get off this subject, there are just a few remarks I would like to make, because this is one instance that bears very largely on the most important thing we have to deal with—and that is, the detention of cars. I have a very strong feeling in the matter, that any company or any individual who, for any reason at all, sees fit to run special cars, or put special appliances on their cars which are not generally used, should bear the burden of maintaining those things in service. It is a great hardship to the transportation business of the whole country to have cars detained at points where it is difficult to make repairs. I think that the whole influence of the railway clubs, and the whole influence of the Master Car Builders' Association, ought to be, without

doing any injustice to any one, in the direction of simplifying this matter of repairs, and I think that the use of constructions that are difficult to maintain and repair ought to be discouraged, as far as it is consistent to do so. Now, I do not mean by that, that the use of refrigerator cars ought to be discouraged, because we cannot get along without them; but in designing refrigerator cars we ought to be just as particular as we can to make them accessible for repairs. I think that is the principle we ought to bear in mind in modifying the rules.

#### BRASSES REMOVED ON ACCOUNT OF SLID WHEELS.

President Morris: We will now pass to the second question. This refers to the charging of brasses removed on account of slid wheels. One of the members of the association had a case that bore on this question, and he seemed to think that he should not be charged with the renewal of brasses on the car, it belonging to the road to whom he gave the defect card for slid wheels.

Mr. Callahan: I do not think he is entitled to any card for his brasses. It is the owner's own car, and he has got the car home with his own brasses in. If the brasses are worn out, he is responsible for their renewal. If they were second hand brasses, he has got what belongs to him.

Mr. Kroff (P., Ft. W. & C.): I think the rules explain that fully. Section 21 of Rule 5 reads: "Journal bearings which require renewal by reason of change of wheels or axle for which the delivering company is responsible." If you deliver us a car with a pair of slid flat wheels, and we remove that pair of wheels and axle, and have to renew the brasses, I think the delivering company is surely responsible for the brasses, as the brass is in connection with the axle. They have the privilege of making repairs, putting in second hand wheels and brasses if they elect to do so. If you break a draft timber and drawbar, which breaks into the combination, and you find a good many of the draft timber bolts broken, you would not think of charging the owner for the old broken bolts and making the balance of the repairs at your own expense. I think the brass question is a penalty for not making the repairs. That is the way I look at the rules.

Mr. Prickett: I do not see how you can go behind the rules on this. The rule says that the delivering company is responsible for the brasses when they do not fit the journal that you are going to apply, and it looks to me as if that would have to be carded for. I know I get re-

quests once in awhile from the owners of a car for slid wheels or cut journals, and they make the request for the brasses just the same.

Mr. Sharp: I think this Section 21 of Rule 3 applies more particularly to a foreign line making repairs. I think if you slide the wheels on your neighbor's car and change them, and in making this change of wheels you change the brasses, then you ought to be responsible for the change of brasses also. But I think if you deliver this car home, as seems to be the case in question, with an M. C. B. defect card, that the owner has got value received. I do not think it is proper to charge for the brasses in this case.

Mr. Grieb (C., M. & St. P.): I can hardly agree with what Mr. Sharp says on that subject. We find that we are quite regularly presented with bills for the renewal of brasses where the change is made necessary by change of wheels, due to causes for which the owner is not responsible. It is always alleged that the brasses are worn out. We never get a case of wheels being removed on account of being worn flat but what the brasses are worn out. Now, it seems to me that Section 21 of Rule 3 makes the renewal of brasses properly chargeable to the party responsible for the change of wheels. The brasses are a secondary consideration. There may be cases where it is not necessary to renew them. Good policy might dictate that they should be renewed, and it seems to me perfectly logical and entirely equitable that the primary cause for responsibility should settle the secondary cause. Thus, if you are responsible for sliding a pair of wheels, or damaging them otherwise, making their renewal chargeable to you, there is hardly any good argument for trying to shift the responsibility for the brasses. I also think it extremely important that the item of brasses should be specified on the defect card. Some people argue that this is understood, and on that account it is not necessary that they be specified on the defect card. We see by the argument here this evening that all people do not take the same view of this matter. It is very fortunate that we have it here in the Car Foremen's Association, but it is not so fortunate when it reaches us as correspondence, which not only travels through one office but through several offices, and on that account I am in favor of seeing these cards made out so specifically that there cannot be any doubt as to what they cover. I would be very much in favor of seeing a motion passed here this evening, to the effect that in case of renewal of brasses made necessary by change of wheels, not chargeable to the owners, the item of brasses be shown on the card in all cases.

Mr. Sharp: Mr. Grieb is right in the statement that where wheels are removed it is usually stated that the brasses are worn out. I remember one case in the past week where we have passed a bill where eighty-four brasses were charged as being worn out. Of course, we cannot question but what they were worn out, but that is the reason I would like to see Section 21 of Rule 3 properly interpreted. This case here pertains to a defect card where the car went home to the owner. Now, it does not seem to me that this is a parallel case. The rule covers cases where you make the repairs yourself. If you slide the wheels and make the repairs, you are responsible under Section 21 of the rule, but there is nothing under the head of defect card that would require you to issue a defect card for brasses. In other words, they are the owner's brasses and they go home on the journal they went away from home on, and I fail to see why the party responsible for the wheels should be responsible for the journal bearings also.

Mr. Grieb: I would like to get a little more information on the subject to clear myself. I would like to ask Mr. Sharp where this differs from such a case as the following: Say, for instance, the C., M. & St. P. slides a pair of wheels under an Armour car, and in making the exchange of wheels it was necessary to apply new brasses, would Mr. Sharp accept a charge for the brasses? I do not see the difference wherein we change that pair of wheels or return it to the owners to be changed.

Mr. Sharp: I presume from what Mr. Grieb has said, the wheels were applied at an outlying point where they have no wheel press. If we were making the repairs we would apply new wheels on that same axle, and the same journal bearings would probably go back under the car. We have followed that practice the past year with a good deal of satisfaction. I think the members present this evening will bear me out in the assertion that we have had fewer hot boxes on our cars in the past year than ever before. We find the question of hot boxes has been reduced to a minimum.

Mr. Bush: I think I see where there is a chance for a different view of this case. From the remarks that have been made, it would appear that the difference lies in this,—that in some cases where wheels are removed they are put back on the same axle, and the same journal bearings are put back on the same journal. My understanding of the case under discussion is, that the wheels are removed and the same axle does not go back under the car, necessitating a change of journal bear-

ings. Now, I think that at the great majority of repair points, particularly where a good many cars are repaired, that it is the practice in taking out a pair of wheels not to put that axle back under the car, but set it aside and put another pair of wheels under the car, and that involves a change of journal bearings. Now, then, if the Pennsylvania road slides a pair of wheels under an Armour car, and they do not elect to renew the wheels themselves, they send the car back to the owner. They say, we will give you a card for the wheels. Now, the question is, in giving card for the wheels should we put on the card the item of brasses? I think that we should, because I think it covers the majority of cases. I think that if the Armour company should receive a car with a pair of wheels slid, from any railway company, they want to get the use of that car just as quick as they can, and probably, instead of mounting another pair of wheels on that axle, they apply another pair of wheels and have to change the brasses. Therefore, I think they would be entitled, as the rule says they are, to card for the brasses. The only question is whether you will put it on the card. Now, inasmuch as there is more or less correspondence covering such cases, I think it would be more specific, when we know we are responsible (that is, the delivering road) that, in addition to putting the wheels on the card, it would make it more clear and avoid correspondence if the brasses were put on the card also.

Mr. Marsh: I believe where a road slides a pair of wheels, which makes it necessary to give card for them if the car is delivered to a connecting line, if they see fit to give card for the wheels, all well and good; but if they send that car home to the owners with slid wheels, and the owner finds it necessary to change the brasses on account of their being worn out, or for any other cause, he should stand the expense of renewing them, as he has received his own bearings home in the car.

President Morris: I do not think this is a question so much of worn-out brasses as it is a case of brasses that did not fit the journal applied. If the same journal was put back and the same journal bearings used again, there would be no question; but if another journal is applied and the old brasses do not fit, the question arises as to whether the delivering line or the owner should stand the expense of renewing the bearings.

Mr. Marsh: I did not intend to bring in the rule of worn-out brasses against this argument. I just simply used that to show that if

that car is sent home to the owner, then he can handle it the way he sees fit and to his own advantage. It is almost invariably the case, where a wheel is slid flat that the brasses are always worn out.

Mr. Sharp: This is rather a queer position to be taking, and for that reason I want to offer a word of explanation. I suppose, if boiled down to a question of one of our cars, you would want to know why we did not want to card for the brasses. I believe that section of the rules was framed without any reference to an M. C. B. defect card, where the car went to the owner. For that reason, we prefer strict adherence to the rules. What I wanted to add, however, is this: The system that we have in reapplying these journals we recognize is not in vogue at every repair station. We do not attempt to reapply the same axle to every car, but we have a system where every bearing that is inspected and pronounced O. K., is numbered by the wheel inspector, and in exchange for that brass the repairman gets a number that buys that brass and no other, and when that axle is run out to go under another car the wheelman goes to the storeroom and gets that brass and it goes back on the same journal from which it was removed.

Mr. Kroff: That postoffice system might be all right on the Armour Car Lines, but I do not know how it would go over our way. We get a good many foreign cars and a fellow might lose his check before we get another car that that same axle would fit. We get a carload of perishable freight in, late in the evening, and we have got to make the best of it in a short time, sometimes in less than twenty minutes, and it would almost take a man twenty minutes to get the check, etc. I do not think that would work with a railway company.

Mr. Marsh: I think the postoffice system would work fully as well with that company as it would for any one. Of course, with foreign cars, there is where the question comes up as to whether a railway company would rather give defect card for the brasses or hold the car, press the old wheels off and new ones on, and apply the same journal bearings.

Mr. Bush: This question will still bear a little more discussion. This rule says: "Journal bearings which require renewal by reason of change of wheels for which the delivering company is responsible." Now, then, the question at issue is not whether that rule is right or not, but whether, to make it specific and avoid disputes afterward, we should put on the defect card for the wheels, the item of brasses also, and settle it then, so that when the defect card goes with the bill against the

line responsible for it, there is no chance for dispute. I do not think it is a question of whether it is right or not. That is the rule. It says there, very plainly, it does not matter whether the car goes back to the owner or to some other road.

Mr. Marsh: I still believe that this question is one which does not reflect upon the rules in any way at all. The rules were put in there for the government of cars offered in interchange, while this question specifies that this car was returned to the owner. The rules there do not say anything about cars returned to the owner. This rule applies as well where the car is offered in interchange a thousand miles from home perhaps.

Mr. Grieb: I would like to ask Mr. Marsh to point out the difference where the car is returned to the owner or to a delivering line. I do not see a particle of difference. The rules place the responsibility for the brasses on the party damaging the wheels, and the question of whether the exchange of cars is made between roads where the owner is not interested, or in cases where car is returned to the owner, it seems to me make no difference under the rules. It is specific; it is plain that the party responsible for the wheels is responsible for the brasses.

Mr. Marsh: I take it for granted from this question here that we are discussing an actual occurrence. It is my opinion there has been a bill rendered for something of this kind and that it is brought before this association for their views on this thing as to what they think is right. I know, of course, we have no right to go around the rules. They are put down there, and if we do not go according to the rules we will hear from it; but I do think this question is brought up here to settle the dispute of the contending parties, and, I think, get the views of this association. That is the reason I take the stand that where this car is returned to the owner he has the right to use those journal bearings if he sees fit. Now, if a road slides a pair of wheels and sends the car home with a defect card covering these wheels, and knows that the brasses are new and serviceable, it is reasonable to suppose that a man would object to furnishing defect card for journal bearings that he knew were going right back in that same car.

President Morris: I do not think you quite understand the question, Mr. Marsh. There is no question at all as to responsibility if the brasses are used again. The question, then, answers itself. The question at issue refers to brasses not used again.

Mr. Bush: Let me state a case, Mr. Marsh. Supposing I had one

of your cars, slid a pair of wheels, and wanted to deliver the car to you without renewing the wheels. Now it is not your fault that the wheels were slid. In the first place, the mere fact that that car has got to go in on the repair track to have the wheels renewed means a certain amount of loss to the car; it means a certain amount of switching, and it may mean a change of bearings. Now, suppose you did have to change the bearings, do you think you ought to stand them, or I?

Mr. Marsh: If I found that the journal bearings were in good condition and O. K. to be used again, and that the only reason for removing them was on account of the slid wheels, and knowing that I would use the same bearing on the same journal later on, I do not think the delivering road should be compelled to give me a card for *new* bearings and allow me to use the *second hand* over again.

Mr. Kroff: I do not see why we cannot be fair with the rules. Say, for example, that we have a Milwaukee car with a side door lost. That is chargeable to the owner. We have a right to charge that to the owner. But in delivering it to the owners are they responsible for it then? Why, because we neglected to replace it. Now, I think slid wheels act the same way. I do not see why we want to look at this in one way on the brass question and another way on some other question. The brasses should be chargeable to the party responsible for the wheels.

Mr. Groobey: What I have understood from this discussion and from the points brought up is this, that when brasses are renewed, per Section 21 of Rule 3, that it would be good practice to place the item of brasses on the defect card, and I would make a motion to that effect.

Motion carried.

#### **“DEADWOODS,” “HEAD BLOCKS,” OR “BUFFER BLOCKS.”**

President Morris: The third question also relates to how a certain section of the rules should be considered. It says: “Referring to Section 43 of Rule 3, is it to be understood that the ‘wood or iron buffer blocks’ mentioned are to be considered as being the same as what is ordinarily known as deadwoods or head blocks?”

Mr. Grieb: It seems to me it would be well to have it so understood. The functions of both are practically the same, although they act in a different direction, and any damage that is severe enough to break the end sill in connection with the dead block, or an end sill in connection with a head block, I think is of the same character, and we ought to decide here this evening that those two items are synonymous as far as their destructibility in connection with an end sill is concerned.

Mr. Kramer: We have been taking them off our cars and have few cars running now with head blocks or dead woods. I should say wherever the end sill is broken, and also the head block or buffer casting, it should all combine one piece and should be charged to the owner.

Mr. Wirtz (A. C. L.): The question, as I understand it, is not whether the buffer block should be charged to any one; it is a question of what it is—what part of the car the buffer block is. I believe you cannot find anywhere in the rules a deadwood mentioned. Under sections providing for labor for removing and replacing different parts of cars, it is called a buffer block, evidently meaning the deadwood, but “deadwood” is not mentioned in the rules anywhere, though I gather from common usage and common understanding that the buffer block is what is sometimes called the deadwood.

Mr. Bush: I would like to ask what distinction has been made, if any, between headblock and deadblock?

Mr. Kroff: I think they are about the same thing. A few months ago when we had pin-and-link drawbars, I think the deadblock or headblock or buffer casting was put on the car for the safety of trainmen and switchmen, in case the head of the drawbar should break off. I think they are all the same thing.

Mr. Bush: There are some cars that have a block on each side of the coupler. I understand that is called the buffer block, or deadblock, or deadwood. It is sometimes made of wood, faced with iron or steel. In other cars there is a block put on behind the horn of the coupler for cars that do not have the outside end sill. Now, are those generally given the same name? Are they the same thing?

Mr. Kroff: I think they are. They are put there for the same purpose. The western people call oil boxes “oil houses,” and by the time they get east they have all kinds of names.

Mr. Groobey: On the C., B. & Q. cars they have the wood buffer blocks and the iron buffer casting.

Mr. Sharp: The Erie Railroad have a number of cars equipped as Mr. Groobey has said, with a wooden headblock, what we used to call a deadwood, then a wooden buffer block with a cast iron face plate. We used to make that distinction in our repair slips—one deadwood and one buffer block; but I find in the abstract of decisions which McConway & Torley issues there is a list of misnomers, and they take those recommendations from common practice all over the country, and they recommend that they all be known by one name, “buffer block,” and I infer

from that they are to be known as one ; in other words, that they form a combination in connection with the end sill.

Upon motion, which was duly carried, they were considered one and the same thing.

The meeting here adjourned.

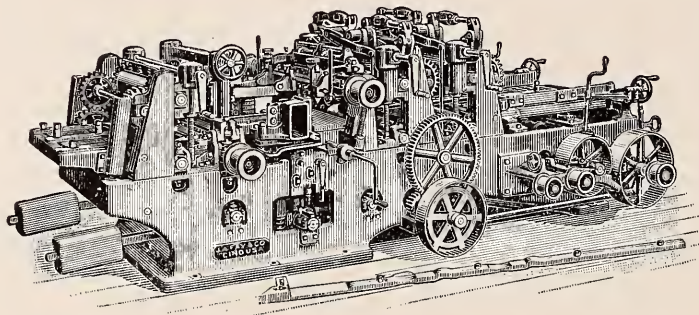
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## A NEW WOODWORKING MACHINE.

We illustrate a new machine recently brought out and placed on the market by J. A. Fay & Co., of No. 8 to No. 28 John street, Cincinnati, Ohio, and patented Jan. 9, 1900, and March 20, 1900. It is their new No. 25 heavy six-roll double cylinder planing, matching and jointing machine.

This is the largest and heaviest combined planer, matcher and jointer made, and it is especially recommended for railway car and repair shops. It will plane 30 inches wide and 14 inches thick, and will work simulta-



neously three sides of two pieces of material of uneven thickness up to 12 inches wide and 14 inches thick.

The frame is massive, perfectly jointed, and bolted to secure rigidity. The cylinders are made from solid forged steel, and are slotted on all their faces. The matching works are very substantial, and are fitted with a patent weighted matcher clip for working cross-grained and knotty lumber and producing rapid and accurate work. The feed works are very powerful, consisting of six rolls 8 inches in diameter, connected by a train of heavy expansion gearing, with double links, and are heavily weighted. In fact, this machine will be found to have embodied in its construction numerous devices and conveniences for facilitating the work, and doing it in the most accurate and rapid manner. If our readers are interested in this machine and will write, the manufacturers will furnish them with prices and full particulars.

## A REMARKABLE NEW TOOL STEEL.

The Bethlehem Steel Co., of South Bethlehem, Pa., has developed a wonderful method of increasing the cutting properties of a special grade of tool steel. Mr. F. W. Taylor and Mr. Maunsel White, of that company, carried on the investigations and experiments, and the tool treating is called the Taylor-White process. Public tests of this tool steel were made July 31, and were more than convincing to those who were fortunate enough to be in attendance. We will cite simply the following instances: A piece of 1.05 carbon steel was carried in the lathe at a cutting speed of 15 feet per minute. A "Taylor-White" tool was set at a 3-16 inch cut and 1-16 inch feed. After running for 16 minutes dry this tool was taken out and on examination showed its cutting edge to be unimpaired. A Mushet tool was then tried, but burned off in 23 seconds. A cast iron roll was run at a cutting speed of 45 feet per minute, with the same cut and feed as in the other piece. A "Taylor-White" tool was run for 16 minutes and suffered no injury. A Mushet tool was substituted, and burnt off in 3 seconds. The "Taylor-White" tool was then again put in and the cut finished in 4 minutes. A piece of .10 carbon steel was run at a cutting speed of 150 feet per minute, with the same cut and feed as in the previous tests. After having run for a few minutes the point of the "Taylor-White" tool became heated to a clear red, but continued to cut cleanly, nevertheless. After 4 minutes' run at this heat, the tool was taken out and found to have the edge but very slightly dulled. A Mushet tool lasted but 6 seconds in its place. A 3-16 dry cut and 1-16 feed for 12 inches was taken over a mild steel piston rod, at a speed of 180 feet per minute, and the tool was uninjured. A cut 1 inch in depth and 3.32 feed was taken in a piece of mild steel on a planer at a speed of 31 feet per minute.

In our next issue we will give an account of the development of this astonishing steel treating process.

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## PERSONAL MENTION.

Mr. W. Denison has been appointed general foreman of the Missouri, Kansas & Texas, vice A. D. Arbergast.

Mr. H. B. Mennick has been appointed foreman of locomotive repairs on the Toledo, St. Louis & Western, with office at Frankfort, Ind.

Mr. A. E. Tremp has been appointed master mechanic in charge of motive power and car equipment of the Toledo, St. Louis & Western, vice Mr. C. Skinner, resigned, with office at Frankfort, Ind.

Mr. J. R. Groves has been appointed superintendent of machinery of the Colorado Midland, vice A. L. Humphrey, who resigned some months ago to go to the Colorado & Southern in a similar capacity.

Mr. C. S. Bancroft has been appointed division master mechanic of the Colorado & Southern.

Mr. J. J. Anderson has been appointed master mechanic of the Tifton, Thomasville & Gulf, with office at Moultrie, Ga.

Mr. D. Rutherford, master mechanic of the San Francisco & Joaquin Valley, has resigned.

Mr. J. W. Marden, formerly superintendent of rolling stock of the Fitchburg, has been made foreman of the car department of the Fitchburg division of the Boston & Maine, with office at Boston.

Mr. Robert Rennie has been appointed master mechanic of the Pennsylvania division of the Delaware & Hudson Company, with headquarters at Carbondale, Pa., vice

Mr. W. R. Johnson, resigned. Mr. Rennie has for some time been foreman of the Lehigh Valley shops at Sayre, and will be pleasantly remembered by many of our readers as having covered the country with the Richmond "tramp" compound locomotive.

Mr. N. E. Sprowl has been appointed division master mechanic of the Southern Railway, with office at Columbia, S. C.

Mr. J. S. Turner, formerly superintendent of motive power of the Fitchburg, has been made master mechanic of the Fitchburg division of the Boston & Maine, with office at Charleston, Mass.

Mr. F. W. Main, purchasing agent of the New Orleans & Northwestern, has resigned to enter private business. Mr. J. Newman Truley, hitherto chief clerk, auditor's department, succeeds Mr. Main, with office at Vidalia, La.

Mr. E. Elden has been appointed assistant master mechanic of the Fitchburg division of the Boston & Maine, with office at Mechanicsville, N. Y.

Mr. M. C. Draper, master mechanic of the Peoria & Pekin Union, has been appointed superintendent of that road, with office at Peoria, Ill.

Mr. F. W. Cox, general foreman of the Chicago, Milwaukee & St. Paul locomotive shops at West Milwaukee, has resigned to go to the Baltimore & Ohio at Baltimore.

Mr. S. W. Crawford has been appointed master mechanic of the Ohio Southern, vice A. E. Tremp, resigned to go to the Toledo, St. Louis & Western.

On the Pennsylvania Lines, W. F. Beardsley, master mechanic at Allegheny, Pa., has been transferred to Crestline, Ohio, succeeding J. D. Harris, transferred to Wells-ville, Ohio. Mr. Harris succeeds Mr. G. P. Sweeley, who takes Mr. Beardsley's place at Allegheny.

Mr. Ira C. Hubbell, who had been long connected with the Kansas City, Pittsburg & Gulf, and, since reorganization, with the new company, the Kansas City, Southern, and the allied interests, resigned as purchasing agent for those companies on July 31, since which date he has been engaged in private business as president of the Locomotive Appliance Company, with office in the Fisher Building, Chicago. This company is offering the valve and valve motion which attracted so much attention at the Saratoga convention. Mr. Hubbell entered the railway service when a boy and continued in railway work until the close of 1883, when he engaged with the Fairbanks people and organized the engineering branch of their business at St. Louis, and for five years continued as manager of their engineering business, during which time he constructed several large steam plants for various purposes, and we believe has the distinction of having designed and constructed the power plant for the first electric railway which was constructed west of the state of Pennsylvania, this being the electric line now in existence between Council Bluffs, Iowa, and Omaha, Neb. In the early part of 1889 the Fairbanks people decided to open their house in Kansas City, and selected Mr. Hubbell as its manager, and for seven years he was known throughout the territory tributary to Kansas City as Mr. Fairbanks' "hired man," later becoming the purchasing agent of the Port Arthur route and allied lines.

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## SUPPLY TRADE NOTES.

Mr. Nat C. Dean ceased to represent the Carbon Steel Co. on September 1. Mr. Dean still continues his connection with the Lowe Brothers Co. railway paint business.

The Richmond Locomotive and Machine Works have just received an order from the Intercolonial Railway of Canada for ten consolidation locomotives with 56 inch drivers; weight in working order 164,000 pounds, with 147,000 pounds on drivers. The boilers

are of the straight top type, 66 inches diameter at the smokebox end, and will carry 200 pounds steam pressure. Five of the engines will be compounds with 22½, 25 and 30 inch cylinders.

The Cloud Steel Truck Co. has issued a neat convention reminder, presenting a view of its handsome exhibit at Saratoga, and also illustrating the various forms of Bettendorf bolsters.

At a recent meeting of the stockholders of the Consolidated Railway Electric Lighting & Equipment Co., held at the general offices of the company at 100 Broadway, New York, the following board of directors was elected: Walther Luttgen, Norman Henderson, C. G. Kidder, George W. Knowlton, Thos. J. Ryan, Isaac L. Rice, Jno. N. Abbott, Aug. Treadwell, Jr. The vice president and general manager of this company, Jno. N. Abbott, was formerly general passenger agent of the Erie Railroad, and subsequently for several years chairman of the Western Passenger Association in Chicago. This company is a consolidation of the various companies heretofore engaged in the manufacture of electric lighting apparatus for all kinds of steam railway cars, the electricity being generated from the car axle while the car is in motion and furnished from a storage battery while the car is stationary. This system is known as the "axle light" system of electric lights and fans for railway coaches, and is in operation on various railway lines.

Mr. Richard D. Gallagher, Jr., has been appointed mechanical engineer of the Standard Coupler Co. Mr. Gallagher has been for some time connected with the car department of the Grand Trunk Railway at Montreal, and was formerly with the Pullman Co. at Pullman, Ill.

The Detroit Steel & Spring Co. suffered from a fire on August 19. The fire was, however, confined to the company's foundry department entirely, where the steel castings for railway and other work are made. The company's rolling mills, spring shops, etc., were in no wise affected, being in separate buildings. The loss on the foundry was fully covered by insurance. The foundry will be running again as usual in a few days.

Gould & Eberhardt, of Newark, N. J., have been awarded a silver medal for general excellence of their machine tool exhibit at the Paris Exposition. The exhibit consisted of Eberhardt's patent Victoria new type gear cutting machine, gear cutter, cutter-grinder, and extension base shaper.

The Rand Drill Company, of New York, has received gratifying recognition from the Paris Exposition in the shape of the grand prize and three gold medals for its air compressors and rock drills.

Mr. J. W. Oliver, president of the American Machinery Company, of Grand Rapids, Mich., is abroad on a three or four months' trip of combined business and recreation. He was to spend considerable time at the Paris Exposition, and also to visit the larger cities of England and the Continent.

A novel reminder of the recent Saratoga convention comes to us in the shape of some "Saratoga chips," made on the Oliver wood trimmers, which are manufactured by the American Machinery Company, of Grand Rapids, Mich.

The International Brakeshoe Company, whose offices are in the Old Colony building, Chicago, has been awarded the silver medal at the Paris Exposition for its exhibit of the Diamond "S" brakeshoe for locomotives and cars. The silver medal is the highest award given for this class of railway appliances.

The McGuire Mfg. Co., of Chicago, Ill., has issued a very handsome folio-calendar that should be of interest in all mechanical offices. It gives large illustrations, produced in the finest style of the art of half-tone, of a series of the famous street and electrical railway trucks made by this firm. It similarly illustrates the snow plow and sweeper, car fender, sprinkler, stove, etc., which the McGuire company makes. The trucks

shown are of more particular interest to steam railway men, as showing how the difficult question of truck design has been worked out for light service.

The Carbon Steel Company closed its western office in the Fisher Building, Chicago, on September 1. The business heretofore transacted through this office will be done direct, either with the head office, Havemeyer Building, New York, or with the Pittsburg office, 32d and Smallman streets, Pittsburg, Pa.

Mr. Paul Synnestvedt, the widely known patent attorney and air brake expert, has his offices now in suite 518-519 Monadnock Block, where he will continue, as heretofore, to give special attention to the practice of patent and trade-mark law, including particularly select patent soliciting, investigations and opinions as to questions of validity and infringement, and mechanical expert work in patent causes.

The Egan Co., of No. 216 to No. 236 West Front street, Cincinnati, Ohio, the largest manufacturers of woodworking machinery in the world, recently issued a large illustrated hanger showing nearly one hundred of the different machines they make, and among which will be found some of the very latest improvements in this line. A number of the machines have been patented since Jan. 1, 1900, and an examination into their merits and capabilities will prove very interesting. The Egan Co. will forward one of these hangers to any of our readers who may be interested and will write them for it, and will also furnish prices and full particulars.

The Ingersoll-Sergeant Drill Co., of New York, has received the grand prize at the Paris Exposition for their mining exhibit, the gold medal constituting this prize being the highest award given.

The Chicago Pneumatic Tool Company has engaged Mr. Fred F. Bennett as sales agent and manager of advertising, with headquarters at the main office of the company, Monadnock Block, Chicago. Mr. Bennett resigned a position as sales agent for the American Steel Casting Company and American Coupler Company, of Chester, Pa., the change taking effect July 1. Mr. Bennett seems to be peculiarly adapted to his present position. His apprenticeship of several years was served on the Chicago daily papers as reporter and city editor, and later he was city editor of the *Omaha Republican*. Subsequent to this he was for many years western representative of the *Railroad Gazette* of New York. His long experience in the journalistic field, his railroad acquaintance, combined with his thorough knowledge of trade publications, should make him a valuable acquisition to the staff of this company, and they are to be congratulated on securing his services in a department of their work for which he seems peculiarly qualified.

The Pearson Jack Co., of Boston, Mass., has acquired a license from the U. S. Car Moving Device Co., of Lowell, Mass., for the sole manufacture and sale, in the United States and foreign countries, of the U. S. Car Pusher. All business relating to the same subsequent to Aug. 1, 1900, is being handled from the Pearson Jack Company's office in connection with its regular line. With the large number who have already purchased this new and practical device, the Pearson Company hopes to do further business, while to those yet unacquainted with its utility, it asks their consideration.

The Standard Pneumatic Tool Co., of Chicago, write to us as follows, under date of August 14: "Inasmuch as it has been called to our notice that a large number of users and prospective users of pneumatic tools are under the impression that suit has been entered against us by one of our competitors for infringement of their patents on account of the fact that they have brought suit against various pneumatic tool companies, we wish to notify the trade in general through your publication that we are not involved in any way, shape or manner in the present litigation, as our 'Little Giant' pneumatic tools are fully covered by patents, the validity of which is not questioned by anyone. We are enclosing to you herewith a circular, which is self-explanatory." The circular referred to is one that we have previously published, and is dated Nov. 29, 1899. It is a joint statement for the Chicago Pneumatic Tool Company and the Standard Pneumatic Tool Company, to the effect that "in the patent litigation entered into between the Chicago Pneumatic Tool Company, Joseph Boyer, the Standard Pneumatic Tool Company and the Chouteau Manufacturing Company, all suits have been dismissed by the advice of their respective attorneys, they recognizing that the Boyer and Chouteau patents cover the fundamental principles of all pneumatic hammers, without the combined use of which no successful pneumatic hammer can be made. Recognizing the value of their respective claims, they have purchased licenses from each other covering their present style of hammers. We consider this action necessary for the protection of users of our respective tools."

# RAILWAY MASTER MECHANIC

WALTER D. CROSMAN, EDITOR.

WILLIAM E. MAGRAW, MANAGER.

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## A METHOD OF COST KEEPING.

BY DAVID VAN ALSTINE.

This article describes a method of cost keeping, which the writer has seen in use in a manufacturing concern, and which he has modified to make it applicable to the mechanical department costs of a railway.

This method is based upon the idea that that information relating to costs will be most useful which will best indicate to mechanical department officials what items of expense most need their attention.

It would seem, for example, to be of little value to motive power officials to know the total costs of maintenance of each engine; but it would be of great value to know the cost of maintenance of various parts of a class of engines.

It is of little interest to know that it costs more to maintain one engine than another of the same class, because, working under like conditions, there is no good reason why there should be any difference, unless the engines are run by regular men and one man is better than the other. The knowledge of who the good men are, and who the poor ones are, is very easily obtained, and it is not necessary to refer to the cost of engine maintenance to determine it.

Where engines are pooled there appears to be very little useful knowledge gained by keeping cost by engine numbers.

On the other hand, if the costs of maintenance of individual parts of engines and cars are shown, and, consequently, the relation of these individual costs to each other, they furnish valuable information for the official whose constant effort is to reduce expenses. The method that I will describe, therefore, consists in determining the cost of maintenance of the component parts of rolling stock, rather than of the rolling stock as a whole.

Under this method engine costs are divided into as many accounts as may be deemed advisable, such as cylinders, pistons, piston rods, pis-

ton rod packing, guides, crossheads, crank pins, solid end rods, drivers, tires, driving axles, driving boxes, spring rigging, valve motion, boiler shells, fire boxes, staybolts, flues, lubricators, injectors, cabs, tanks, tender frames, tender trucks, tender wheels and axles, engine trucks, engine truck wheels and axles, air brakes, etc.

Similarly, freight car costs are divided into wheels, axles, bearings, trucks, bodies, roofs, doors, couplers, draft rigging, draft timbers, air brakes, brake shoes, painting, etc.

Sub-accounts under these accounts are kept to whatever extent desired, by classes, kind of material, or name of manufacturer. For example, under the account "staybolts," the sub-account would be "Ulster special" or "Taylor iron;" under the account "tires," the sub-account would be "classes A, B or C;" under the account "trucks," the sub-account would be "wood," "pressed steel," or "cast steel," and so on. It will be seen that this method can be made very simple or very complicated, and the greater the extent of detail the more clerical work there would be involved in keeping it.

The writer believes, from a year's experience with this method, that a great deal of valuable information can be obtained in this way by very little additional clerical labor.

The distribution of labor under the various accounts and sub-accounts is made by the time-keeper on sheets attached to a Shannon file, and the sheets, being alphabetically entered on the file, are easily found.

DATE .....

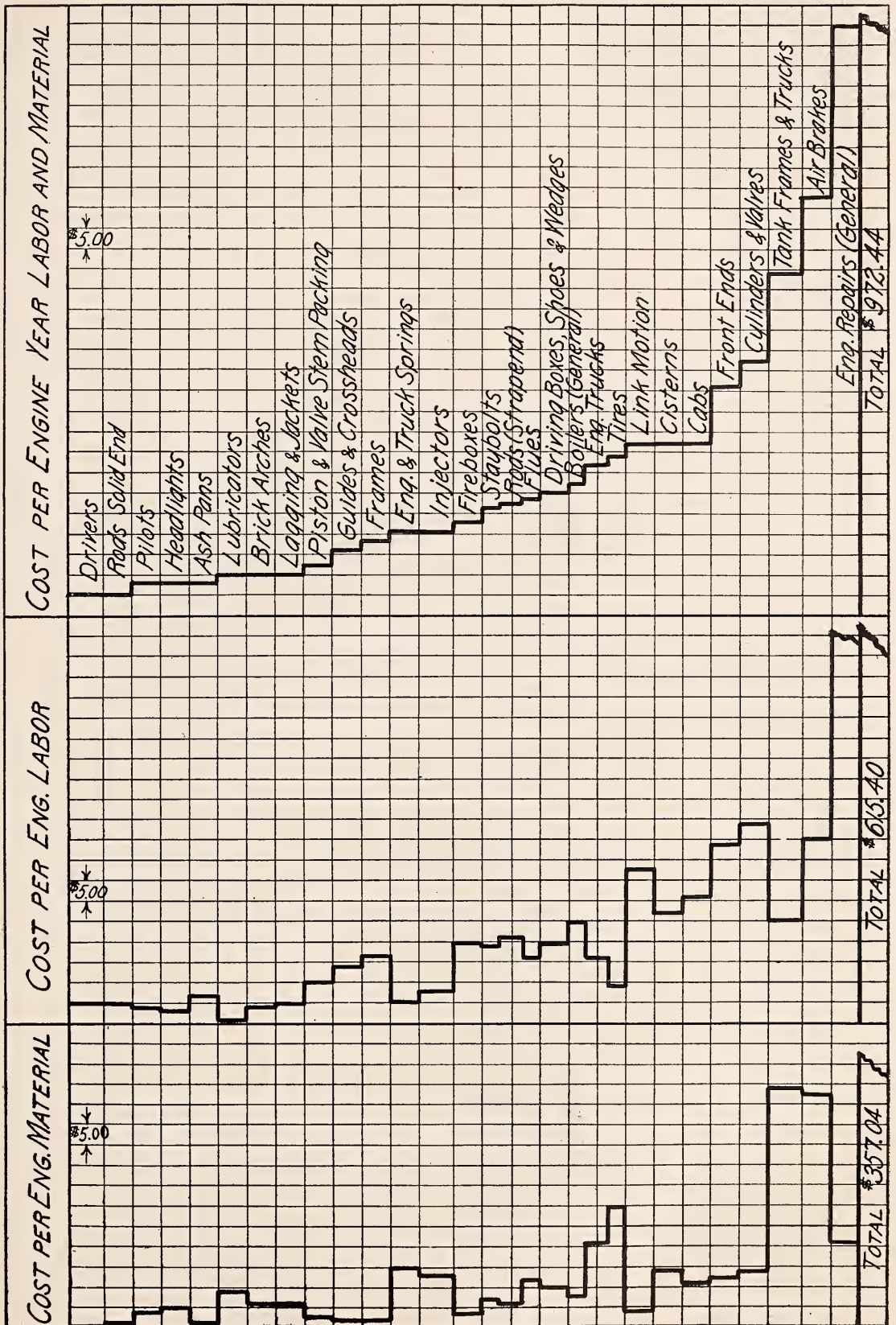
Account Rods Sub Account Solid End

													Total Hours	Rate	Amount
2	10	4											16	.25	4.00
5	3	2	4										14	.30	4.20
4	2	3											9	.25	2.25

SAMPLE TIME SHEET.

On the right hand side of the sheet (see sample) are three columns, headed "total hours," "rate," "amount." The rest of the sheet is ruled in both directions, so that it is divided into small squares.

In the column headed "rate," the various rates of the men engaged on the work, on which time is being taken, are entered, and as each man reports the number of hours of his time chargeable to the account it is entered opposite the rate which that man receives. When a horizontal



GRAPHIC SHOWING OF LOCOMOTIVE COSTS.

row of squares opposite a rate is filled the same rate is entered further down the sheet, and additional hours at the same rate entered as before.

In this way it is not necessary to write employes' names, and space is economized. The storekeeper who issues material has the same accounts and sub-accounts, and charges material accordingly.

The extension can be made on these labor and material sheets at the end of each month, and transferred, and the same sheets continue in use, if there is still room on them for another month.

An important advantage of the method is, that it enables the master mechanic or master car builder to get at any information relating to his costs without making special arrangements therefor, by simply instructing his subordinates what account or sub-account to enter on the file.

Work is constantly being done in railway shops, the cost of which is of special interest. For instance, the shop may receive an order to finish up for stock, fifty driving boxes. If a sheet under the account, "driving boxes," sub-account, "describing this lot of boxes," is entered on the file, an accurate cost of this particular lot will naturally follow. Later on, another lot of fifty of the same kind of driving boxes may be finished, but by a different method or on different tools. If their cost is also kept, an exact comparison is afforded, showing the economy effected.

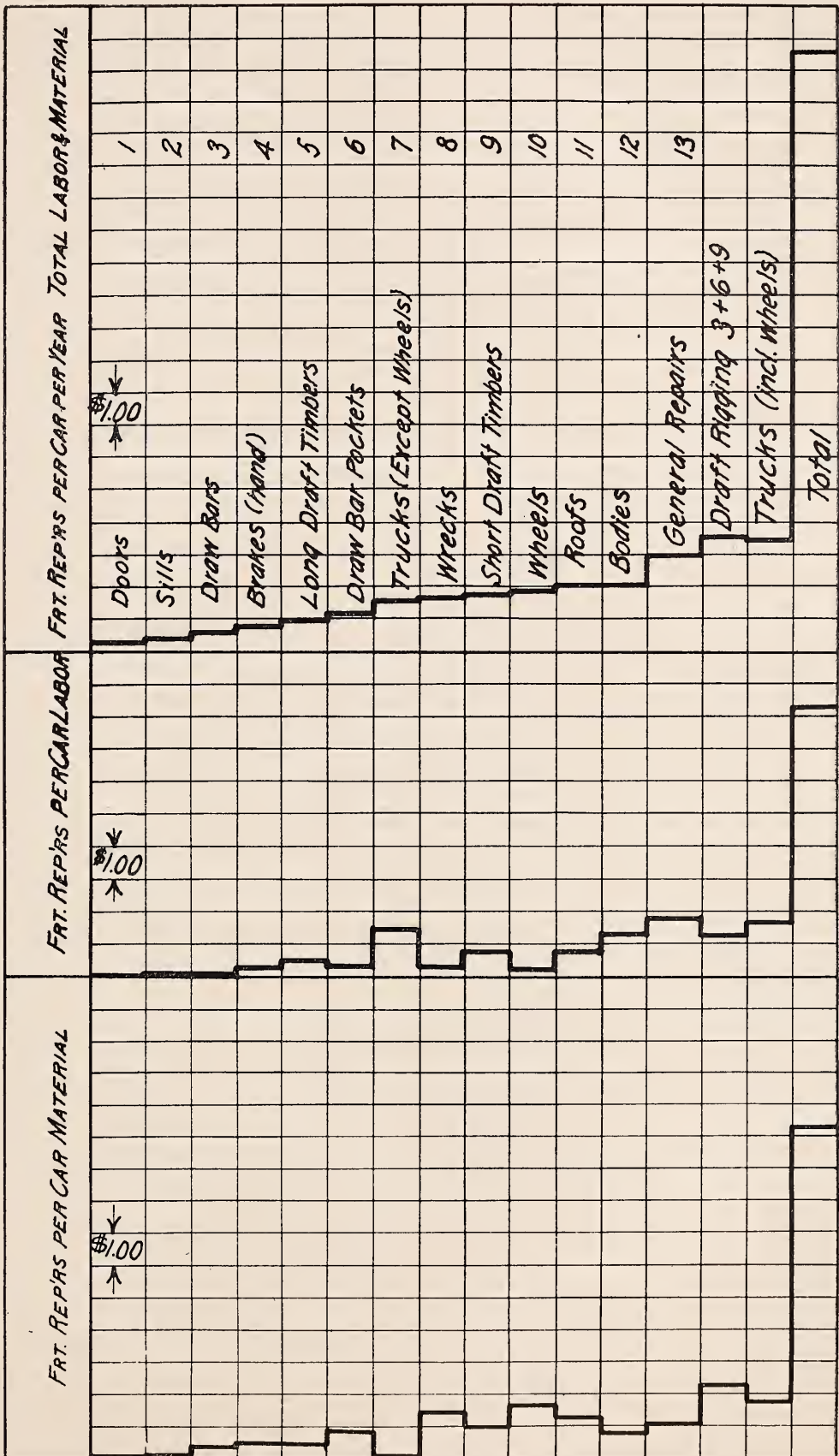
Thus, the effect of any change made, either in material or methods of doing work, will, in course of time, show how the costs have been affected, and the information will be definite and final because obtained under actual service conditions, and extending over as long a time as desired.

Finally these accounts, graphically shown by diagram, indicate at a glance which ones are high and worthy of attention, and which low and so insignificant that it is not worth while to waste much time on them.

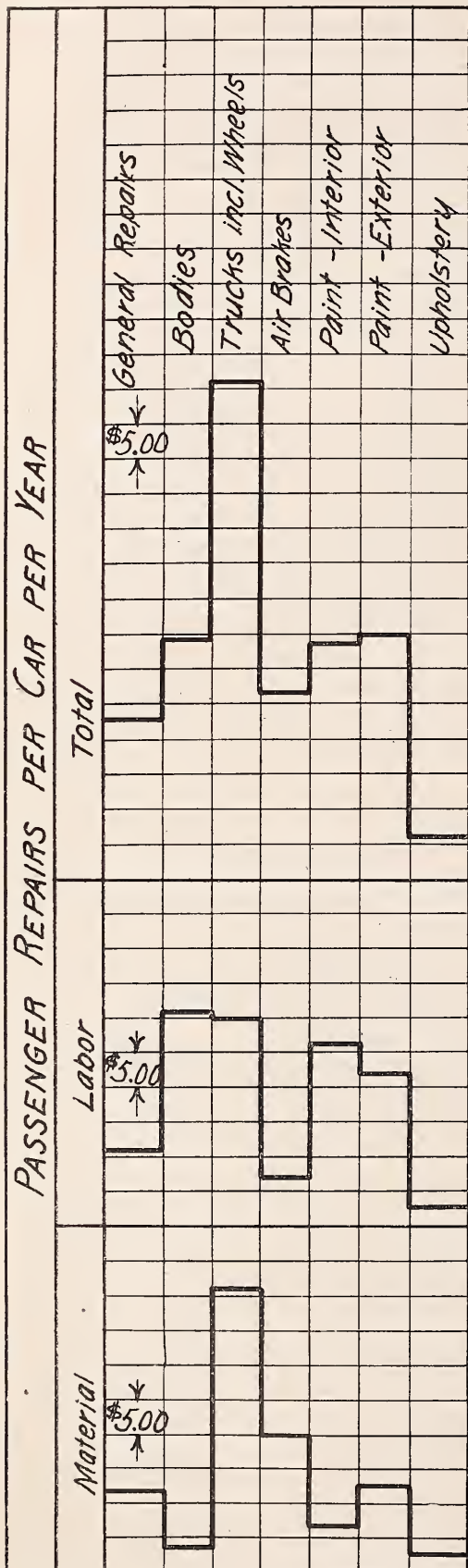
If labor and material are shown separately on the diagram, it would be readily seen which accounts are high in labor and which high in material.

A diagram of this kind would show that in the staybolt account the labor is three times as great as the material, and the conclusion would be that an improvement in the tools for applying and removing staybolts is what is wanted.

It might also show (as it has in one case) that the maintenance of staybolts costs \$26.00 per engine year, and remind the master mechanic that some change in boiler design or care of boilers would reduce the staybolt account.



GRAPHIC SHOWING OF FREIGHT CAR COSTS.



GRAPHIC SHOWING OF PASSENGER CAR COSTS.

It would also show, in freight car repairs, that the draft rigging account is 20 per cent of the entire cost of maintenance of the car, and that the material item in the draft rigging account is twice as much as the labor; that short draft timbers butting against the body bolster are twice as expensive to keep up as long draft timbers extending through the body bolsters; that trucks, exclusive of wheels, are, in the older forms, a considerable item of expense, which consists mainly of labor, and so on.

In short, the diagrams show at a glance what parts of rolling stock are expensive, by comparison, in their maintenance, a reduction of which if possible, will have the greatest effect in reducing the general average.

They bring the master mechanic or master car builder into close touch with the details of his work, and suggest lines of inquiry and investigation which would not otherwise occur to him.

The same division of accounts is applicable to roundhouse costs, and car costs at small stations, and if the pay rolls at some points are apparently unreasonably high, the detailed costs will show in which items the discrepancy lies, and lead to an investigation of the cause.

The diagrams here shown are the result of a year's experience with the method which has been described, and the division of accounts was made without sufficient care, more to test the feasibility of the scheme

than for getting accurate results the first year. Some of the accounts, such as cabs, front ends and tank frames, are abnormally high by comparison, because extensive renewals of these items were made during the year the accounts were kept.

They are all exactly as taken from the time and material sheet, however, and serve to illustrate the points which the writer has endeavored to bring out in this article.

The writer wishes to make clear the fact that the figures represented in these diagrams are not figures relating to the road with which he is connected—the Chicago Great Western. They are, however, exact figures developed in the operation of another (and smaller) road several years ago. They are given in this diagrammatic form to show the value of graphics in presenting accounts to the eye; but they incidentally, however, show up some very interesting real figures of a small road.

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## THE PRESENT CONDITION OF CAR COUPLERS.

The Interstate Commerce Commission has received the following satisfactory report regarding safety appliances on the lines of the Atchison System, at Chicago, from Mr. Chas. Hine, inspector for the Interstate Commerce Commission. The report is dated September 4, and is based on inspection at the Twelfth street yards at Chicago:

“An inspection of some two hundred A., T. & S. F. cars in this yard failed to disclose a single defective coupler. Of the fifty or more cars of other owners in the yard, five were found with defective couplers, but the car repairers were after these. One car came to yard in bad order and was to go to shop for heavy repairs, but arrangements had been made to put in new knuckle to avoid using link and pin on way to shop.

“The Santa Fe have profited by the last report of Inspector Watson. Since August 14 they have had a special inspector to look after couplers. They call him ‘the Interstate Commerce man.’ He inspects rigidly against connecting lines, who are paying heavy bills for repairs to couplers.

“This is the most gratifying condition yet found.

“It might be well to inform other roads of the good effect obtained by having a special inspector until the inspectors are educated up to the new order of things.”

## HELVE HAMMERS VS. STEAM HAMMERS.

Some time ago a mechanical engineer of note sent to us a short communication on the subject of helve hammers, as follows :

Helve hammers are calling for attention of late in some quarters. There are some mechanical department officials who have not yet learned that the best hammer that can be used for forging axles and other heavy wrought iron parts which are subjected to particularly hard service is the much despised helve hammer. Some are lamenting because they cannot replace their old helve hammers with an up-to-date steam hammer, and while this feeling is commendable; in so far as certain classes of work are concerned, the cause of the lamenting is good fortune when axles are to be made. The modern steam hammer strikes a sharp, quick blow, just the thing for rapid work on the less important forgings; but when forging axles and similar parts the hammer should rest for an instant where it strikes the metal, so as to hold for a longer interval the pieces of scrap or bar in the close proximity to which they are brought by the blow. The result sought after is to maintain for an instant the pressure on the metal so as to drive out more thoroughly the slag and give the pure metal a better chance for thorough welding. The helve hammer delays for an instant after the blow is struck and this delay makes the hammer more desirable for this class of work. The experience of some has been confined to helve hammers which are raised by the shop main shaft through the medium of a cam, or which are raised by other aggravating appliances, and such experience puts these hammers in disfavor. But a helve hammer raised by means of a steam cylinder should give satisfaction; with such hammers the delay after the blow can be regulated for such interval as is necessary for best results.

This communication we placed before several well known experts in hammer work, who comment upon the propositions above advanced as follows :

*J. A. Hughes, Illinois Central Railroad*—There are several reasons why helve hammers, which look so clumsy and take up so much shop room, are, nevertheless, preferred over the upright hammers in the working up of wrought scrap iron into slabs for various forms of forgings and the making of iron axles. First, the cost is less; second, the drip of condensed steam on the highly heated material is avoided; third, there is a wider surface to work the material on, without straining or jar-

ring the hammer. No matter where the material be placed—at the near edge of the die center or at the extreme far edge of the die, the blow falls to better advantage than it would with an upright hammer. On the other hand, with the upright hammer the nearer the hammer keeps to the center of the die the better it will be for the operator, for the forging in hand, and for the life of the hammer. A deviation from this rule results in the breaking of the piston rod and packing rings, the rapid wear of the bearing surface, causing lost motion and, often, a complete rupture of the frame itself. But this can be easily avoided by the using of ordinary common sense. I should consider it an evidence of incompetency on the part of the workman if he did not keep as near to the center of the die as his material permitted.

*John Buckley, Illinois Central Railroad*—The best hammer for making iron car axles is a question over which railway officials have recently been concerning themselves to some extent. In this line of work the helve hammer is not without merits. In a shop where iron axles are made exclusively, I consider the helve hammer preferable in many ways to the double frame hammer. It is easier to secure a heat under a beam than under a frame hammer. A heat can be swung from furnace to die of helve hammer more rapidly than to die of frame hammer. The majority of practical iron axle makers, with whom I have talked on the subject of axle making, admit that the helve hammer is preferable to the double frame hammer. There are numerous advantages and disadvantages to be met with by the axle maker which are never considered by railway officials. It is claimed that a slow blow from the hammer is necessary when making iron axles. This is true, especially if the pile from which the axle is being made should have been overheated on the outer surfaces. In making steel axles for cars and locomotives, the double frame hammer is preferred by many practical axle makers. Here the ingot from which axle is made does not require a high heat, and can afford subjection to heavy blows and working off as quickly as possible. In railway shops where but few axles are made, a double frame steam hammer, in my opinion, is preferable, as it is best adapted to all classes of railway shop work.

*George F. Hinkens, Westinghouse Air Brake Co.*—Your contributor claims that the helve hammer delays for an instant after the blow is struck; that it maintains for an instant the pressure on the metal, so as to drive out more thoroughly the slag and give the metal a better chance for welding. In so far as slag is concerned, a certain amount is neces-

sary and acts as a flux. Excessive slag is thrown off in making the slabs preparatory to forging the axles. As to sufficient time not being allowed under the steam hammer for the metal to weld, on account of sharp, quick blows, etc., in my opinion this is not the fact. In operating upon heated materials the work should be done as quickly as possible, because of the cooling of the bar or axle. The idea is to have the hammer of sufficient weight to affect the center of the metal as much as the outside, and when this is accomplished the hammer need not rest for an instant in order to hold the pieces of scrap or slabs. The metal being in a proper state of fusion, a force of blow sufficient to penetrate the center is all that is required. As the pressure after the blow is struck is as nothing compared to the force of the blow, it will not prevent the metal from separating. In a word, the metal particles once united will not need any pressure to hold them together.

*A Railway Master Blacksmith.*—If a pile from which an axle is to be made is properly heated, the more rapid the manipulation is, so long as the iron remains hot enough to weld, the better will be the results. So far as expelling the slag is concerned, it will be as effectually done by rapid hammering as by the squeezing process; but in either case, the welding should be done on flat dies. If a pile is brought from the furnace to the hammer at proper heat, and placed immediately in swedge dies and worked to the required size, the slag has not as good an opportunity of escape as it has if flat dies are used for the first few blows, then finished in swedges.

*A Prominent Builder of Power Hammers.*—We never before have met such a question as put forth—that a slow, hesitating blow would displace slag held in a pile, to a greater extent than a rapid blow. We are not prepared to state it may not be the case, but if so it is unknown to us.

*H. F. J. Porter, Bethlehem Steel Co.*—It is not without a sense of sincere sadness that, after reading what your correspondent has to say about helve hammers, I appreciate how little, in these days of modern methods, can be said of old friends who, no matter how well they served their purpose in their prime, have long ago outlived their usefulness. It would seem to me wise when there is so little to say in favor, it would better remain unsaid, for it only “damns with faint praise.” There is really nothing said which is not equally applicable to the drop-hammer, or that type of steam hammer which has no top steam. If top

steam is added to the steam hammer, the "delay" referred to can be made to last as long as desired after the delivery of the blow, but as top steam can also be added to the helve hammer, the latter will do the same thing, and honors again are easy. The helve hammer is, to my mind, one of the best illustrations of the slow development of the inventive faculty in man. The earliest traces of the metal workers' craft are hidden in the prehistoric past, and the earliest tool was the uplifted hand, enclosing a rock. Man is an imitative animal, and the helve hammer is only a natural development through the sledge and hand hammer from the earliest tool. All these implements served their purpose amply and well in the days of small work, and especially for wrought iron forgings, but they, as well as their successors—the drop and steam hammers—have now been superseded by the forging press, which meets the demands of modern developments in the iron and steel industry. In this tool there is no "delay" after the plunger has reached the surface of the metal. It keeps right on doing its work, and the force applied is just as powerful at the end as at the beginning of the stroke. The molecules of the metal require a certain amount of time to flow, and the requisite pressure should be maintained throughout this period. Thus, the force applied by the press is felt throughout the mass, and is not dissipated in the surface metal as is the impact of all hammers. But the steam hammer, which first encroached on the domain of the helve hammer, is only half a century old, and after hundreds of years of custom man harks back by heredity from sheer inability to break away altogether from what has been established. From this point of view I am glad to hear once more a voice, weak though it be, calling out of the past not to forget our once faithful servitor, the helve hammer. With its pioneering blows, and those of its predecessors and successors, was beaten the anvil chorus which inaugurated the grand opera of our modern civilization. Let us, by all means, listen to this last faint whisper in its praise, and, though grieving through fond recollections of its glorious past, that it can no longer hold its own in the mighty rush of progress, lay it on that shelf in the museum which illustrates the history of the iron trade, and pass on, all the more appreciative, to contemplate the superior methods of its modern representative in the development of the great steel industry—the hydraulic forging press.

## COMMUNICATION.

## "A STUDY IN INDICATOR CARDS."

NEW YORK, September 18, 1900.

*To the Editor of the Railway Master Mechanic:*

In the RAILWAY MASTER MECHANIC for September appears a communication from Mr. Ira C. Hubbell, headed "A Study in Indicator Cards." Comments there made are based primarily upon indicator card No. 3, as reproduced from "Rehabilitation of the Piston Valve," earlier published in your journal. Mr. Hubbell's intent was, doubtless, to qualify the value of the indicator diagram referred to, and others which he has produced, rather than to disqualify the writer of the piston valve matter. The choice of expression is therefore to be regretted, wherein reference is made to "the person who has had experience in stationary practice." The stationary work of the writer of the article quoted occupied several years, previous to his acquaintance with locomotive building.

The card No. 3 not only may be, but is, a fair or even good locomotive card, as cards are obtainable from uninterrupted, non-supplementary, shifting-link valve gear. The manner of its endorsement was therefore carefully considered. To compare, offhand, a locomotive card with a stationary card is as valueless as to compare, for relative contour, a pump cylinder water card with a steam cylinder diagram. All mechanics recognize and freely admit the extravagances of the ordinary locomotive valve gear as part of the price that is paid for ready mobility of the locomotive in reversing its action.

The diagrams showing comparative effects of constant and of interrupted valve motion, are interesting. When obtained under identical running conditions they are of value. The omission of minutest data in making such comparison is always to be regretted, however, and detracts much from the value of the matter. The particular valve gear referred to has much to recommend it to careful consideration and trial.

Yours very truly,

R. F. HOFFMAN.

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\* The article on the "Boxers," in the September *Open Court* is doubtless the most authoritative statement of the origin of the Chinese troubles that has yet been published in English. Dr. Candlin, its author, is a Christian missionary of wide Oriental experience, an authority on the Chinese language and literature, and has resided for many years in the remotest parts of the Flowery Kingdom. He has been latterly in the far north of China, which for some years past has been the seat of violent Boxer disturbances, and just managed to escape to Japan, via Tientsin, on the eve of the present outbreak. His article is accompanied by illustrations from native Chinese newspapers, and translations of Boxer placards.

# A SCHEDULE FOR APPRENTICES.\*

BY GEO. R. HENDERSON.

Of late years considerable attention has been paid to manual training for young men, and various papers have been presented on the schedule of shop experience for apprentices. These have been well planned, and if carried out as intended, the proteges of our shops would be desirable mechanics at the end of their apprenticeship. As a certain tropical locality (familiar in name to many of our members) is said to be "paved with good intentions," so, also, in many cases the apprenticeship system is typically planned, but in the ordinary rush of work the detail arrangements are overlooked, and the boys are left to the tender mercies of some foreman, who may not take any particular interest in their welfare, or if he does, will often find it convenient to permit a good machine hand to remain too long on that side of the shop, feeling that he is getting better results from him in that capacity than if on the floor or bench.

If the apprentices could be sent around to the various departments by one person, whose duty it was to watch this branch of the work, it could be better handled; but changes occur in the personnel of the heads of departments, and with every change the learners suffer.

In order to prevent injustice to the young men fitting themselves for mechanics, foremen and other officers, the Chicago & Northwestern has in force in its Chicago machine shops a system especially devised to obviate the above mentioned difficulties.

Two classes of apprentices are taken—regular and special. The first are those who have had but a common school education, and are taken on for a four years' course. The latter are those who have had a technical education, and these are received for three years.

They have the following course allotted to them:

## REGULAR APPRENTICES.

Tool room.....	3 months.
Machines .....	15 "
Erecting floor.....	12 "
Rod and vise .....	6 "
Laying off.....	3 "
Drawing room.....	6 "
Test work.....	3 "

\* A paper read at the September meeting of the Western Railway Club.

SPECIAL APPRENTICES.

Machines.....	9 months.
Erecting floor.....	12 “
Rod and vise.....	6 “
Drawing room.....	6 “
Test work.....	3 “

At the end of their time a certificate is given them, which reads as shown below :

CHICAGO & NORTHWESTERN RAILWAY CO.

DEPARTMENT OF MOTIVE POWER AND MACHINERY.

CERTIFICATE OF APPRENTICESHIP.

.....  
 Has served an apprenticeship as.....  
 In the shops of this company at.....  
 During the period from.....to.....

WORK ON WHICH EMPLOYED.

TIME EMPLOYED.	KIND OF WORK.
.....	.....
.....	.....
.....	.....
.....	.....

OFFICERS UNDER WHOM EMPLOYED.

NAME.	TITLE.
.....	.....
.....	.....

General Record of Apprentice.

.....  
 Chicago, Ill., ..... Supt. M. P. and Machinery.

This is printed in old English letters on bond paper, and blue prints can be made from same, if they desire to show their credentials to prospective distant employers.

C. & N.-W. RY. SCHEDULE OF WORK FOR CHICAGO SHOPS  
MACHINIST APPRENTICES

Year	1900				1901				1902				1903				1904		
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Quarter	S.T.	T.	Y.																
Tool Room																			
Machines	*M.A.H. K.I.B.N. O.P.Q.R. *B.*A.	S.K.N. O.P.Q.R. *B.*A.	F.I.J.K. N.O.P.O. R.S.T.V. W.X.Y.	F.I.J.O. R.S.T.V. W.X.Y.	F.J.O.R. S.T.V.Y. W.X.Y.	S.T.V.	T.Y.	Y.											
Erecting Floor	D.I.J.C. F.	C.D.F.G. H.J.	C.D.E.G. H.U.	C.D.E.G. H.K.N.P. U.	E.G.H.N. K.P.U.	E.K.N.O. P.R.U.V. W.	K.N.O.P. R.S.V. T.V.W.	O.P.R.S.	O.R.S.T. V.V.	T.X.Y.	T.X.Y.	X.Y.	X.						
Rod and Vise	E.G.	E.			D.I.	†J.X.	U.X.	K.N.	†N.P.	P.R.V.	O.R.S.	S.T.W.	T.W.Y.	†V.Y.					
Laying Off						†I	U.		K.	O.	P.	R.	S.	T.	Y.				
Drawing Room				Q	*C.Q.	*D.G.H.	*F.H.	X.	U.X.	K.U.W.	K.V.W.	O.P.V.	O.P.	R.S.	*R.S.	*T.V.	Y.		
Test Work						*Q.F.	*E.*G.	*H.	W.	X.	U.	*K.	R.V.	*O.*P.	T.	*S.	*V.		

NOTE:—\* Regular apprentice out of time. † Special apprentice out of time.

It will be noticed above, that each portion of time is a multiple of three months, or a quarter of a year. The method of assigning the apprentices is illustrated by the attached sheet. This is ruled off into squares—seven longitudinal lines, one corresponding to each branch of work, and four vertical lines to each year, each thus constituting a quarter, or three months. The regular apprentices are taken on only on the first of January, April, July and October. When one is employed an index letter is given him on the record, and his whole course is mapped out ahead for him, by putting in the proper squares his letter, allowing the time assigned to each department. By this method one can tell at a glance where any of the boys should be at any time, and how many will be at one time in any department, thus preventing congestion at one period and vacancies at another.

Let us follow apprentice designated by letter "S." Taken on Jan. 1, 1900, he spends one quarter (or three months) in the tool room, handing out tools; five quarters on machines, commencing April 1, 1900; four quarters on the floor, from July 1, 1901; two quarters on rod and vise work, beginning July 1, 1902; one quarter laying off, from Jan. 1, 1903; two quarters in drawing room, and one quarter on test work, finishing his time Dec. 31, 1903. This arrangement always gives a boy to hand out tools, and will keep a uniform number constantly in each department; besides, having fixed periods for changing, the matter is not likely to be forgotten.

Special apprentices are taken on July 1 for the three years' course, on account of finishing their school term in June, and these can be distributed among the squares to give them their full time, but not get too many together. The congestion noticed on the machine side during 1900 results from a necessary assignment of young men taken on before this scheme was put into force.

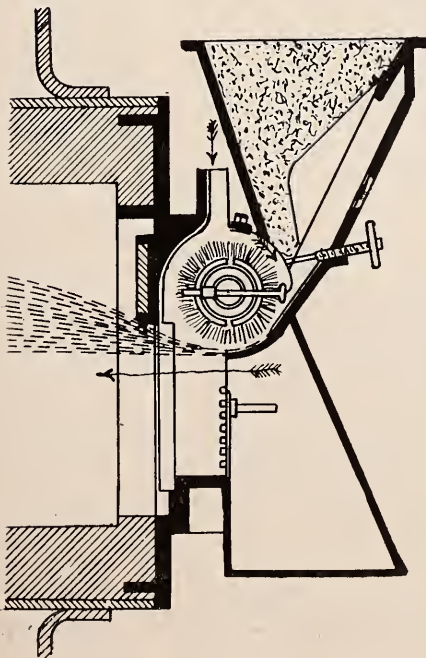
In regard to the drawing room work, the apprentices are given to understand that if they study the principles of mechanical drawing, either by night classes or a correspondence school, they will be given an opportunity to obtain the valuable experience to be gained by a sojourn in this department, but it is made plain to them that we will not "teach" them to draw. They are encouraged to spend their spare time in study, and suggestions for a course in drawing, or mechanical engineering regarding instructions, books, etc., are gladly given any who take enough interest to help themselves. If, however, their opportunities are neglected, and when the time comes for them to go to the drawing room, they have made no effort to prepare themselves, they will be sent

back to the shop at once. Care is taken, however, to keep them posted as to when they are due in that department, and they are advised to prepare themselves for it. Some of the young men seem to appreciate the advantages offered in this direction, and on the whole we believe it to be a benefit in encouraging earnestness in work.

Of course, these plans are not entirely unselfish on the part of the company, as we desire to have thorough mechanics who will be eligible for promotion, and some of our most promising foremen of the present day are those who have gone through the course in our shops. We look to these for prospective master mechanics. The whole scheme has been outlined with the idea of giving every opportunity for the apprentice to develop into a valuable mechanic, and later on an officer of the railway, provided he has the necessary qualities in him.

## POWDERED COAL FOR FUEL.

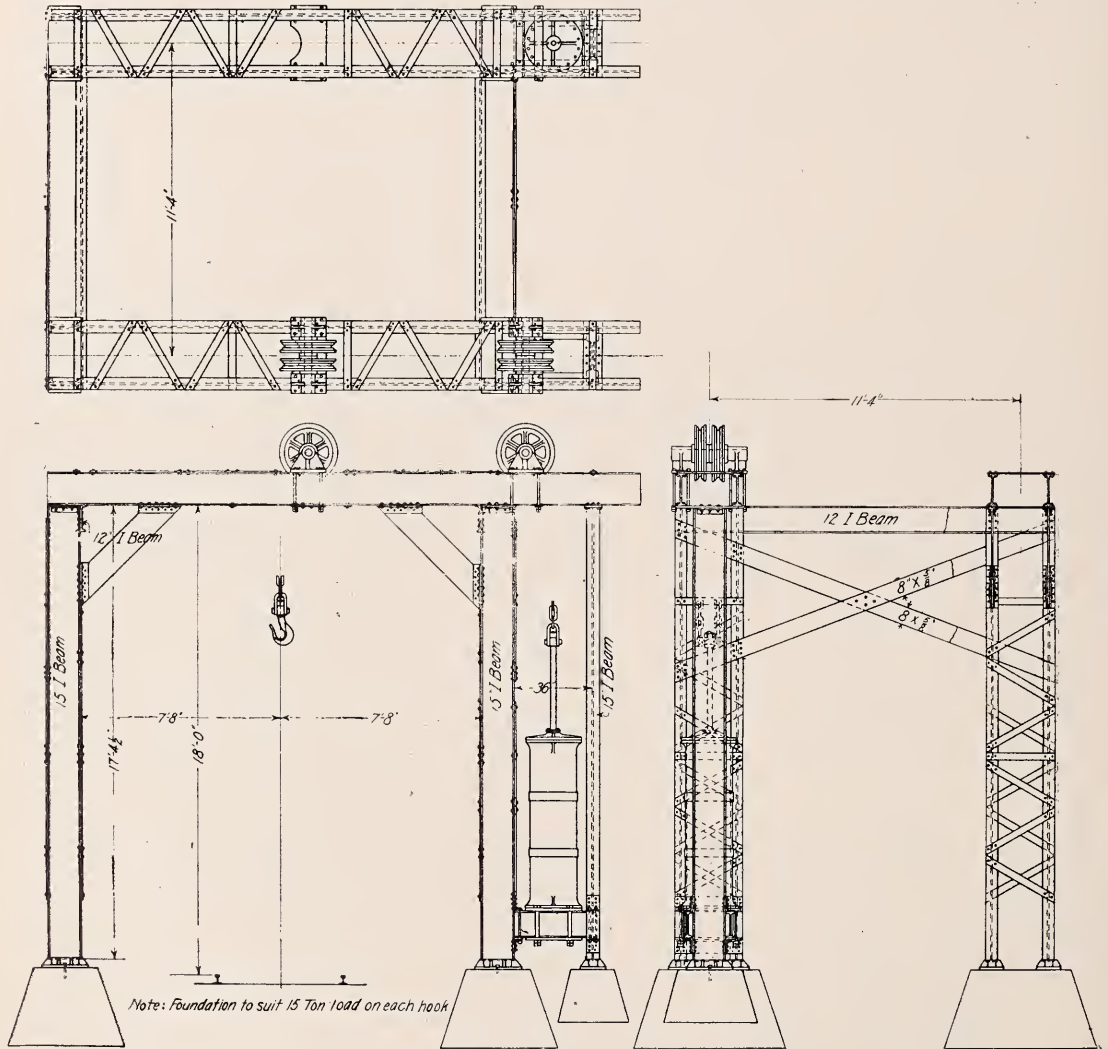
The Illinois Central Railway is experimenting at its power house at 14th street, Chicago, with a device for burning powdered coal under stationary boilers. We give a rough sketch of the appliance used. It consists simply of a hopper for the coal dust, placed over the fire door. An automatic shaker jars the dust down to contact with a revolving steel bristle brush. The brush, which is cylindrical in form, and about 18 inches long and 6 inches in diameter, revolves at about 800 revolutions per minute, and throws the dust into the fire box, as shown in the sketch.



The shaker consists of simply an arm set eccentrically upon the shaft of the brush, and which at each vibration taps the thin back sheet of the hopper, thus jarring the dust down to the pocket in which the brush revolves. A set screw varies the size of the opening at the bottom of the hopper. The brush is at present operated by a small stationary engine.

Results so far have been satisfactory, and point to the successful use, in this manner, of cheap fuel. The coal may be powdered in any convenient way. The combustion is simply perfect, the "spray," if it may be so called, of

coal dust, of course immediately bursting into white flame within the box. There is as yet no appreciable residue noted on grates or in flues, and the combustion is practically smokeless. The possibilities of this device are considered very alluring. There has been some thought about adapting the device to use on locomotive furnaces, but as yet nothing in that direction has been done.



## LARGE AIR HOIST FOR HANDLING HEAVY MATERIAL, C., R. I. & P. RY.

A modern storehouse for the large railways presents a great many points of interest, and the systematic and economical handling of incoming and outgoing material is one of the many problems confronting the storekeeper.

For some time the need of a hoist for loading and unloading boilers,

tender tanks and other heavy pieces quickly and safely was keenly felt by the officials of the Chicago, Rock Island & Pacific, and with the concerted efforts of Mr. J. R. Mulroy, general storekeeper of the road, and the mechanical department, the air hoist herewith illustrated was erected.

As seen by the illustrations, the hoist consists of four columns, with cross girders, the whole made up of I beams (scrap from old bridges) connected with suitable angle plates and braces. The cylinders are  $19\frac{1}{2}$  inches in diameter and allow a lift of about 6 feet. In order to avoid unusual dimensions of chain, a 1 inch short linked chain is run in pairs over the cast iron guide wheels. The piston is made from the same pattern as for the  $19\frac{1}{2}$  inch cylinder engines, but provided with leather packing. Each cylinder is independent of the other, but the starting valve handles are so located that the operator controls both at the same time. In raising a boiler, for example, more weight is likely to come on one cylinder than on the other; but by allowing a different pressure in the two cylinders, the movement of the load will be uniform.

With an air pressure of 100 pounds, each cylinder will raise about 15 tons, or 30 tons with the two.

We are indebted to Mr. Geo. F. Wilson, superintendent of motive power and equipment, for this information and the blue prints from which our engraving is made.

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## SOME FACTS ABOUT AMERICAN RAILWAYS.

From summaries which appear in the Twelfth Statistical Report of the Interstate Commerce Commission, prepared by its statistician, being the complete report for the year ending June 30, 1899, the following facts and figures are taken, as being of particular interest to the mechanical departments:

### *Equipment.*

There were 36,703 locomotives in the service of the railways on June 30, 1899, or 469 more than the year previous. Of the total number reported, 9,894 are classed as passenger locomotives, 20,728 as freight locomotives, 5,480 as switching locomotives, and 601 are not classified.

The total number of cars of all classes in the service of the railways on June 30, 1899, was 1,375,916, an increase of 49,742 being shown in

this item. Of the total number, 33,850 are assigned to the passenger service, 1,295,510 to the freight service, and 46,556 to the direct service of the railways. It should be understood, however, that cars owned by private companies and firms, used by railways, are not included in the returns made to the commission. The report under review contains summaries intended to indicate the density of equipment and the extent to which it is used. It appears that the railways of the United States used on the average 20 locomotives and 734 cars per 100 miles of line; that 52,878 passengers were carried, and 1,474,765 passenger miles accomplished, per passenger locomotive; and that 46,303 tons of freight were carried, and 5,966,193 ton miles accomplished, per freight locomotive. All of these items show an increase when compared with corresponding items for the preceding year ending June 30, 1898. There was also a decrease in the number of passenger cars per 1,000,000 passengers carried, and a decrease in the number of freight cars per 1,000,000 tons of freight carried.

Both locomotives and cars being embraced in the term equipment, it is observed that the total equipment of the railways on June 30, 1899, was 1,412,619. Of this number 808,074 were fitted with train brakes, the increase being 166,812, and 1,137,719 were fitted with automatic couplers, the increase in this item being 228,145.

Practically all locomotives and cars in the passenger service were fitted with train brakes, and of 9,894 locomotives assigned to that service 6,128 were fitted with automatic couplers. Nearly all passenger cars were fitted with automatic couplers. With respect to freight equipment, it is noted that nearly all freight locomotives were equipped with train brakes and 45 per cent of them with automatic couplers. Of 1,295,510 cars in the freight service on June 30, 1899, 730,670 were fitted with train brakes and 1,067,338 with automatic couplers.

#### *Employes.*

The number of persons employed by the railways of the United States, as reported on June 30, 1899, was 928,924, or an average of 495 employes per 100 miles of line. As compared with the number employed on June 30, 1898, there was an increase of 54,366, or 21 per 100 miles of line. From the classification of these employes it appears that there were 39,970 enginemen, 41,152 firemen, 28,232 conductors, and 69,497 other trainmen. There were 48,686 switchmen, flagmen, and watchmen. Upon the basis of special returns made to the secretary of the commission, it appears that the number of switchmen, flagmen, and

watchmen included in this aggregate could fairly be assigned in the proportion of 6, 3, and 2, respectively.

Disregarding 9,334 employes not assigned to the four general divisions of employment, it is found that the services of 34,170 employes were required for general administration, 287,163 for maintenance of way and structures, 180,749 for maintenance of equipment, and 417,508 for conducting transportation.

The report contains a statement of the average daily compensation of eighteen classes of employes for eight years, beginning with 1892. A summary in the report also gives the total compensation of more than 99 per cent of railway employes for the fiscal years 1895 to 1899. During the year ending June 30, 1899, \$522,967,896 were paid in wages and salaries, an amount \$77,459,635 in excess of that paid during 1895. The compensation of the employes of railways for 1899 represents 60 per cent of their operating expenses, and 40 per cent of their gross earnings.

#### *Railway Accidents.*

The total number of casualties to persons on account of railway accidents during the year ending June 30, 1899, was 51,743. The aggregate number of persons killed as a result of railway accidents during the year was 7,123, and the number injured was 44,620. Of railway employes, 2,210 were killed and 34,923 were injured during the year covered by this report. With respect to the three general classes of employes, these casualties were divided as follows: Trainmen, 1,155 killed, 16,663 injured; switchmen, flagmen and watchmen, 273 killed, 2,992 injured; other employes, 782 killed, 15,268 injured. The casualties to employes resulting from coupling and uncoupling cars were, persons killed, 260; injured, 6,765. The corresponding figures for the preceding year were: killed, 279; injured, 6,988.

The casualties from coupling and uncoupling cars are assigned as follows: Trainmen, killed 180, injured 5,055; switchmen, flagmen and watchmen, killed 74, injured 1,533; other employes, killed 6, injured 177. The casualties resulting from falling from trains and engines are assigned as follows: Trainmen, killed 337, injured 3,053; switchmen, flagmen and watchmen, killed 60, injured 377; other employes, killed 62, injured 540. The casualties to the same three groups of employes caused by collisions and derailments were as follows: Trainmen, killed 280, injured 1,713; switchmen, flagmen and watchmen, killed 14, injured 115; other employes, killed 40, injured 325.

The number of passengers killed during the year was 239, and the

number injured was 3,442. Corresponding figures for the previous year were 221 killed and 2,945 injured. In consequence of collisions and derailments, 82 passengers were killed and 1,557 passengers were injured during the year embraced by this report. The total number of persons, other than employes and passengers, killed was 4,674, injured 6,255. These figures include casualties to persons classed as trespassers, of whom 4,040 were killed and 4,730 were injured. The total number of persons killed at highway crossings was 693, injured 1,125, distributed as follows: Employes, 19 killed, 38 injured; passengers, 2 killed, 17 injured; other persons trespassing, 170 killed, 168 injured; not trespassing, 502 killed, 902 injured. The number of persons killed at stations was 443, injured 3,306. This statement covers: Employes, killed 83, injured 2,139; passengers, killed 37, injured 580; other persons trespassing, killed 282, injured 444; not trespassing, killed 41, injured 143. The summaries containing the ratio of casualties show that 1 out of every 420 employes was killed and 1 out of every 27 employes was injured. With reference to trainmen—including in the term engine-men, firemen, conductors, and other trainmen—it is shown that 1 was killed for every 155 employed, and 1 was injured for every 11 employed. One passenger was killed for every 2,189,023 carried, and 1 injured for every 151,998 carried. Ratios based upon the number of miles traveled, however, show that 61,051,580 passenger miles were accomplished for each passenger killed, and 4,239,200 passenger miles accomplished for each passenger injured.

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## THE MANUFACTURE OF STEEL CARS.\*

BY S. B. ELY.

Pressed steel, as we know it today, being quite a modern invention, it may be of interest to hear some of the details of its manufacture. I propose to talk on the processes and means of handling pressed steel in the construction of an all steel railway car, particularly as done by the Pressed Steel Car Company of Pittsburg.

The steel, after coming from the steel yard, goes into the shearing department, then to the pressing department, then to the punching department, and then into what is called the construction department. In this department the floors, ends and sides of the cars are assembled

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\* Abstract of paper read before the Engineers' Society of Western Pennsylvania.

and riveted together, all the machine rivets being driven here. Then these parts go into the erection shop, where they are fitted together to form the car and finally hand riveted.

In the shearing department are shears of various sizes, kinds and capacities. However, most of the work is that of shearing plates, which seldom run thicker than  $\frac{3}{4}$  of an inch. The special feature of this department is the various odd shapes that have to be cut, and many problems arise of laying out on a flat surface the shape of a complicated pressed piece. This will require some modification of the ordinary way of developing solids as given in text books on descriptive geometry, due to the stretching of the piece, especially when the piece is to be pressed hot. These shapes involve many special shear knives, made with proper curves and offsets, as many of the cuts are impossible on the ordinary shear. Some pieces, after pressing, are trimmed by the shears, but a very great number are of such shapes that it is impossible to do this after once being pressed. Hence, you can see the importance of getting the flat blank correct to start with. In the Fox Pressed Steel Company Works, in England, I noticed that they had several special machines and heads for shearing pressed shapes that the ordinary plate or angle shears would not catch. This, however, is an unnecessary operation, even from a standpoint of looks, as these pieces so trimmed were not seen when in position on the car, and illustrates the fact that the English devote more time to the finish of machinery than we here in America think necessary.

In the pressing department, which is perhaps the special feature of the business, there are presses of all sizes and capacities, from 30 or 40 tons up to 800 tons. You are all familiar with the action of these presses, which are worked entirely by hydraulic pressure. Most are built by Bement, Miles & Co., and consist essentially of four upright columns set in a heavy iron foundation, at the top of which in a horizontal position is the top plate of the press; and against this comes a movable bottom plate, the piece to be pressed lying between the two. Very important factors in pressing are the dies or forms between which the piece is shaped. These dies are always made in two portions, the upper half being bolted to the top plate of the press and the lower half to the bottom. Naturally, from the work done, these dies vary in size from the small ones of a few inches to ones that measure 10 or 15 feet; most of them are made of cast iron, and many have hard steel wearing strips that can easily be replaced when worn by the rubbing of the pressed pieces. It is hard to say what the best metal for a die would

be, but I suppose some alloy will some day be found that may combine the necessary properties.

Some of the work done on these presses is done with the piece cold. Other shapes are such that it is impossible not to tear the piece unless it has been heated to a red heat. Some shapes are such that two, three or more pressings by different dies are necessary; each operation bringing the piece a stage nearer the shape desired. In hot work the dies will, of course, expand and contract with heat; a die 8 feet long will expand something like  $\frac{7}{8}$  inch, and it is of course necessary that the dies be at the proper temperature, independently of what may be the temperature of the piece; so that here comes in a little complication, and this point must be watched closely in order to obtain satisfactory results.

Another point in this connection, which I alluded to when speaking of shearing blanks, is the stretch of the pressed piece. The best way to make this clear will be to take an example of a piece of the shape of Fig. 1.

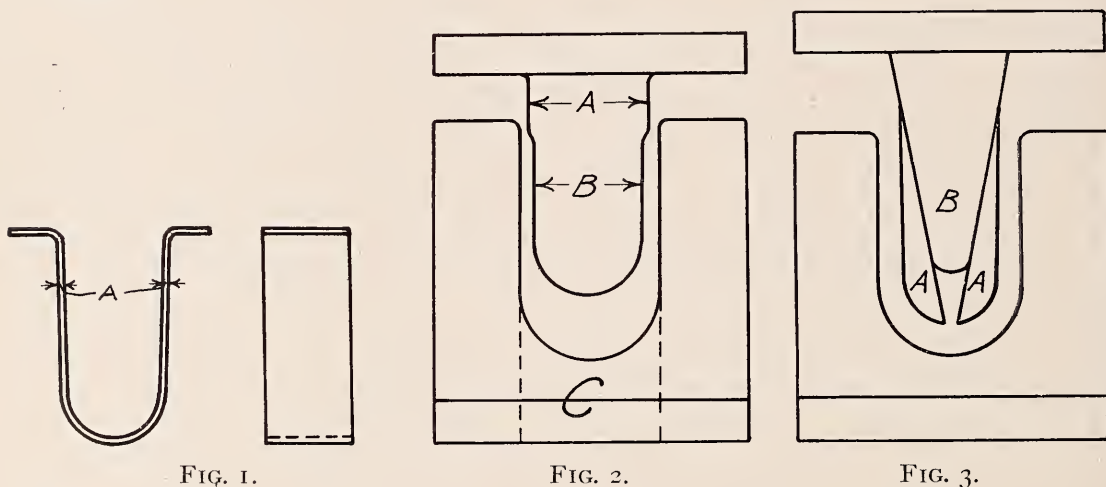


FIG. 1.

FIG. 2.

FIG. 3.

The steel used in this piece is  $\frac{3}{4}$  inch thick, with a width of 6 inches. At the point shown by the dimensions A, the thickness will be diminished about  $\frac{1}{16}$  inch; and as you caliper down from this point the thickness gradually increases to  $\frac{3}{4}$  inch. The top flanges will show no appreciable stretch. The total length of the steel—about 60 inches—will stretch about 4 inches; so that the piece will be cut 4 inches shorter than the figured length would indicate.

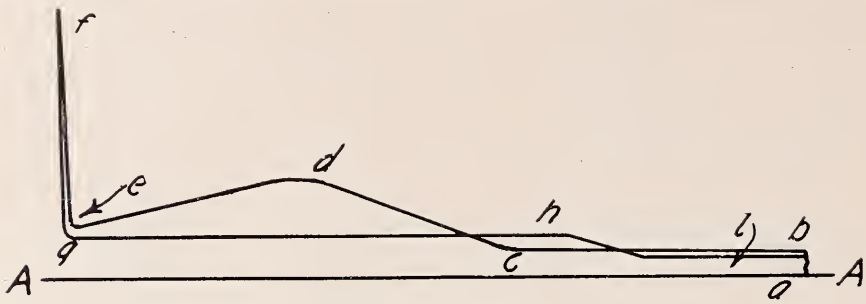
The sketch, Fig. 2, shows the outlines of the top and bottom dies; the top die has an increase in width of  $\frac{1}{8}$  inch at A over that at B, otherwise there would be a hump at these points on the inside of the pressed piece. The lower dies' sides are of course straight.

There is often trouble with the pressed pieces sticking to the dies and giving a distorted piece after it is pried out with pinch bars. On all large presses a false bottom is employed to overcome this. This is a movable piece for the bottom of the lower half of the die; and in Fig. 2 the dotted lines shown on the lower die would represent the sliding surfaces; the whole portion C, raising and thus pushing out the piece. This is actuated by a small piston inside the large piston of the press. Thick oil is also a help and has the advantage of saving the wear on the die; and also in hot work it burns on the piece, helping to keep the proper temperature while the piece is being adjusted to the gauges. Sometimes dies are constructed as shown in Fig. 3, still using the same shape already shown as an example. The upper portion of the die is made in three pieces, the portions A sliding on B; the wedges thus release as soon as the press is lowered.

Presses are also much utilized for gang punching, shearing and slotting. In these operations the same methods are pursued, the dies being constructed to hold punches or shear knives. Many odd shaped blanks are cut out complete at one stroke; it would be hard to say what maximum number of holes could be punched at one stroke; but if the punches are made in different lengths it allows an even distribution of pressure throughout the stroke. Thus, by proper adjustment of this lead of one punch over another, according to the number of punches used, the maximum capacity of the press can be reached. The same may be said of the shearing, the proper angles being given to the knives.

If an ordinary steam engine indicator, with the proper reducing valve, be attached to the cylinder of the press, and a rig attached to the movable press plate, the accompanying card diagram (see next page) will show the general results obtained when a single straight flange is turned up on a plate.

The line A A is the atmospheric line, and the height  $a b$  shows the pressure required to lift the press, and with it the lower die and plate to be pressed on it. From  $b$  to  $c$  the press is steadily moving upward, and at the point  $c$  the material is engaged between the dies. From  $c$  to  $d$  the piece is being flanged,  $d$  being the point where the flange has gone through  $45^\circ$ ; this, of course, will be the maximum pressure required, and from here on the pressure falls to  $e$ . At  $e$  the two dies come together, and the full accumulator pressure is obtained, thus carrying the line to  $f$ . The moment the press is released the pressure falls to  $g$  and the press runs down to the point  $h$ , the line  $g h$  being at a greater pressure than  $a b$ , for at this time the false bottom is forcing the piece out of the die,  $h$  being the point at which the false bottom valve is closed. The



CARD FROM PRESS.

line  $l$  then returns to  $a$ , the press falling under the action of gravity; and the line  $l$  being slightly lower than  $c b$  as the exhaust water's friction in the pipes is overcome by the weight of the press only. From a study of this card it will be seen that the high pressure at  $f$  was not a necessary condition to do this work; that at  $d$  being all that is absolutely required. By practice and experiment it has been found that while some pieces of pressed work will require the full accumulator pressure, a very large number do not, as in the example taken above. Consequently, if a device can be obtained by means of which we can obtain a higher pressure than the accumulator has, it will be a saving in many ways. This is done by means of an intensifier under the press, operated on the principle of differential areas. To go back to our indicator diagram,  $d$  would represent the accumulator pressure and  $f$  the pressure after the intensifier has been thrown in. The theoretical gain will be immediately apparent, for in one case the steam pumps must keep the water pressure constantly at  $f$ , while in the other the accumulator will always be up at the pressure shown at  $d$ . Other advantages in the way of having less pressure on the main pipe lines, less friction, etc., are readily seen.

Leaving the pressing department the steel goes to the punches. Some few special machines are used, but mostly the ordinary single punch. The templets by which the position of the hole is marked on the piece are of the ordinary bridge type, and made generally of wood. As there must always be slight variations in pressed pieces, the ideal templet would be a flexible one that would fit the piece closely under all conditions. If a material could be obtained like fairly hard rubber it would be just the thing. Attempts at hinging and jointing templets have so far not proved very satisfactory.

The riveting machines used are of all sizes, shapes and kinds. The greater number are actuated by hydraulic power, but air is also used. Many pneumatic hand riveters, chippers, reamers, etc., are necessary.

This department is nearest to bridge work, with the machines closely spaced and plenty of overhead cranes.

In the erecting shop the large parts of the cars are fitted together by night and riveted by day, a gang leader and gang being required to fit a certain number of cars ready for the gang and leader who come on in the morning to do the riveting; thus taking twenty-four hours to complete a car. I might state here that all work of all descriptions is done by piece work throughout the whole plant.

The cars lastly go into the paint shop for brake equipment, door adjustment, etc. The plant requires many additional departments, such as the truck shop, axle and wheel shop, pattern, machine and blacksmith shops; all supplying various parts but none of which contain any specially novel features.

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## NATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.

At Detroit, September 18 to 21, the National Railroad Master Blacksmiths' Association held its annual convention. The sessions were well attended, and the work was good. Following is an abstract of the report and papers presented:

A committee, consisting of D. B. Swinton, John Buckley, John C. Frost and J. W. Rilley, presented a report on

*Best Methods of Making and Repairing Locomotive Frames,*

the substance of which follows:

Briefly, previous committees have arrived at the following conclusions:

The selection of clean scrap and manner of piling same.

The reducing of pile to slabs, cutting, reheating and double hammering.

Making slabs in various ways.

Since the last decade, or thereabouts, locomotives have attained such dimensions that it has become more and more difficult for the forgerman and the smith to make satisfactory frames, one of the principal reasons for this being that it is much more difficult to produce large masses of forgings that are sound; but it is infinitely more difficult to weld these large masses in a satisfactory manner, even with the most approved methods of handling and by the use of the steam hammer for welding.

One radical defect in the forged frame is, that the grain of the iron in the leg and in the back are at right angles, and a continuous fibre is impossible to attain. In order to overcome this defect to some extent,

we have welded the leg in with a male and female scarf, some firms putting the scarf across the frame, but generally lengthwise. These systems, however, induce so many failures on the road with which the chairman of this committee is connected, especially in frames which were designed with two extension arms to carry the cylinders; and there were so many cases of the lower arm being broken off at its junction with the front leg, that it was finally decided to make the front leg and lower arm in one piece, by forging them together under the hammer with a common scarf, in the same way that a carpenter "half laps" two pieces of timber and screws them together. In this manner the grain of iron runs from end to end. This succeeded so well that it was decided to follow the same method in welding the piece thus made to the frame back. The back was forged at this point sufficiently thick to allow it to be scarfed down, and, the leg being scarfed to suit, they were welded under the hammer.

Speaking generally, your committee would recommend that all welding should be done under steam hammer, the edges of scarf to be thoroughly welded with a wash heat by hand.

With regard to the system of putting in the lower braces, no better method has been devised than the old reliable "V" weld. It may be advisable here to remark that the first "V" should go about three-quarters through the frame, and should be welded under steam hammer, and the other "V" should cut out cleanly the point of the first "V." These "Vs" should have an angle of about 90 degrees, so that the point of the "V" has a good chance of welding solidly.

Your committee has also taken up the subject of cast steel frames. We find that ten out of the twenty-five roads to which we addressed inquiries are using cast steel frames, five of which have been using them for some years and report very favorably, and state that the cast steel frame can be repaired as easily as wrought iron. The other five roads have not been using cast steel frames long enough to form any opinion as to the relative advantages of the material in question.

Your committee is of the opinion that it would be of very great value to induce some of the members to make an experiment with two pieces of cast steel frame, welded with a male and female or "V" weld, and then let it be subjected to the drop test, in comparison with two pieces of wrought iron frame of the same size and welded in the same manner. It is, perhaps, doubtful whether the "V" weld would prove satisfactory, though the common scarf weld might do so.

Mr. A. W. McCaslin presented a paper on

*Piece Work and Day Work,*

of which the following is the substance:

The piece work system is not the only just or equitable one, if it deserves credit at all. It generally kills the man by his overreaching his limit of endurance. It abuses material, and produces an inferior article.

In some cases the piece work system may be all right, that is, work made on presses, bulldozers, etc., "machine made work," but in the general run of blacksmithing proper, I think it wrong. All things being equal—material, tools, fuel, etc.,—any article made in a blacksmith shop by the hour or day should not cost any more than the same article produced by the piece work system. The following is my argument: I have a blacksmith at \$2.50 per day, and a helper at \$1.50 per day, making a \$4.00 per day fire. These two men, as a test, made 140 inferior welds in  $\frac{3}{4}$  inch diameter brake rods in 10 hours. There is a concern in our neighborhood paying 5 cents per weld for this same class of work. Now, 140 welds at 5 cents each means \$7.00 per day, and the welds are inferior, not properly heated or worked. My men, at day work, will only have to make 80 welds at 5 cents each, or at the piece work price, to earn their wages, \$4.00 per 10 hours; these 80 welds have consumed the full 10 hours in honest labor. The piece work men will make these 80 welds in  $5\frac{3}{4}$  hours. These men being equal in ability, etc., which men will do the best work, the  $5\frac{3}{4}$  hour men or the 10 hour men?

Suppose the price for forging an engine rocker arm was \$5.00. The piece work man will make  $1\frac{1}{2}$  rockers in 10 hours, making one rocker in  $7\frac{1}{2}$  hours. My \$5.00 a day man will make a rocker in 10 hours.

These men also being equal as far as speed and workmanship goes, which rocker will be machined at the least cost, the one made in 10 hours or the one hurried through in  $7\frac{1}{2}$  hours? A cheaper man may do less work; a higher priced man must do more; which proves the justice of an established or specified time for every item to which a piece work price can be applied; and that time or price for making each article must equal the cost of that fire by the hour or day.

If your shop is not equipped for piece work, you cannot work piece work. If it is equipped for piece work, it is also in splendid condition for day work, and you can get the amount of work required with ease.

If a man does a good honest day's work, he can only do more by slighting his work, or at the expense of his health. If he is not disposed to do a fair day's work, under a schedule of prices he is forced to earn the expenses of his fire at piece work prices, and if a man will not earn his own wages and permit his helper to earn his, he simply dismisses himself. The only difference in day work and piece work is this: The man working day work is limited, the piece work man is not, but is permitted to increase the amount of his inferior output at the expense of his employer or the consumer.

If you work piece work and day work both in your shop, the shop is demoralized. The piece work men have the right of way to hammers and tools, etc., and the day men simply have to await an opportunity. The piece work man will waste more fuel and break more tools, two to one, than the men working by the day.

I am running my shop under the system of a schedule of prices with perfect satisfaction. The schedule is placed in the shop where all can see it, and they know just what is expected of them. We get the most

of our work by the hour or day at piece work prices, and it still leaves me foreman of my shop.

A committee consisting of James Walker, Wm. Smith, Joseph Northend and John F. Heiffer reported on

*The Best Kind of Fuel for Furnace Use.*

This committee considered that the kind of furnace, the nature of the work and the locality had a great deal to do with the question. As a rule, it considered coal to be cheaper, for with it the fire can be banked and heat retained in the furnace over night, while with oil the fire cannot be banked to retain the heat. The committee, however, recommended oil for work that does not require a welding heat, such as making bolts and rivets, bending arch bars, and all kinds of irons used on cars, and for all irons used for other purposes, where they are similar in size to those used on the cars, and for spring making in all its parts, as a larger amount of work can be accomplished in a given time than can be done with coal. For all classes of heavy work, such as making car and driving axles, crank pins, locomotive frames and all heavy irons that are made of scrap iron, which requires heavy heating, the committee recommended the use of coal, except in localities where oil may prove to be as cheap. The committee's experience had been that it takes 140 gallons of oil to heat as much iron to a welding heat as can be heated in the same furnace, and to the same temperature, with 1,200 pounds of coal; this amount of oil costing in the locality of Chicago \$4.20, while the cost of the fuel is but \$1.20. The use of coke the committee deprecated.

*Forms and Tools for Forming Machines.*

Mr. Henry Faulk, of the Altoona shops of the Pennsylvania Railroad, read a paper on this topic, the substance of which follows:

The forms for bending machines will not permit of much alteration, as in nearly all cases there are male and female dies. A small change in the forging to be produced (say the metal  $\frac{1}{4}$  larger or smaller) means throwing away your costly dies and forms and making new ones. The designers in many cases do not take into consideration the expense in producing the tools. It is a simple matter for the designer of forgings to open his dividers a quarter of an inch and strike a larger circle or increase the dimensions of the bar on paper. When it comes to the smith, it is not so simple if the forgings are produced by forms and dies. The female portions of the die can be cut out in some cases to meet the changed conditions. The male portion has to be enlarged. In most

cases it is a nicely finished tool and cannot be enlarged to meet the conditions and has to be thrown away.

Forging and forming machines are indispensable in any shop where a large quantity of forgings of standard dimensions are produced. It requires much of the foreman's time to design tools to produce forgings in what is termed the upsetting machine. If properly managed, this machine will produce more work than 8 or 10 blacksmiths. In designing dies, the foreman smith should outline them himself, and see how the metal is going to flow when the pressure takes place. Make the proper allowance for shrinkage in cooling—one-eighth of an inch to the foot, practically speaking, will answer for forming or forging machines. The contour of the dies in the forging machine (if the forging is to be produced with one revolution of the machine) must be the exact shape of the required forging. The male portion, or reinforcing die, should be as near a fit as practical to avoid fining. I find it convenient, in many cases, to cut out a space in the upper side of the dies, and the exact outline of the forging, by placing a piece in this recess. The fine fins or any other portion of the metal that has protruded on account of some imperfection in the dies will be pressed into the heated metal, making a perfect, smooth, forging.

An important point in constructing dies is to first ascertain how much of the metal of the original is required to produce the forging. This is easily ascertained by calculating the cubical contents of the article and dividing the same by the area of the bar from which the forging is to be produced.

You will see at a glance if it is practical to produce the required amount of metal in the dies. Cutting and trying with tools of this character is expensive. If the required metal cannot be produced with one revolution another operation will be required to gather the metal. In this case the metal should be at least  $\frac{1}{8}$  smaller than the next aperture in the dies to receive it, for the reason that the dies should not grip the portion to be enlarged before the reinforcing tool has done its work. Should the dies grip the portion to be shaped before the upsetter acts, in nine cases out of ten the inner portion of the forging will not properly fill.

For irregular shapes, the neutral axes of the article should be in a central line with the header block or plunger, for the purpose of avoiding undue strains on the machine as well as the dies.

The furnace is an important factor in the output of the machine and should be so arranged that alterations can readily be made to meet the conditions or changed shape of the required forgings. The apertures to receive the bars should be as near the dimensions of the bar of iron to be heated as practical. This can be easily accomplished by having a temporary front to the furnace. The aperture can be changed at any time in a few moments to meet the conditions.

The steam hammer is the most important tool in every shop. Much forming and shaping can be accomplished with simple forms placed on

the anvil without changing dies—such as carry irons, or any shape that has to be bent at right angles, or approaching that degree, or bars to be shaped of considerable length.

The forming machine, or “bulldozer,” is indispensable. Side movements can, and in many shops are, applied to the “bulldozer,” and dies operated similar to the upsetting machine. The demand for the rapid productions at the present day is so great that every shop should be furnished with forging and forging machines in addition to the steam hammer. Without these tools you cannot compete with the up-to-date shops that have similar ones.

### *Wrought Iron Axles.*

Mr. John McNally presented a paper on the manufacture of wrought iron axles, in the course of which he said in part:

So far as relates to the manufacture of good wrought iron axles, there are very many elements that enter into it, and they are as follows:

First: a number one scrap, properly selected, is the foundation, and on the road with which I am connected we have an abundance of first-class scrap, as all the car and locomotive scrap on the system is shipped to Chicago, where it is carefully sorted and the best of it picked out and forwarded to the blacksmith shop for the manufacture of axles. When it arrives at the shops an experienced man at the shears cuts it to proper length. At the same time, should there be any steel in this scrap, it is thrown out, and this man is held responsible for the proper selection of this material. Then it goes to the man who piles it, and he who piles it is also accustomed to the use of steel and iron and he makes further inspection of it, as he piles it, so that it is a very difficult matter for us to get the steel past the shears and these two inspectors without it being detected. Now, having our piles composed of good, clean fibrous iron, we proceed to the second part.

Second: The heating of these piles is most important, and if the heater does not pay strict attention to his post, and should he allow the pile to get too hot, it will make a poor slab, and it is often customary for men to double this back and re-weld it, and then let it go into the axle. This should always be avoided, as the pile which is overheated should be a factor of weakness in the axle, and there is only one thing to do in such a case, namely, throw the overheated pile or slab out, as the life of it is already lost and would not be restored by re-welding.

Third: In order to make a good axle, all slabs should be double hammered or double worked. This is a little more expensive than the slab worked with one heat, but it gives us a superior axle, and the life of it and the superiority of it more than pays for the extra labor involved.

Fourth: The next operation is welding up the slabs to form the axle. It is first essential in this operation that the furnaces be in good shape to do the heating, and that a good quality of coal be used, and

that the same be as free as possible from sulphur. The furnaces should be also constructed so that you will be able to obtain the minimum of dirt in your heats from the coal. The heater in this operation also plays a very important part. He must exercise care in getting his heat and must avoid overheating, for in this case if he gets too high a heat, all of the previous labor goes for naught.

Some remaining papers will be given in a later issue.

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## THE MASTER CAR BUILDERS' COMMITTEES.

Committees for the current year's work of the Master Car Builders' Association have been appointed, as follows:

### STANDING COMMITTEES.

On Arbitration—John MacKenzie, chairman; W. W. Atterbury, J. N. Barr, P. H. Peck, S. P. Bush.

On Supervision of Standards and Recommended Practices—A. M. Waitt, chairman; G. L. Potter, Wm. Apps.

On Triple Valve Tests—G. W. Rhodes, chairman; A. W. Gibbs, J. O. Pattee, W. S. Morris, W. McIntosh.

On Brake Shoe Tests—S. P. Bush, chairman; Geo. Gibbs, R. P. C. Sanderson.

On Prices in Master Car Builders' Rules—J. N. Barr, chairman; C. A. Schroyer, J. H. McConnell, W. E. Symons, T. B. Purves, Jr.

On Tests of Master Car Builders' Couplers—W. W. Atterbury, chairman; W. P. Appleyard, F. A. Delano, W. S. Morris, H. Monkhouse.

### SUBJECTS AND COMMITTEES FOR 1901.

Revision of recommended practice for springs, including design for springs for 100,000 pound cars—Charles Lindstrom, chairman; R. P. C. Sanderson, A. G. Steinbrenner.

Uniform section of siding and flooring—R. P. C. Sanderson, chairman; W. P. Appleyard, J. S. Lentz.

Draft gear—E. D. Bronner, chairman; G. F. Wilson, Mord Roberts, T. A. Lawes, C. M. Mendenhall.

Side bearings and center plates—B. Haskell, chairman; H. M. Pflagler, T. W. Demarest, J. W. Luttrell, W. H. Marshall.

The chemical composition of all steel car axles—E. D. Nelson, chairman; F. A. Delano, C. A. Schroyer.

Cast iron wheels—J. N. Barr, chairman; Wm. Garstang, D. F. Crawford, J. J. Hennessey, Wm. Apps.

Index of proceedings—F. A. Delano, chairman; D. F. Crawford, W. A. Nettleton.

Air brake hose specifications—Jas. Macbeth, chairman; H. F. Ball, R. N. Durborow.

Subjects — Samuel Higgins, chairman; W. A. Nettleton, A. E. Mitchell.

Establishment of library in connection with the American Railway Master Mechanics' Association—J. T. Chamberlain.

## THE MASTER MECHANICS' COMMITTEES.

The committees appointed for preparing the work of the next Master Mechanics' convention are as follows:

Relative merits of cast iron and steel tired wheels—J. N. Barr, chairman; A. M. Waitt, A. L. Humphrey, H. S. Hayward, John Hickey.

Ton-mile statistics—H. J. Small, chairman; C. H. Quereau, W. H. Marshall.

What is the cost of running high speed passenger trains?—G. L. Potter, chairman; F. A. Delano, George F. Wilson.

The most satisfactory method of handling, cleaning and setting boiler tubes—W. H. V. Rosing, chairman; A. E. Miller, C. H. Doebler.

What is the most promising direction in which to effect a reduction in locomotive coal consumption?—A. E. Manchester, chairman; A. Forsyth, A. F. Stewart.

What should be the arrangement and accessories of an up-to-date roundhouse?—Robert Quayle, chairman; V. B. Lang, D. Van Alstine.

Maximum monthly mileage that is practicable and advisable to make; how best to make it, both in passenger and freight service—Geo. F. Wilson, chairman; Mord Roberts, T. H. Symington.

What is the most approved method for unloading locomotive coal, prior to being unloaded on the tank?—William Garstang, chairman; T. S. Lloyd, W. E. Symons.

Subjects—F. D. Casanave, chairman; S. M. Vauclain, A. J. Pitkin.

Advisability of this association joining the International Association for Testing Materials—S. M. Vauclain, chairman; H. S. Hayward, T. W. Gentry.

Establishment of a library in connection with the Master Car Builders' Association—A. M. Waitt.

Index of proceedings—F. A. Delano, chairman; S. P. Bush, C. M. Mendenhall.

# THE CAR FOREMEN'S ASSOCIATION OF CHICAGO.

## SEPTEMBER MEETING.

The regular meeting of the Car Foremen's Association of Chicago, was held in Room 1741, Monadnock Block, Chicago, Thursday evening, September 13. Meeting was called to order at 8:00 p. m. by President Morris. Among those present were the following:

Alvy, David	Etten, L.	Konze, Wm.	Shaw, M.
Bannes, A.	Earle, Ralph	Lauer, John	Smith, E. B.
Bripps, D. L.	Grieb, J. C.	Mercatoris, M.	Swoboda, Jos.
Bossert, Chas.	Guthenberg, B.	Marsh, Hugh	Saum, C. L.
Bollow, J. E.	Helwig, H.	McAlpine, A. R.	Stagg, C. S.
Bates, G. M.	Husband, E.	Morris, T. R.	Stimson, O. M.
Bundy, C. L.	Hughes, Chas.	McCullough, A.	Thayer, H. D.
Blohm, Theo.	Harvey, H. H.	McOmber, A. H.	Thiverge, J. C.
Barton, J. E.	Harkenrider, J. M.	Olsen, L.	Toringhaus, G. H.
Blackburn, D. W.	Hagge, W.	Prickett, Jas.	Van Cleave, R. S.
Carey, C. H.	Hedrick, E.	Peterson, A. F.	Wessell, W. W.
Cather, C. C.	Hall, W. B.	Roof, C. S.	Wentsel, Geo. W.
Constant, E. J.	Hansen, A. P.	Ruff, A. W.	Woods, E. S.
Chadwick, A. B.	Jones, R. R.	Richardson, W. H.	Wensley, W. H.
Cardwell, J. R.	Keebler, C. F.	Schramm, Chas.	Williams, Thos.
Deen, Chas.	Kramer, Wm.	Sanderson, S. P.	
Depue, Jas.	Kline, Aaron	Stewart, H. A.	
Downing, D.	Kroff, F. C.	Sharp, W. E.	

President Morris: The committee on prices for applying draft timbers to refrigerator cars is not ready to report, and asks for another month's time. If there are no objections it will be granted an extension.

At the last meeting of the executive committee, which was held on the 3d of this month, it was decided that a change should be made in the manner of paying dues. At the present time the dues should be paid twelve months from the time a member joins. It makes a great deal of unnecessary work for the secretary, and it was decided by the executive committee that October be considered the first of the fiscal year, and that dues will be expected to be paid at that time. Those who join at other months of the year will be expected to pay up to the first of October. The secretary will prepare a circular and send it out to all the members, notifying them of this change. I believe this practice is in force in all other associations, and simplifies matters a great deal.

Secretary Kline: The following have made application for membership in the association:

Wm. Benning, C., M. & St. P. Ry.; Otto Torason, Frank Chambers and A. H. McOmber, Armour Car Lines; Fred Delson, Live Poultry Trans. Co.

President Morris: These names have been passed upon by the executive committee and will be enrolled as members. We will now take up the regular program of the evening.

The first question is the discussion of the new M. C. B. rules for 1900. [The changes made at the last M. C. B. convention were read by the president, but as there were few changes, and they all seemed to be satisfactory, there was no discussion.] We would like to hear remarks from any one who has anything to say in regard to these changes as a whole.

Mr. Grieb: There was a modification recommended for Section 19 of Rule 5, relating to the use of the words "replace" and "renew," that emanated from the Car Foremen's Association, to the effect that the words be used according to their grammatical sense, and I was under the impression that it was considered favorably by the executive committee, and would be incorporated in the rules; however, I do not find such is the case. In looking up the proceedings, I find that through some error it was referred by the executive committee to the committee on prices, because in connection with our recommendation on that point was embodied a recommendation on prices for labor in replacing truck transoms. We had some cases here in the association, one evening, which showed it to be very important to have that modification made, so that the proper words would be used in their proper places, and it seems to me it might be well to direct attention to it. I think the proposed change was very well considered by the association and by all others, and it ought to be incorporated in the rules.

Mr. Bates: I have a copy of the new rules that are now in force, and no change has been made since last year in that respect.

Mr. Sharpe: I move that the secretary be instructed to write the secretary of the M. C. B. Association, calling attention to the recommendation made at the last M. C. B. convention.

• Carried.

#### ODD MATERIAL.

President Morris: The second question relates to cars equipped with odd material not generally used, (for instance, couplers with 6 inch shank, 30 inch wheels, etc.) The point is, what action should be taken

by the Car Foremen's Association to discourage their use? One of the members called attention to the fact that this was a little bit sweeping, inasmuch as it is intended to discourage the use of couplers with 6 inch shank, and the fact is, with the large capacity cars we are having, the 6 inch shank will very soon be the general style of coupler. But there are a great many other parts of cars that fail that make it very inconvenient to make repairs, and there is no doubt that each one of you has run across some such thing and can give us some good ideas as to what action we should take.

Mr. Bates: There is considerable material that is not M. C. B. standard used by several railways, and, of course, I do not think that it is the proper thing to do. Now, today we had a call from a station on our line asking for a coupler with a narrow shank—a shank narrowed down to 3 inches. You cannot use a regular M. C. B. standard coupler, and are compelled to get a special make of coupler; I think that the use of such material should be discouraged. The Union Pacific, I believe, uses a coupler that is longer than the M. C. B. standard, and when broken it is necessary to hold the car out of service three or four days until repairs can be made. The same thing applies to axles and other parts, and I think we ought to go on record as protesting against the use of such material.

Mr. Deen: There are some cars coming into our yard quite frequently that we cannot make repairs on when it comes to a broken coupler. They have the rear end of the coupler shank only 3 ½ inches, and 2 inches longer than the M. C. B. standard. In such cases as that we put a chain on and let the car go home.

Mr. Kroff: There are a few roads that have a very narrow coupler, and I think the Grand Trunk is one of them. I do not think there is much trouble of that kind experienced. Thirty inch wheels and the like of that are mostly all on special cars; 33 inch is standard on most all lines.

Mr. Morris: Do you have any trouble with collarless journals?

Mr. Kroff: Yes. We simply hold one or two of them and turn the collars out. You might stick in an M. C. B. axle and apply M. C. B. oil boxes and brasses.

Mr. Bates: When I spoke of M. C. B. bars, I did not mean to make any objection to the 6 inch shank. There are cars having couplers which are not M. C. B. standard length, and when you attempt to put in an M. C. B. standard coupler the bracket strikes the deadwood. That is what I had reference to.

Mr. Wensley: About the only trouble I have is with 30 inch wheels. If I get a car with a broken coupler which I cannot replace, I put a chain on and send it home.

Mr. Deen: We are not having as much trouble with the coupler as we are with the coupler pocket; this is a matter that ought to be brought up for discussion here. Coupler pockets run from 8 inches up to 22 inches.

Mr. Wentzel: We have not had any trouble that I know of with couplers; we can use M. C. B. standard for all we have in use now. If we get a Grand Trunk car with a coupler broken, we put a chain on and send it home.

Mr. Cather: We have had in the last ten days or two weeks an epidemic of 3 inch couplers, and in every case it has been with Grand Trunk cars or National Despatch Line cars controlled by the Grand Trunk. The practice of our road has always been, in cases of this kind, except on rush loads, to simply order a coupler from the owners and put it in when we get it. In one case (and I do not know what was done with it, any more than that we ordered a coupler—strange as it may seem, in St. Louis or East St. Louis it was impossible to get a coupler with a 3 inch shank—) we asked them to grant authority to change the car to take an M. C. B. standard drawbar. The car was a rush load, and I presume that was what was done, although I have never heard from the matter since; but it does seem to me that in cases of odd sized drawbars—or any other part of the car not M. C. B. standard—that the burden of the expense should be with the owner of the car. It is all right to chain cars where you can handle them easily and turn them over to the road without any further breakage; but I do not believe any road would take chances on chaining a car and running it several hundred miles. They not only run chances of damaging it further, but run chances of damaging adjoining cars.

Mr. Grieb: It hardly seems right to me to discuss this subject and drop it without making some definite recommendation. It seems, from what has already been said, that there is more or less trouble in this direction. If we do have such trouble we ought to go on record as recommending some steps to bring the matter to somebody's attention who will adopt some means to effect a solution of the problem. I suppose that all the large roads have more or less of this odd material, but it does not seem right to impose upon any other road any of the expense incident to renewing such odd or special material that is suitable for one class of cars only. There are roads here in Chicago, I believe, that use

36 inch wheels that are not willing to allow you to use 33 inch wheels to haul that car home, a distance of less than one hundred miles. That hardly seems right, as they could take out the 33 inch wheels if they are disposed to maintain those 36 inch wheels. It does not seem right to compel one to carry odd wheels just for one line of road's cars. The same way with odd axles. We had a B. & O. car on our repair track in Milwaukee the other day, that had an axle with wheel seat less than the M. C. B. standard, but longer than anything we had, and in order to make repairs we had the choice of putting that axle in again, making a new one or getting an axle from the owners. We are badly crowded with repair cars and have no desire to get more work. In this case we put in the same small axle and notified the owner. A few weeks ago we had, at Kansas City, a tank line car with 30 inch wheels, three pairs of which had to be renewed, and we simply had to go to work (as the connecting line refused to take the car, and under the local rules they were justified) and apply a pair of wrecking trucks to get the car forward; then we had to haul that pair of trucks up to our shops, which entailed an extra haul of nine hundred miles. It seems to me, if anybody wants to use odd material they should pay for keeping it up, and I would make a motion to the effect that it is the sense of this meeting that it is very desirable and important, not only for the owner of the car, who necessarily must suffer by the delay incident to the repairing of such cars, but to all interested, that the use of odd material in such parts as are liable to fail, and must be replaced regularly during the life of the car, should be of standard construction, such as is in general use, and in case of the failure of such parts the party making the repairs should be authorized to make them with M. C. B. standard material, if there is an M. C. B. standard for such parts, charging the owner for the expense incurred.

Mr. Cather: Is there an M. C. B. standard size for wheels; that should regulate what a company should put under their equipment? Is there anything prohibiting the use of 30 inch or 36 inch wheels, or, in other words, is not a 30 inch wheel as much M. C. B. standard as a 33 inch wheel?

Mr. Kroff: I do not think there is anybody that has seen a 36 inch wheel in an 80,000 pound capacity car. I think they are all in the old cars and also with the old trucks. There is odd material, and everybody has more or less odd material in the old equipment, and I think the Master Car Builders are getting to a standard on the new cars built at the present time, so I do not think that ought to go on record to make

any changes; we certainly should not make any changes on the old equipment.

President Morris: Don't you think, Mr. Kroff, that if parties wish to continue that odd equipment, it should be kept on their own line?

Mr. Kroff: That would be drawing the line pretty close.

Mr. Wensley: We received on our line, yesterday, a class of new cars just out of the shops, and I do not think it is possible for any man in Chicago to repair any one of those cars. They are solid steel from one end to the other, and there is nothing on the car but what is riveted from one end to the other, and the material is all odd.

Mr. Cather: I do not think there is any M. C. B. recommendation for standard wheels. We had a pair of 30 inch wheels with 5 x 9 journals under a car at Memphis. We had to hold that car until we could get 30 inch wheels from the owner to put under it. The same trouble is experienced with growth of cars in size of journals—4¼ x 8, 5 x 9, 5½ x 10, and so on. It is a matter of increasing sizes in equipment all along the line. I do not want to be understood, however, as opposing the use of standard parts, nor the idea of making the owners stand the expense incident to the repairs of odd parts. If a road chooses to maintain an odd sized wheel or odd sized drawbar, or anything that is not classed as M. C. B. standard, when that part fails the expense incidental to its repairs should be borne by the owner.

A Member: I think, inasmuch as the prices are given in the rules for two different diameters of wheels, there cannot be any M. C. B. standard diameter for wheels. I noticed last year's rules had three sizes of wheels, but the present rules have but two—33 inch and 36 inch, and price for both of them.

Mr. Stimson: I do not think that this association could afford to go on record as opposed to the use of odd material, unless it would go a step further and say what it would consider odd material. I do not believe that there is a road represented here that would consent to receive its cars that were equipped with any style of drawgear, for instance, that was not M. C. B. standard, that was returned home with an M. C. B. standard drawgear; certainly, we would not. If a 22 inch drawbar pocket was standard to the car (tandem spring standard to the car) that might be accepted as being an odd part. I cannot believe it would be justice to the car owner to equip that car with an M. C. B. standard drawbar, and I do not believe I would pass a resolution unless the association would go further and specify what are considered odd parts.

Mr. Bates: I do not believe that this motion ought to cover wrought

iron. Pockets vary in size, of course, but these things can be made, while odd sized wheels and couplers cannot be made where the cars are repaired. I think, therefore, that the motion ought to cover such parts as cannot be made at the shops.

Mr. Sharpe: I am very much in favor of the motion as made by Mr. Grieb, to a certain extent; I might say, perhaps, to a limited extent. There is no company that can afford to have its cars delayed at a repair station, waiting until material is shipped all over the country, any more than the railway company making these repairs can afford to gather these odd parts again and return them home after the car has been unloaded. However, there are a great many different parts of a car that cannot be classed as M. C. B. standard that are being used, and used successfully. We are living in a progressive age, and these M. C. B. standards are revised only annually, and sometimes not that frequently. The cases cited by Mr. Stimson would apply as forcibly to our equipment. We have a drawgear which we consider far superior, and yet it is not M. C. B. standard; we would not feel like accepting our cars home with an M. C. B. draft gear in place of the metal rigging that we use. However, I would be glad to see the association go on record to the extent of wheels, a certain size of wheels—a recommendation to discourage the use of parts that cannot be repaired with M. C. B. standards in emergency cases.

President Morris: I would like to call the attention of the members to the fact that the question does not specify M. C. B. standard parts. It says "parts not generally used."

Mr. Cather: It seems to be the idea, I believe, that it is all right to comply with uniform parts as long as they do not interfere with a particular hobby; that seems to be the idea all the way through. Another point about this is, if we pass a rule that only certain things should be used or permitted, it would, in a certain sense, bar progress. A railway company would go a little slow in attempting something that might appear good, for the simple reason that it would not get a fair test. It would have to stand the expense of the repairs from all over the country, and would be compelled to receive the car back with any old equipment on it, just as Mr. Sharpe has stated in regard to the draftgear that his company has. It would be an injustice to the Armour car lines, if a part of their draft rigging became broken to substitute for that a common M. C. B. standard and say that that must go. It might be well to take up the most important parts that give us trouble, and have a recommendation made to the effect that the matter be brought before

the M. C. B. convention, with a view to its adopting certain standards; but a recommendation is of no value of itself.

Mr. Morris: I believe the idea is to bring the matter to the attention of the parties in authority. We do not expect to have our ideas or recommendations followed to the letter, but simply bring them before the attention of those who have the authority to make changes or standards.

Mr. Stimson: I would like to see that motion amended to cover such parts as members have difficulty with—30 inch wheels, narrow shanks and couplers; and it occurs to me that it might be well for us to allow the motion to include only those; if there are other parts that we have difficulty with, we certainly would be pleased to hear from the members, and let those be embodied in the motion.

Mr. McAlpine: I would like to remind the members that we already have permission to use M. C. B. standards according to Rule 4, Section 3: "In repairing damaged cars, M. C. B. standards may be used when of dimensions that do not impair the strength of the cars, in lieu of the parts forming its original construction."

Mr. Cather: The trouble is here—that there are not M. C. B. standards for these points we are grappling with. A 3 inch drawbar shank is not mentioned by the M. C. B. rules; it is impossible to use M. C. B. standards there. The same way with wheels; there is no M. C. B. standard, inasmuch as the M. C. B. Association has not stated what shall be standard. Now, the only thing left for us to do, as I can see, is to urge that certain standards be prescribed for these parts we have difficulty with. If we want a standard drawbar that is so and so, it must come from the M. C. B. Association; but the rules do not say that it is compulsory, or that the owner is compelled to accept them.

President Morris: The idea is, in case of narrow shank couplers you cannot use M. C. B. standard couplers.

Mr. Cather: Now, as to wheels, it appears that there is no standard. You can go into this matter a little deeper yet. You can take roads that build 80,000 or 100,000 pound cars; they use a heavier wheel than is used under cars of 40,000 pounds capacity, and they are both 33 inches in diameter. Is it proper that a light weight 33 inch wheel be used?

Mr. Stimson: I would like to amend the motion before the house to this effect: That it is the sense of this association that we discourage, as far as possible, the use of wheels that are not 33 inches in diameter, and the use of couplers that are not of M. C. B. standard dimensions.

Carried.

The original motion, as amended, was then put and carried.

President Morris: The next question is in regard to a case in dispute between parties represented in the association, as follows:

#### CASE NO. 1.

"A" receives one of *his* cars from "B" in damaged condition, with an M. C. B. card attached, in which the defect specified was: "One wrong top center plate, two queen posts." In addition to this, there were the following defects, not covered by defect card:

1 oil box broken.	1 door latch bent.
1 truck channel bar broken	1 door hinge bent.
2 draft bolts broken.	2 oil box covers bent.
1 cross tie bolt broken.	6 side sheathings damaged.
2 body truss rods bent.	1 deadwood damaged.
2 br. hanger eyebolts bent.	2 br. hanger blocks split.
2 cyl. lever hangers bent.	2 Kewanee br. fulcrums broken.

"A" made request to "B" for M. C. B. defect card to cover the additional damage.

"B" replies that the damage did not occur on their line, and declines any responsibility, claiming damage was all done at time cards were issued by C. . . . . R. R.

"A" then requests C. . . . . R. R. to issue card covering additional damage, to which C. . . . . R. R. replies that it repaired and carded for all the defects which occurred while on its line, and delivered car to B. . . . . R. R. in good condition. As evidence of this, B. . . . . R. R. holds no records of the defects when it received the car from C. . . . . R. R.

"A" again returns correspondence to B. . . . . R. R., calling attention to what C. . . . . R. R. has said, and renews original request for M. C. B. card.

"B" promptly returns correspondence, declines all the responsibility, and later declines to answer any of the correspondence pertaining to the case.

Note there are three parties to the dispute—

- "A" 1. The owner of the car.
- "B" 2. The railroad delivering the car home.
- "C" 3. The railroad issuing the defect cards.

"A" does not attempt to say on whose line his car was damaged, but asks that he be advised by the Car Foremen's Association how he must go about it to procure M. C. B. cards, and what is the responsibility of B. . . . . R. R. in the case.

Mr. Wensley: I do not see, myself, where there is any argument in this case. This man B, if he does not make repairs to the car while on his line, certainly becomes responsible. Now, if I have a car on my line and damage it, or if I receive a car from a delivery line and fail to get all the defects on it, I certainly become responsible for any and all of those defects.

Mr. Bundy: I believe that B is responsible to A for the defects, and should give him a card for all the defects the car had. If B received the car from C in this condition he ought to get a card from him for it.

Mr. Bates: I agree with the two gentlemen who have just spoken; I think B is responsible. It does not seem possible that he could have accepted the car with all the defects unnoticed.

Mr. Marsh: I cannot see anything that relieves B in any way at

all. If that car was defective when he received it, his inspectors should have caught it. It is certainly very evident there were no defects on it when he got it, and, therefore, B should be responsible for all the defects while in his possession.

Mr. Grieb: I presume it is taken for granted that the damage occurred in unfair usage. I believe there was a defect card issued for some wrong repairs, and I would like to know if there was any other card on that car possibly indicating that it had received repairs by somebody; if so, what the repairs consisted of, as they, in connection with the parts left unrepaired, would possibly throw some light on the question.

President Morris: I do not know as we can go back of the returns in any way, as far as getting information is concerned. The abstract here shows only one card, a defect card issued by C; it is evident that B got car from C, and the other defects were missed by B, or else they occurred while on B's line. Now, the question is to decide whether, in either case, he is responsible to A.

Mr. Stimson: In my judgment, there is no reasonable excuse that B could offer for not assuming the responsibility for the damage when it was returned to the car owner. I agree with the gentlemen who spoke first, that there is absolutely no argument in the case. I am satisfied that were the case prepared for arbitration they would not consider it five minutes. I move that it is the sense of this meeting that A is entitled to a defect card from B.

Carried.

The meeting here adjourned.

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## A NEW TOOL STEEL WITH REMARKABLE CUTTING PROPERTIES.

The Bethlehem Steel Company, of South Bethlehem, Pa., has for the past two years been engaged in the development of a method of increasing the cutting properties of a special grade of tool steel. The results of this work are certainly remarkable, and, in some ways, revolutionary. The extraordinary cutting speeds attained by the process of treatment finally adopted were heard about for some time, both at home and abroad, and the Bethlehem works were visited by many seekers for information. The company awaited public mention of its work until it could have its whole shop in practical operation with the tested tools, in all of the machines in which they were available. On July 31, it gave a

public demonstration at its shops of just what had been accomplished, to the entire satisfaction of all the guests.

The process of tool treating is termed the Taylor-White process, having been the result of the research and experimentation of Mr. F. W. Taylor and Mr. Maunsel White. The Bethlehem Steel Company supplies us with the following statements concerning the development of the process and the remarkable work attendant upon its adoption:

Mr. F. W. Taylor, in the reorganization of the shop methods of the Bethlehem Steel Company, found several changes necessary, the most important of which was the discontinuance of the miscellaneous assortment of tool steels used by the different men in the shop, and the establishment of a standard and uniform grade of tool steel, the use of which would be enforced upon all of the men, regardless of their preferences.

A special lathe was set aside for the purpose of experimenting with tool steels of different makes, with a view to the selection of a standard for use, and several picked men were set to work testing the relative merits not only of the different tool steels then in the shop, but all brands of established reputation. In the elaboration of these tests the services of the company's engineer of tests, Mr. Maunsel White, were enlisted.

This full and exhaustive investigation led up to the discovery which afterward, carefully studied and persistently followed up, step by step, has resulted in the remarkable development which can be seen in the company's machine shop at the present time.

In the tests of these various makes of tool steels, over 200 tons of steel forgings have been cut up into turnings on the experimental lathe, and it is estimated that over \$100,000 has been expended in labor and material alone in developing the process called by the names of the discoverers, the "Taylor-White" process. A still further large sum has been invested in the patents covering the process, which have been purchased by the Bethlehem Steel Company from the inventors.

This large investment, however, has more than been repaid in the last year by the saving in labor cost and larger output. The increase in cutting speed of the various machine tools throughout the machine shop has entirely reversed the inequality of balance existing two years ago, so that the capacity of the forge has had to be largely increased to keep pace with the rapidly growing efficiency of the machine shop.

The introduction of this process for the treatment of the company's tools has enabled it to speed up its main lines of shaft from 90 to 250 revolutions, and further changes in countershafts have been made to speed up individual machines, which has brought about the largely increased efficiency in the machine shop.

In order that the rate of progress might be observed, records from time to time were made of the average amount of metal cut per hour per tool throughout the shop. The table shows the increase in efficiency made up to January of this year:

AVERAGE.	Oct. 25. 1898	May 11, 1899	Jan. 15, 1900	Gain in % cut of 3rd over 2d.	Gain in % of cut 3rd over 1st.
Cutting speed.....	8'-11"	21'-9"	25'-3	16%	183%
Depth of cut.....	.23"	.278"	.30"	8%	30%
Feed.....	.07"	.0657"	.087"	32%	24%
Pounds of metal re- moved per hour..	31.18	81.52	137.3	68%	340%

This gain has since been increased by the further speeding up of other machines and the more general interest taken by the men, with a fuller understanding of the changed conditions of higher speeds.

The virtue of the "Taylor-White" process is, that it gives to the steel the very valuable and exceptional property of retaining a high degree of hardness when heated to a visible red heat. It is possible with one of these tools to cut steel at a speed so great as to heat up the point of the tool to redness, and have it continue to cut for several minutes at this speed, leaving an unusually smooth finish on the work, as well as cutting accurately to size. The advantage in leaving a smooth roughing cut, and of having the work accurately to size will be readily appreciated, as it materially lessens the work of finishing. The practical speeds at which these tools will run has been found to be from two to four times that of any steels which the Bethlehem company has experimented with, and it has endeavored to obtain the best in the market.

The effect of the "Taylor-White" process, which is applied after the tool has been dressed or machined to shape, penetrates to the center of the steel, even in the largest tools the company has ever treated — i. e., 4 inches square.

All the standard brands of self-hardening steel which have been experimented with are improved, to a more or less extent, by the treatment; it is preferred, however, to use a steel of special composition in order to get the greatest uniformity and maximum results. This special steel forges so much more readily than the general run of self-hardening steels that tools of difficult shapes may be easily made up.

The company has also discovered a simple and comparatively rapid method of annealing its special steel, by which tools may be easily machined to shape, making it applicable to twist drills, chasers, inserted cutters, etc., which have heretofore not been made from self-hardening steel.

A very important feature resulting from the use of this process is, that the tools are extremely uniform in quality, so that work on which they are used can be regularly performed at the maximum rate of speed. The variation in the quality of these tools does not run over 5 per cent, which insures a much greater degree of uniformity than is attained in any other tools that the company knows of, whether made either of tempered or any air-hardening steel. With uniform tools the piece work system can be most efficiently used, as the piece rate must always

be based, not on the average cutting speed of the tools but on the speed of the worst tool in use.

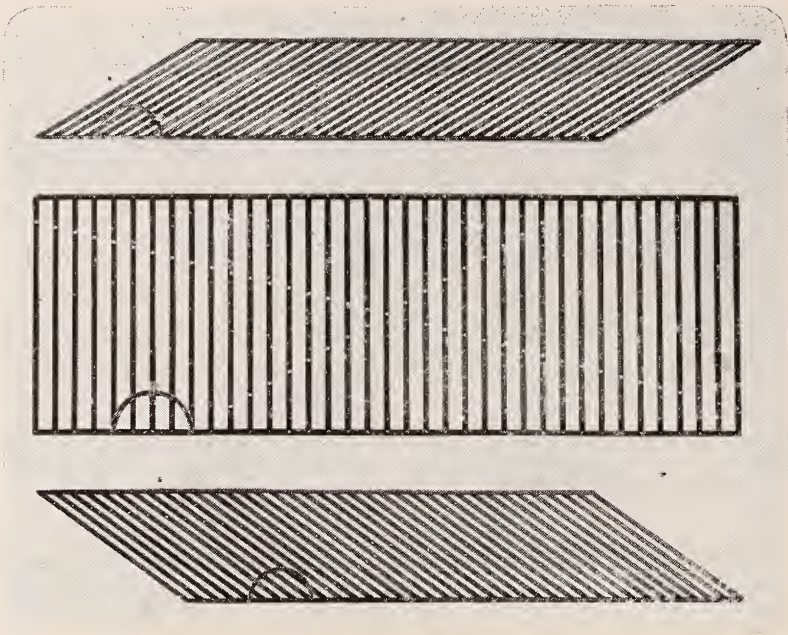
A great advantage in the use of these tools is, that when cutting dry at the rate of maximum efficiency the chips should come off blue; these blue chips enable a foreman at a glance to tell whether the work is being done at the proper speed. When running under water at the proper cutting speed, the chips should show blue immediately upon shutting off the water and allowing the tool to cut dry for a few moments.

The apparatus used in the "Taylor-White" process offers also a simple and effective means of heating any other tools at uniform temperatures which can be easily controlled, so that ordinary carbon steels can be hardened through the use of the same apparatus, at temperatures which will insure greater uniformity and higher qualities in this class of steel, as well as in self-hardening steels. As is well known, tempering steels of different makes and different qualities require different temperatures for hardening to obtain the best results; therefore, by means of this apparatus, which is capable of closely controlling temperature, these points may be accurately determined for each class of steel, and made use of in daily practice. The operation of the process is extremely simple, as it is controlled by apparatus which regulates the different steps and does not require skilled or expert labor.

The Bethlehem company has been glad to undertake in its shop any experiment desired, in order to satisfy interested parties of the value of its treated tools. It has an experimental lathe, before mentioned, fitted up especially for making tests, which can be run at speeds from 2 to 300 revolutions per minute, and will take work up to 60 inches in diameter. It is driven by an independent motor of 40 horse power, which gives ample power for any desired test. The company has on hand forgings of steel of different hardness, running from the hardest tool steel to soft merchant steel, and of wrought iron; also, castings of steel and cast iron, with which it can carry out any test necessary to compare its treated tools with any others.

In our last issue we gave some results of the tests made on the special day above referred to. We now give some figures of a subsequent test, furnished to us by the Bethlehem company, as follows:

Material Operated Upon.	Feed.	Depth of Cut.	Cutting Speed, Feet per Minute.	Duration of Cut, Minutes.	Total Longitudinal Feed of Tool, Inches.	Diameter of Work, Inches.	Steel of Tool.
Tool Steel.....	$\frac{1}{16}$	$\frac{3}{16}$	15	15	8	$6\frac{11}{16}$	Taylor-White.
" ".....	$\frac{1}{16}$	$\frac{3}{16}$	15	$\frac{3}{4}$	$\frac{1}{4}$	$6\frac{11}{16}$	Mushet.
Cast Iron.....	$\frac{1}{16}$	$\frac{3}{16}$	50	20	$14\frac{5}{8}$	$11\frac{1}{2}$	Taylor-White.
" ".....	$\frac{1}{16}$	$\frac{3}{16}$	50	$1\frac{3}{4}$	$2\frac{1}{8}$	$11\frac{1}{2}$	Mushet.
Machinery Steel.....	$\frac{1}{16}$	$\frac{3}{16}$	150	15	32	$14\frac{3}{8}$	Taylor-White.
" ".....	$\frac{1}{16}$	$\frac{3}{16}$	150	$\frac{1}{2}$	$\frac{1}{2}$	$14\frac{3}{8}$	Mushet.



### BOILER MAKERS' LAYER-OUT.

This tool was invented by a practical layer-out, and is designed to do away with the use of the compass and to save time and labor, thus simplifying the work of dividing the holes on plates. While the appliance is called a layer-out, it is really an adjustable spacing machine, and with its aid it is possible for a man to do his work quicker and more accurately than in the old style way of using a compass for each individual hole, thus reducing the cost of the work by permitting the layer-out in the shop to accomplish more in a certain period of time. The accompanying cut illustrates at the top the layer-out as it is used for the smallest spacing; the middle cut represents the general view of the layer-out as it is opened; the bottom cut represents the layer-out as it is used for the largest spacing. The layer-out will space holes all the way from  $1\frac{1}{2}$  inch centers to  $2\frac{1}{2}$  inch centers, or any division or multiple of these centers.

In using the layer-out, after laying out the plate the circumference is divided into spaces of about 5 feet or less. Then, after having determined how far apart the holes are to be spaced, the layer-out is either spread or folded together until the desired spacing between the holes in the layer-out is obtained. Then after placing the center of the hole over two of the division points the spaces are marked off. The layer-out is manufactured by the Scully Steel & Iron Company, 136 Fulton street, Chicago, who have a large stock constantly on hand.

## BRAKE SHOE TESTS.

Referring to the announcement in our last issue to the effect that the Master Car Builders' brake shoe committee would make tests of brake shoes during the month of March, 1901, we are informed by the committee that no tests will be made after March 1, 1901. Accordingly, if any of the railroads represented in the association wish to have brake shoes tested, they should at once put themselves in communication with the chairman of the committee, in order that proper arrangements can be made for conducting the tests at an early date. Address S. P. Bush, superintendent of motive power, C., M. & St. P. Ry., West Milwaukee, Wis.

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### THE COEFFICIENT OF FRICTION OF BRAKE SHOES.

At the September meeting of the Western Railway Club, Professor R. A. Smart, of Purdue University, presented a valuable paper on the friction of brake shoes under various conditions of pressure, speed and temperature. The conclusions arrived at, after extensive experiments, are stated as follows :

1. The coefficient of friction of brake shoes decreases with increase of pressure.
2. The coefficient of friction of brake shoes decreases with increase of speed, except from about ten to twenty miles per hour, between which speeds it increases slightly.
3. The coefficient of friction of cast iron brake shoes is practically constant with variations in temperature of shoe and wheel within the limits of the experiments.

[The tests involved ranges of temperature of the shoe up to 1500 degrees Fahr.; speeds of from 40 to 60 miles per hour; normal pressures of from 2,800 pounds to 6,840 pounds; and continuous runs of about five miles in length and from five to ten minutes in duration.]

In view of the variable action of the majority of brake shoes while under test, it seems to the writer that it would be unwise to attempt to specify very narrow limits for the frictional qualities of shoes. A possible plan would be to choose some standard speed (or, possibly, two speeds) and prescribe a range of performance for different pressures within which the mean coefficient of friction of all shoes must come.

In order further to secure a sufficient degree of uniformity in the friction of each shoe during the length of the application, it should be specified that the coefficient of friction at a certain number of feet, after

the application commenced, should not be less than such a per cent of the mean coefficient of friction, and that the coefficient of friction a certain number of feet from the stop should not be more than a certain per cent above the mean coefficient of friction, and should be less than a certain fixed limit. This arrangement would provide an element of elasticity which would cover the unavoidable variations in the results of tests, and at the same time would secure a degree of uniformity which would, in great measure, remedy existing evils.

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The Proceedings of the Master Mechanics' and of the Master Car Builders' Associations have been gotten out by Secretary Taylor with most commendable promptness. They are in their usual handsome form ; but Mr. Taylor has added a valuable feature to the Proceedings of the Master Mechanics, in the shape of profuse marginal notes on the reports. He has also provided more elaborate indexing than usual.

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## PERSONAL MENTION.

Mr. Richard English, division master mechanic of the Rio Grande Western, has resigned and will take service with another road in California.

Mr. L. I. Knapp, master mechanic of the Lehigh Valley at Buffalo, has resigned. His successor is George W. Seidel.

Mr. G. V. Wagner has been appointed master mechanic of the South Georgia Railway, with headquarters at Heartpine, Ga.

Mr. F. A. Givin, assistant master mechanic of the Pittsburg, Shawmut & Northern, has resigned to enter the service of the Westinghouse Air Brake Company.

Mr. William Singer has been appointed master car builder of the Pittsburg, Shawmut & Northern, with office at St. Mary's, Pa.

Mr. J. H. Fildes has been appointed general foreman of the Lehigh Valley at South Easton, Pa.

Mr. Howard M. Smith, former master mechanic of the Terminal Railroad Association and the St. Louis Merchants' Bridge Terminal Railway, died at his residence in St. Louis on September 23.

Mr. C. Skinner has been appointed master mechanic on the Chicago & Alton, with headquarters at Slater, vice W. J. Bennett, resigned.

Mr. P. M. Hammitt has been appointed assistant superintendent of motive power of the Boston & Maine.

Mr. W. B. Page has been appointed master mechanic of the Pennsylvania R. R., with headquarters at Lambertville, N. J., vice J. L. Mohun.

Mr. J. M. Graham has been appointed division master mechanic of the Boston & Albany, with headquarters at Rennselaer, N. Y., vice E. Priest.

Mr. George Bonker, a locomotive engineer who died recently at Sedalia, Mo., was born at Deposit, N. Y., in 1835 and began railway life as a water boy on the Erie when he was 8 years old. His first firing was done on the Alton in 1856, and he ran the first train of that road into St. Louis in 1859. He was chairman of the engineers' committee

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that waited upon the late "Jim" Fisk and persuaded him to increase the wages of Erie engineers from \$2.90 to \$4.00 a day, and also was instrumental in organizing the insurance department of the Brotherhood of Locomotive Engineers. He entered the employ of the Missouri Pacific in 1882 and continued with that company until his death.

Mr. C. W. Cross has been appointed master mechanic of the Michigan division of the Lake Shore & Michigan Southern, with headquarters at Elkhart, Ind., vice J. O. Bradeen, resigned.

Mr. George W. French has been appointed master mechanic of the Little Rock & Hot Springs Western, with headquarters at Hot Springs, Ark., vice J. G. Mackendon, resigned.

Mr. C. E. Slayton, master mechanic of the Virginia & Southwestern Railway, has also been appointed master mechanic of the Virginia Iron, Coal & Coke Co., an allied company.

Mr. C. A. Strom, who has been draftsman on the Illinois Central, has been promoted to be mechanical engineer, succeeding E. Grafstrom, resigned.

Mr. J. M. Sheetz has been made road foreman of engines on the Philadelphia & Reading, Reading division, succeeding D. H. Deeter, who has been appointed master mechanic of the New York division.

Mr. L. L. Knapp, master mechanic of the Lehigh Valley Railroad, has been succeeded by George W. Seidel, formerly of the Southern Valley.

Mr. Joseph T. Schlacks has been appointed division master mechanic of the Rio Grande Western, vice R. English, resigned.

Mr. C. E. Miller has been appointed general car foreman of the Ann Arbor Railroad, at Frankfort, Mich.

The office of Mr. F. M. Whyte, mechanical engineer of the New York Central & Hudson River Railway, has been moved from West Albany to 610 Grand Central Station, New York City.

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## SUPPLY TRADE NOTES.

The recent discovery of Goldschmidt, that aluminum in powder form is one of the most powerful reducing agents known, has attracted widespread attention. It is possible, by this means to reduce the most refractory oxides, and produce such metals as chromium, tungsten, molybdenum, manganese and nickel, perfectly free from carbon and in the fused state. This is possible because of the enormous heat produced by the chemical reaction of the aluminum upon the various oxides. The heat so produced is estimated at about 5,000 degrees, and can be equaled only in an electric furnace. It is with considerable interest that we learn the Ajax Metal Company, of Philadelphia, have acquired a similar process for producing the alloys of the above metals with iron, and so low in carbon and silicon as to meet all the requirements of steel makers, but by the use of a far more inexpensive reagent. Ordinary carbon steel castings can be made by this process in the crucible or on the open hearth. The castings so produced are so low in carbon as to almost approach malleable iron, and require no annealing. The Ajax Metal Company intend to manufacture these alloys in ingot form for the use of tool steel makers and manufacturers of armor plates, projectiles, etc.; also to manufacture chrome, nickel and ordinary steel castings of superior quality.

Business opportunities are offered on the line of the Chicago Great Western Railway in Illinois, Iowa, Minnesota and Missouri. There are first-class openings in growing towns

for all kinds of business and for manufacturing. The company's list includes locations for blacksmiths, doctors, dressmakers, furniture, grain and live stock buyers, general merchandise, hardware, harness, tailors, cold storage, creameries and canning factories. Those interested should write fully in regard to their requirements so that the company may advise them intelligently. Address W. J. Reed, Industrial Agent, C. G. W. Railway, 601 Endicott Bldg., St. Paul, Minn.

The Naval Electric Company, with offices at 95 Liberty street, New York City, has been organized to succeed the B. & H. Electric Company, of Dansville, N. Y., and New Haven, Conn. The same officers continue, the change in name being made as more appropriate for the distinctive line of electrical business in which the company proposes to engage. F. G. Hall, Jr., A. S. M. E., is the manager for the company, and I. E. Burdick, secretary and treasurer. Both of these gentlemen have been engaged in the electrical business for about ten years, and have devoted their attention more especially to the application of electricity to naval and marine purposes. They are graduates of the Sheffield Scientific School, and at the beginning of the war with Spain came into prominence among scientific investigators by their joint invention of an arc light for use under water, and known as the Yale Submarine Arc Lamp. This lamp has since proved its entire practicability for submarine use in connection with divers, and is being used by wrecking companies, dredging companies, dike and bridge builders, sponge and pearl fisheries, in navy and dock yards, railroad docks, ship yards, and by the United States and Russian governments. It is being placed on the market by the company, who are negotiating for its adoption in all foreign navies, and by various steamship companies at home and abroad. Another specialty that is being placed on the market by the company is known as the B. & H. Rapid Fire Electric Saluting Yacht Cannon. These are made after the style of the Hotchkiss gun, and are meeting with popular favor among owners of fine yachts. The guns have a new electric firing attachment for firing from any part of a yacht. The company prepares specifications for marine electric lighting and power plants, in accordance with the National Electrical Code, and will make a specialty of the installation of marine electrical apparatus aboard ships and yachts. They will supply general naval electric specialties and staples, as search lights, hoists, dynamos, motors, engines, lamps, telephones, wires, cables, diving apparatus, signaling apparatus, submarine mines, yacht fixtures, naval war and engineering supplies. The company has foreign connections, and will purchase for export. Manufacturers are invited to submit prices.

The Baltimore & Ohio Railroad management introduced some time ago an innovation in uniforming its entire corps of train and station employes.

The conductors' suits are made of navy blue serge, three-button cutaway coats, embellished with gold B. & O. buttons and monogram "B. & O." in shield device on coat collar, with appropriate cap. Baggage men and brakemen have a sack suit of dark blue "Slater" cloth and gold B. & O. buttons, with shield device on coat collar and cap to match. The train porters have a sack coat of same material as trainmen, with silver buttons and trimmings and cap of khaki. The station masters have "Slater" cloth suits, with Prince Albert coats with two rows of five gold buttons on breast, and gold metal badge on cap. Stationmen have dark blue "Slater" cloth suits, with square crown black silk caps; and station porters are fitted with brown corduroy trousers, dark blue flannel shirts with initials "B. & O." in white across the breast, and khaki cap. These attractive uniforms will enable the traveler to readily distinguish train and station employes, who at all times will be prepared to courteously render any service and furnish all information possible to patrons of the road.

# RAILWAY MASTER MECHANIC

WALTER D. CROSMAN, EDITOR.

WILLIAM E. MAGRAW, MANAGER.

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## Wide Fireboxes for Locomotives.

The fact that the length of grate for locomotive boilers had reached the maximum for stoking by hand, was realized some years ago, but it seems that it was only the conditions for burning anthracite coal that furnished the necessary urgency for developing the wide firebox. At all events, the large grate surface was developed first for anthracite coal.

A very good reason why the large grate area was used first for anthracite coal was that the large grate was really necessary for the successful burning of this fuel, particularly so because the intention was to use as fuel the large accumulation of what was then the refuse of the mine, by such railways as had this fuel convenient to their lines and did not have bituminous coal equally as convenient. In a word, there was the strong incentive—in fact, the necessity—of developing a firebox in which such fuel could be successfully used. Although efforts were made to use the large grate surface with the softer coal, there was lacking a sufficiently strong incentive to justify a study of the question with the seriousness necessary to insure success.

Efforts were made to burn bituminous coal on large grate surfaces, but, as success did not come with the first trials, many men thought to profit by the experience of the few and continued to build fireboxes limited in width by the spread between driving wheels. It may be appropriate to explain, in a word, that the conclusion to avoid the wide firebox was probably influenced quite as much by the failure of faulty boiler designs (which designs have been improved since, as dictated by experience) as by failure in steaming qualities.

Until the more recent rapid increases in heating surface, the grate surface of locomotives using soft coal was not so prominently deficient, and any increase in demand for heat was met by an increased rate of combustion. Of course, this meant a decrease in the rate of evaporation, but it was necessary for a certain degree of tension to develop to

justify radical departure from firmly established practices. This degree of tension has resulted from increased weight of trains and increased speeds, demanding larger heating surface to supply the amount of steam required. The heating surface has, accordingly, increased at a rapid pace in more recent years, until it has become necessary to concentrate attention on the firebox with the purpose of providing a grate surface in proper ratio to the heating surface, and as there has been developed, first, a means of increasing the width of the firebox, we have the wide firebox locomotive and the radical departures in designs made necessary by the use of the wide firebox.

It is quite possible that a means may be provided for stoking by machinery a longer grate than can be properly stoked by hand, and if this develops it is reasonable to presume that this method will be favored.

The wide firebox is necessary for large grate surface and hand stoking, and in providing the large grate there seem to result incidental advantages which will be quite material, as follows: The firebox temperature will be less intense, and, therefore, the firebox sheets may be expected to deteriorate less rapidly; with the decreased length of firebox the service of the staybolts should be improved.

The wide firebox works in very nicely with driving wheels as large as 63 inches over tires and a boiler as large as 72 inches in diameter, giving a throat of reasonable depth, and placing the boiler not too high for stability for locomotives with three, four or more pairs of driving wheels. Designs have been proposed for wide fireboxes over large diameter driving wheels, but it is questionable whether such would work to entire satisfaction with soft coal. The recent designs of locomotives with wide fireboxes for bituminous coal and large diameter drivers have used a pair of carrying wheels 50 inches or 52 inches in diameter under the firebox, driving wheels forward of the firebox, and either a 2-wheel or 4-wheel leading truck. With three pairs of drivers, such designs require a long tube, and, if we anticipate a month or two, we may say that the 20-foot tube has been reached. With, however, many pairs of drivers located ahead of the firebox; the trailing wheels must carry the firebox, and already we have reached what seems to be about the limit of weight on one pair of carrying wheels.

## Road Tests of Locomotives.

At the September meeting of the Central Railway Club a paper on the above subject was read by Professor Gaetano Lanza, of the Massachusetts Institute of Technology. On account of the high standing of Professor Lanza in the field of research engineering, it is not too much to expect that any improvements devised in the last few years which, if used, would make possible more accurate road tests of locomotives, would fall under his observation and be reported by him in such a paper, therefore the absence from his paper of any new ideas is remarkable, and attests very strongly the wisdom displayed by the committee of the American Society of Mechanical Engineers which reported in 1893 on "A standard method of conducting locomotive tests." Undoubtedly the individual standing of the members of the committee promised this; but there is also another reason, the pronounced infrequency, during the last few years, of elaborate locomotive tests. At the time the committee formulated its report, and during the few years immediately preceding that time, the compound locomotive was being developed, and the very thorough study which it was receiving required tests more thorough and much more accurate than the tests made of the simple locomotives previous to that time. There has been no great improvement in locomotives, since the development of the compound, which has justified greater refinement of testing than can be obtained at reasonable cost.

Approving comment on any paper, as a whole, can be put into one sentence, but as differences of opinion must be arranged in the most convincing manner, it will be well to give a general approval of the paper under consideration and to proceed at once with the specific criticism.

Professor Lanza "imagines that every one will agree to the proposition that the main objects sought to be accomplished by a road test of a locomotive are to ascertain correctly: 1st, the coal or other fuel burned; 2d, the water evaporated and used; 3d, the work done." This supposition is not a correct one, and it is from such suppositions that erroneous conclusions are drawn and suspicion cast upon all road tests of locomotives. Generally there is, and always there should be, a particular object in view in making a test, and the data relating to the particular object should be carefully taken; then it is necessary to confine a study of the data to the particular relation which they bear to the object sought. It

is just as important to know *why* the data was taken, and all the conditions of the test, as to know *how* the data was taken. A test may be made to determine whether a locomotive can develop power sufficient to haul a certain train regardless of the amount of fuel and water used; but incidentally the amount of coal and water may be taken roughly, possible errors of 10 per cent or 15 per cent in observing these items being unimportant, because those for whose information the data were taken would value them properly; but, and this should be strongly emphasized, publication of such data should not justify one who is not familiar with the conditions of the test to attach his own valuation to the data, either to the extent of accepting them as absolutely accurate or of declaring them entirely worthless.

It is safe to say that it will be many years before results of locomotive service tests will be as close approximations as tests of stationary steam plants; if, in the test of a stationary steam plant, the engines are stopped at short intervals and remain quiet during different lengths of time, the test would not be considered of value as showing the best possible efficiency of either engine or boiler, but it would show the efficiency under the conditions prevailing, and conclusions should not be drawn without a thorough understanding of these conditions. Should such data be compared with the same engine and boiler working continuously under a uniform load, suspicion would be cast on both sets of data. Do not use data without judgment; some of it may be obtained for selling arguments.

Concerning the duration of road tests of locomotives: Comparable data should be taken from runs of equal duration of time, but there will be nothing gained by reducing the percentage of error in measuring coal and water and power, and allowing to creep in an error, due to tired observers, equal to or greater than the above mentioned reductions.

Finally, let us draw general conclusions from locomotive tests, just as we must from tests of stationary plants; no attempt is made to show absolutely how much more economical is one method of stoking a stationary boiler than is another method, nor can it be shown; so, if in a test a compound locomotive shows a saving of 10 per cent, and in another test a saving of 20 per cent, let us not conclude that either one or both tests are wrong, but rather, that the compound is from 10 to 20 per cent more economical. Let us criticise the uses to which the data are put, as well as the methods used for obtaining them.

## THE CARE OF MACHINE SHOP SCRAP.

Mr. J. A. Carney, division master mechanic of the Chicago, Burlington & Quincy Railway, at Beardstown, Ill., presented a paper on the subject of handling railway scrap, before the last meeting of the St. Louis Railway Club. The handling of scrap is not one of the most desperately important details of railway work, but we should always bear in mind the many arguments presented by Mr. J. N. Barr about the ever present need of looking after the "little things." Mr. Carney's suggestions are in substance, as follows:

It is the purpose of this paper to touch upon a method of handling machine shop scrap, from the time it is made at the machine until it is loaded for shipment to some central point, where it is sorted into grades which will bring a maximum price. From this standpoint, scrap divides itself into (1) borings and turnings; (2) punchings and shearings, and odds and ends, weighing not more than five or six pounds; and (3) large pieces. Borings and turnings should be collected in wooden trays set under the machine, and which catch nearly all of the scrap; the small quantity which falls outside the trays can be collected by the sweeper, who wheels the scrap to a bin where it can be conveniently loaded into cars. At one shop this bin is arranged something on the coal chute order. The bins are filled from a platform on one side, and are so arranged that they can be emptied into a car on the other side by means of a suitable chute or apron. By this method no shoveling whatever is done. The only sorting that this kind of scrap can be given in most shops is to keep cast iron separate from steel and wrought iron.

Punchings, shearings, odds and ends should be put into boxes of about 200 pounds capacity at the machine where they are made. These boxes, when full, are carried to the scrap shed, where they are piled up ready for shipment to the scrap dealer, or to a central point, where it is finally sorted. If the scrap is sold, the boxes are dumped into cars. If, however, it is going to some central point for sorting, the boxes filled with scrap are carried into the cars and piled up securely. At the central point the scrap is unloaded in the boxes, sorted, and thrown into the scrap bins, the boxes being returned to the point from which they started.

The advantages of handling scrap in boxes are: (1) Reduced cost of labor for handling; and (2) sorting by natural selection.

The old method of piling scrap up on the ground, then when the pile got in the way to move it to some other place, handling it with a shovel or picking each piece up by hand, was expensive. Practice has developed that a 200 pound unit is an easy and convenient one to handle; therefore, if a box of 200 pounds' capacity is used, and, when full, is stored until ready for shipment, it is treated as a unit, and as such is economically handled.

The cost of handling small scrap by the old method amounted to



PITTSBURGH TWELVE-WHEEL COMPOUND FOR THE CHICAGO & EASTERN ILLINOIS.

Total weight—189,700 pounds; weight on drivers—150,000 pounds; cylinders— $21\frac{1}{2}$  and  $33 \times 30$  inches; drivers—54 inches; heating surface—2,447 square feet, of which 181.4 square feet is firebox and 2,265.6

square feet tube surface; grate area—72 square feet; fuel—run of mine bituminous

coal; working steam pressure—200 pounds; boiler 72 inches; tank capacity—water 4,500 gallons; coal 10 tons.

about 20 cents per ton for each handling. By the box method it can be handled for about 6 cents per ton.

Where work on machines is fairly uniform, the quality of the scrap made must necessarily be of about the same quality. This scrap, when collected and stored in boxes, maintains its character, and requires little if any sorting. In this way machine shop scrap, blacksmith shop scrap, and boiler shop scrap, especially that covered with scale and known as "lime" scrap, are kept separate, and can be sorted in 200 pound units much quicker and easier than if each piece, weighing a few ounces, is handled separately. Therefore, by the box method, scrap is sorted by natural selection at the place where it is made, and, being in 200 pound units, can be handled at a minimum cost both for loading and unloading and for final sorting.

The boxes used are made of 1 inch unfinished pine; and are 24x14x5 inches deep, inside dimensions. The sides are extended to make handles for carrying, and the ends are bound with hoop iron.

Pieces of scrap too large to go into boxes are economical units in themselves, and are handled a piece at a time.

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## PITTSBURGH TWELVE-WHEEL COMPOUND FOR THE CHICAGO & EASTERN ILLINOIS.

The Pittsburgh Locomotive & Car Works recently turned out a handsome compound locomotive for the Chicago & Eastern Illinois. It is of the twelve-wheel type, with wide firebox.

This engine weighs 189,700 pounds, of which 150,000 pounds are on the drivers. It has compound cylinders, 21½ and 33 x 30 inches; 54 inch drivers; a Wootten extended wagon-top boiler, 72 inches in diameter, and designed to carry 200 pounds working steam pressure; a firebox 9 feet long and 8 feet wide, and 71⅝ inches deep at the front and 59⅝ inches deep at the back; a grate area of 72 square feet; and heating surface of 2,447 square feet, of which 181.4 square feet is firebox and 2,265.6 square feet tube surface. The engine will burn bituminous coal, run of mine. The tank has a capacity of 4,500 gallons of water and 10 tons of coal.

The fittings of this engine include cast steel main driver centers, steeled cast iron centers for the other drivers; metallic piston rod packing, balance slide valves, Fox pressed steel tender truck, and steel channel tender frame.

## OBSERVATIONS ON SMOKELESS GASES IN FIREBOXES.\*

BY A. BEMENT.

There are two factors generally recognized as being necessary for smokeless combustion; first, that of high temperature, and second, that of liberal air supply. To these I would add a third, and arrange them in a different order of importance: First, that of temperature; second, what may be termed mixture; and last, that of air supply.

As affecting temperature, the locomotive firebox with its comparatively cold walls, tends toward a lower furnace temperature, as compared with a brick lined furnace. The very high rate of combustion on the other hand, however, tends toward a higher temperature, caused by the rapid generation of heat as compared to the cooling capacity of the walls. This may be illustrated by saying that what may be termed the temperature head is higher. With the same gas analysis but different rates of combustion, the more intense heat would show a higher temperature of the gases above the fire.

Temperature would be lowered from two causes. The most serious in the locomotive is from large amounts of fuel being supplied at a single coaling, and from increased air supply.

In the matter of mixture, if every atom of carbon was attacked by one or two atoms of oxygen the problem would be solved as far as smoke is concerned. But the tendency is for air to enter in masses, and for the hydrocarbon gases to pass from the fuel in like manner, and while a volume of gas may be in contact with a volume of air, their molecules are separated and there is no combination. It is probable that the force and violence of the combustion process in itself, promotes mixture in a slight measure. Also, the molecular activity being greater as the temperature is higher, the effect is in a measure the same; but these influences can have but small effect as their range and scope is small. The brick arch so much used in locomotives now, is the instrument of first importance as effecting mixture. Second to it is the steam jet; each promoting a stirring up and mixing together of hydrocarbon gases and air. The arch is an obstacle in the path of the gases, changing their direction and promoting a more thorough intermingling, with the effect of causing the contact of carbon and oxygen, and when this is secured the combination is instantaneous. The direct effect of the

\*Abstract of paper read before the Western Railway Club, October, 1900, meeting.

arch on temperature is very slight. It is, of course, true that at times heat is stored up, and given up at other times, but it is so small in amount as to be of no material consequence. Its indirect effect on temperature, though small is favorable, because by its action in stirring the gases together, more combustible is oxidized with a corresponding increase of heat and temperature. The arch being of brick, and, therefore, at a higher temperature, is of more value for the purpose than if made of water cooled surfaces.

The steam jet, like the arch, is an instrument promoting mixture, by stirring up and beating together the gases. Mechanically, it is very effective if properly applied, but is not equal to the brick arch. It has the effect of reducing temperature owing to the high heat capacity of steam. It should have charged against it the steam taken from the boiler, and the heat carried away. When the use of jets is accompanied by the reduction of smoke, it is because carbon has been brought in contact with oxygen, and for no other reason. While it is difficult to arrive at any definite conclusions as to what the possible heat loss may be when the jet is used, it is probable that in many cases combustion is promoted to an extent that makes up the loss incident to its use, leaving the reduced amount of smoke as a gain.

Large air supply is accompanied, necessarily, by low furnace temperature, and low temperature is favorable for the production of smoke. Within certain limits, however, very large air supply may be effective in promoting mixture, and show a favorable result. This is a characteristic of stationary boiler fires that are under long brick arches, which maintain a high furnace temperature, and allow the fire to be drowned with air. In this way the carbon may all be oxidized because each atom has several times as much oxygen as can be used, ready to combine when opportunity offers. While if the same air supply exists with the fire directly exposed to the boiler, smoke cannot be prevented. I have found cases where it was necessary to cut down air supply that smoke could be reduced. Excessive air supply, however, is a condition which does not usually affect locomotives.

When the admission of air over the fire is accompanied by a reduction of smoke, it is caused by the oxidation of carbon rather than by dilution. And cold air admitted over the fire is in no wise different in effect from cold air admitted through the fire bars, except that the air through the grate is liable to be better distributed, affording a superior mixture.

There are cases, of course, where smoke is small in amount with

conditions of moderate temperature and excessive air supply, together with a fairly good mixture, which is brought about by careful firing, certain coals, or both; but it is only by examining the controlling factors that the process may be illustrated.

The oxidation of carbon is immediately followed by the disappearance of flame. With high temperature and considerable flame the tendency is for smoke to escape. With low temperature and large coalings the smoke may be observed to rise from the surface of the fuel.

While the foregoing refers to the action of the furnace and the combustion process in connection therewith, it takes no account of the management or operation. This I find to be the most important factor, and that too much is expected of some particular device or method, and too little attention given to the quality of the work done by the man.

It is generally understood that there are good and poor firemen, but just what may be meant by the term "good firemen" is not very well defined. In this connection, a recent writer calls attention to the fact that we may not know the quality of the work unless we "examine the chips the man makes, or, in other words, the flue gases."

The reduction of smoke from locomotives will require considerable improvement in the quality of work performed by the fireman. The brick arch and the steam jets can only put the finishing touches on his work, which, if not properly done, leaves more for the arch or jet than they are able to perform.

I have yet to find a furnace that will be smokeless, or nearly so, under all kinds and conditions of treatment they may be subjected to, and do not expect to find such; and it must be said that in much of the prevailing practice, firing is done in a manner that would be required if the production of smoke were the important object sought.

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## A SCHENECTADY LOCOMOTIVE ON THE VANDALIA.

In March, 1899, the Schenectady Locomotive Works built for the Vandalia Line four 20 x 26 inch eight-wheel passenger engines, one of which was illustrated in our issue of May, 1899. On October 9, Mr. W. C. Arp, superintendent of motive power of the Vandalia Line, wrote to the locomotive works the following letter concerning the performance of one of these engines:

"I thought it would be interesting to you to give you the perform-

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ance of engine 177. This engine was delivered to us in March; went into service on the 23d of the same month, and was in continuous service up until the month of August this year, making a total mileage of 165,013 miles without being taken into the shop for classified repairs. Had it not been that the engine was in an accident, we feel safe in saying that it would have made 200,000 miles. During this time the engine lost 29 trips."

The general dimensions of this engine are as follows: Cylinders, 20 x 26 inches; driving wheels, 78 inches diameter; boiler steam pressure, 190 pounds; heating surface—tubes, 2,066 square feet; heating surface, firebox, 175 square feet; total heating surface, 2,241 square feet; grate surface, 30.7 square feet; weight on drivers, 85,800 pounds; total weight, 132,300 pounds.

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## CAST IRON CAR WHEELS.\*

BY G. W. BEEBE.

The cast iron car wheel, while not entirely overlooked at an earlier date, has not until a comparatively recent date been given the recognition which it demands. Close competition between wheel manufacturers, increased capacity of freight cars, running trains at a greater rate of speed, undoubtedly have opened up a greater field for consideration in regard to the cast iron wheel.

The Interstate Commerce Commission in its report of June 30, 1899, give the number of cars and locomotives in use in the United States, as follows: Locomotives, 36,234; coaches, 33,595; freight cars, 1,248,826. Taking eight wheels to each freight car, and allowing 50 per cent of the wheels under coaches and locomotives for the steel tired and designs other than the cast iron wheel, there are in use at the present time, 10,269,924 cast iron wheels. Taking into consideration the small amount of damage done, due to the failure of the cast iron wheel, it would almost seem that the manufacture of the cast iron wheel has been brought down to a science. Undoubtedly a persistency in the use of the drop and thermal test has been productive in bringing about these favorable results.

A prominent wheel manufacturer made the remark recently that "close inspection and tests had been leading factors in lifting him out

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\*Paper read before the Western Railway Club, October 16, 1900.

of a rut in which he would doubtless have remained had it not been for inspection and tests.”

A number of manufacturers of cast iron wheels have made quite a protest against the thermal test, assuming that, in making wheels to meet this test, they would do so at a sacrifice of the wearing qualities. While the adoption of the thermal test does not date back far enough to give correct data on this subject, we think there is no reason for this anxiety on the part of the manufacturer regarding loss in wear in wheels made to stand the thermal test specifications, provided the thermal test specified is a reasonable one. For the fact is conceded that, no matter what may be done with a car wheel, some extraordinary conditions may arise which will break it.

The thermal test specifications as required by the C., B. & O. R. R. are as follows :

“The test wheel must be laid flange down in the sand and a channelway  $1\frac{1}{8}$  inches wide and 4 inches deep must be moulded with green sand around the wheel. The clean tread of the wheel must form one side of the channelway and the clear flange must form the bottom. (It will be noted that the width of the channelway is equal to the height of the flange, namely,  $1\frac{1}{8}$  inches.) The channelway must be filled to the top with molten cast iron, which must be poured with two ladles directly into the channelway. The molten iron must be taken from the big ladle directly after a tap for pouring off wheels has been drawn from the cupola. The channelway must be filled with the molten iron in no greater time than one minute after the iron has been taken from the big ladle. No puddling or cooling of the iron will be allowed. If the molten iron boils in the ladles, they must be refilled until all indications of boiling cease before the channelway is filled. The time when the pouring ceases must be noted, and two minutes later an examination must be made, and if the wheel is found cracked in the plates or through the tread, the wheels represented by the test wheel will be rejected. Wheels that are wet or have been exposed to the frost may be warmed sufficiently to dry or remove frost before testing.” (See Fig. 3 as to the method of pouring the thermal test.)

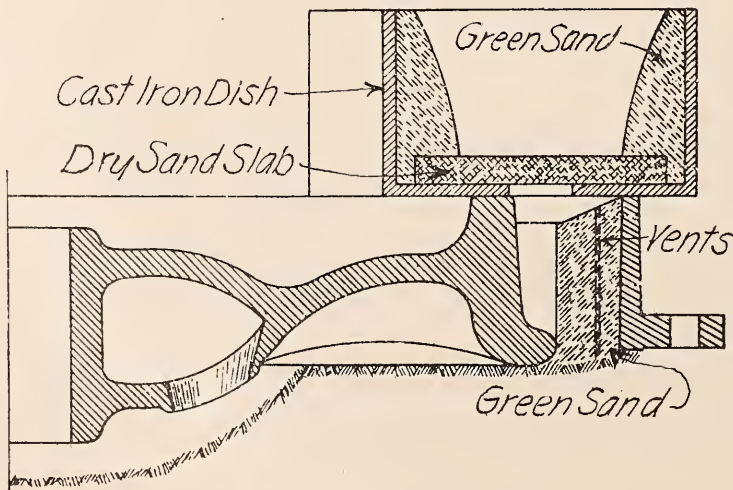


FIG. 3.

In addition to the above, the following recommendation is made, namely :

“ That at the option of the manufacturer, if the test wheel fails under this thermal test, a second wheel showing the next lower shrinkage size to the wheel which failed, and cast on the same date as the failed wheel, may be selected by the inspector and used for test. If the second wheel stands the thermal test, all wheels of the same and all lower shrinkage sizes may be accepted, while the wheels of the same and higher shrinkage as the failed wheel must be rejected.”

Wheels tested according to the above thermal test specifications, and in conjunction with the Barr drop test, will assure the railroads of the greatest degree of safety in using cast iron wheels.

The above recommendations are made for the following reasons, namely: The shrinkage allowed on a cast iron wheel is  $\frac{1}{2}$  inch,  $\frac{1}{4}$  of an inch above and  $\frac{1}{4}$  of an inch below the mean circumference, divided in 4 tape sizes  $\frac{1}{8}$  of an inch; the tape No. 1, or highest shrinkage, are the weaker wheels, conditions being normal. The inspector being aware of this, almost invariably selects the tape No. 1, or highest shrinkage number, for test. He is justified in so doing, for the first thing to consider in the inspection of wheels is the point of safety. If the tape No. 1 fails when in the thermal test, reject them, and allow the inspector to select one of the tape No. 2, or next lower shrinkage number, and if the second wheel fails, reject all of the wheels represented; providing, however, the second wheel stands the thermal test, it seems hardly fair to the manufacturer to condemn the second and lower shrinkage numbers, the inspector being satisfied by test on the second tape sizes that they are sufficiently strong and are hard enough to give the wear. If we were purchasing a barrel of apples we would hardly condemn the whole barrel on account of a few bad ones, providing we were not called upon to pay for the bad ones.

An inspector should make a study of iron, so that he can readily designate at a glance whether the first wheel failing could be attributed to bad iron or some unforeseen abnormal conditions in the pitting or handling of the failed wheel.

A wheel can be made of a hard, close grain iron that will stand the drop test or concussion in service, but if subjected to a severe and continued brake application is liable, as a boy says, “to go up in smoke.”

A gritty, hard chill will not make the mileage that a tough chilled wheel will. A gritty chill will shell out quicker than a tough one, because it will not stand the heat that is caused by severe brake application. Good white iron is tough, as well as being hard enough. There

is a great difference in the quality of white iron, as there is in gray iron; good white iron has a large proportion of combined carbon; bad white iron has a large proportion of sulphur. I believe that the steel tired wheel proves that the toughness gives the wear. I have not seen or heard of a steel tired wheel shelling out. I have heard some railroad men say that when they can cut the chill of a wheel with a chisel, that the wheel will not make good mileage. If this is the case, the steel wheel could not make the mileage that is claimed for it, because you know that the steel tired wheel is turned before being put into service, and it certainly must be soft in order that it can be turned.

These hard, gritty wheels will fail in the thermal test, or by severe brake application.

The manufacturer who will try to pawn off this class of wheels on railroad companies, or the owners of private line cars, providing the inspector does pass them, has become a fossilist. He might possibly have been successful in the manufacture of the cast iron wheel in times gone by, when freight cars were not equipped with air brakes, and their carrying capacity did not exceed 15 tons, but certainly will drop out of existence under the advanced stages of railroading.

The following table shows a comparative record of tests made by the writer under the Barr drop, in 1893, as against tests made in 1900:

TEST OF WHEELS MADE IN 1893—BARR DROP.

Wheel No. 000, tape 2—weight, 585 pounds; diameter, 33 inches—	
Number of blows to break.....	14
Wheel No. 000, tape 2—weight, 585 pounds; diameter, 33 inches—	
Number of blows to break.....	21
Wheel No. 000, tape 2—weight, 585 pounds; diameter, 33 inches—	
Number of blows to break... ..	37
General average of blows to break.....	24

TEST OF WHEELS MADE IN 1900—BARR DROP.

Wheel No. 000, tape 2—weight, 585 pounds; diameter, 33 inches—	
Number of blows to break.....	175
Wheel No. 000, tape 2—weight, 585 pounds; diameter, 33 inches—	
Number of blows to break... ..	227
Wheel No. 000, tape 2—weight, 585 pounds; diameter, 33 inches—	
Number of blows to break.....	93
General average of blows to break.....	165

(The above wheels tested were made by the same manufacturer.)

These tests certainly show a marked improvement in the strength of wheels made in 1900, as compared with those made seven years ago.

Regarding depth of chill, it should not exceed  $\frac{3}{4}$  of an inch in the throat, or 15-16 of an inch in the center of the tread. The minimum

should not be less than  $\frac{1}{4}$  of an inch in the throat, or  $\frac{3}{8}$  of an inch in the center of the tread.

Line "A" on Fig. 1, shows the dividing line between the solid white



FIG. 1.

iron and the blending of the white iron with the gray iron; "B" shows the termination of the blending of the white iron. Points "C" to "D" give the depth of chill  $\frac{3}{8}$  of an inch. Assuming that we have the maximum depth of chill, 15-16 of an inch, we get the blending of the white iron through the entire tread and begin to crowd the danger line, and gain nothing thereby. A highly chilled wheel will shell out and become comby by sliding more readily than a medium chilled wheel. In breaking up 300 defective wheels that were removed on account of shelled spots, 95 per cent showed a high chill.

The responsibility of the wheel manufacturer is frequently a disputed question; both parties agree, in the majority of cases, excepting as to the difference in comby and worn flanged wheels. There should be no disputed question as to the comby wheel, as it is a very easy matter

to determine whether this defect was caused by a severe brake application or faulty metal.

The matter of fitting wheels, especially at contract shops, does not receive the careful attention in many cases that it should, and many instances can be given showing gross carelessness in pressing the wheels on the axles, and also in imperfect boring and mating of the wheels.

While visiting a contract shop recently, I noticed them mounting wheels at as high a pressure as 85 and 90 tons. Pressing wheels on axles at as high a pressure as 85 tons will produce strains in the wheel that are very likely to develop and cause trouble after the wheel is placed in service.

It seems to the writer that some of the following recommendations, followed up closely, would lead to better results in the use of the cast iron wheel:

First. That more attention be given to the taping and mating of wheels in nearly all contract shops, and in some railroad shops the tape sizes that are applied to the wheels where they are manufactured are used without any check. All wheels should be re-taped where they are mounted.

Second. All axles should be centered and a gauge used, similar to

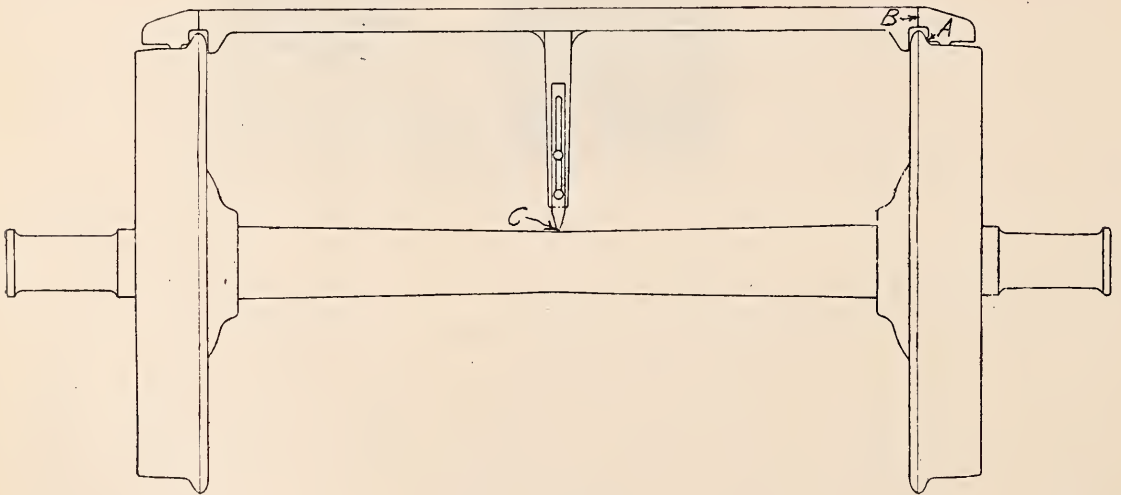


FIG. 2.

the one shown on Fig. 2. Fillet in the throat of the wheel (see letter "A" on Fig. 2), and the apex or separating line on the flange (see letter "B" on Fig. 2), are the only correct points to work from in pressing on wheels. Care should be taken to have letters "A" and "B" on the wheel form a conjunction with letter "C" on the axle.

If we press one wheel a little too far on the axle and its mate not

quite far enough, we mismate them, also by forcing one wheel to run on the high part of the tread close to the flange, while its mate runs on the low part of the tread close to the rim, and in a short time we will have a worn flange wheel on one end of the axle and a worn tread on the opposite.

Third. That the practice, as followed in some shops, of only taking one cut in boring out wheels be discontinued, as it is not practical to get a good wheel fit without taking a finishing cut.

The New York Central Railroad, I believe, sends a practical man to look after the turning up of axles, fitting and mating of wheels, at contract shops where they have cars under construction. It seems to the writer that this is a very good practice, and one that all railway companies could profit by.

Fourth. That, where practical, wheels made by the same manufacturer should be mated on the same axle, as a very slight variation in the turning up of the chill will make quite a difference in the shrinkage

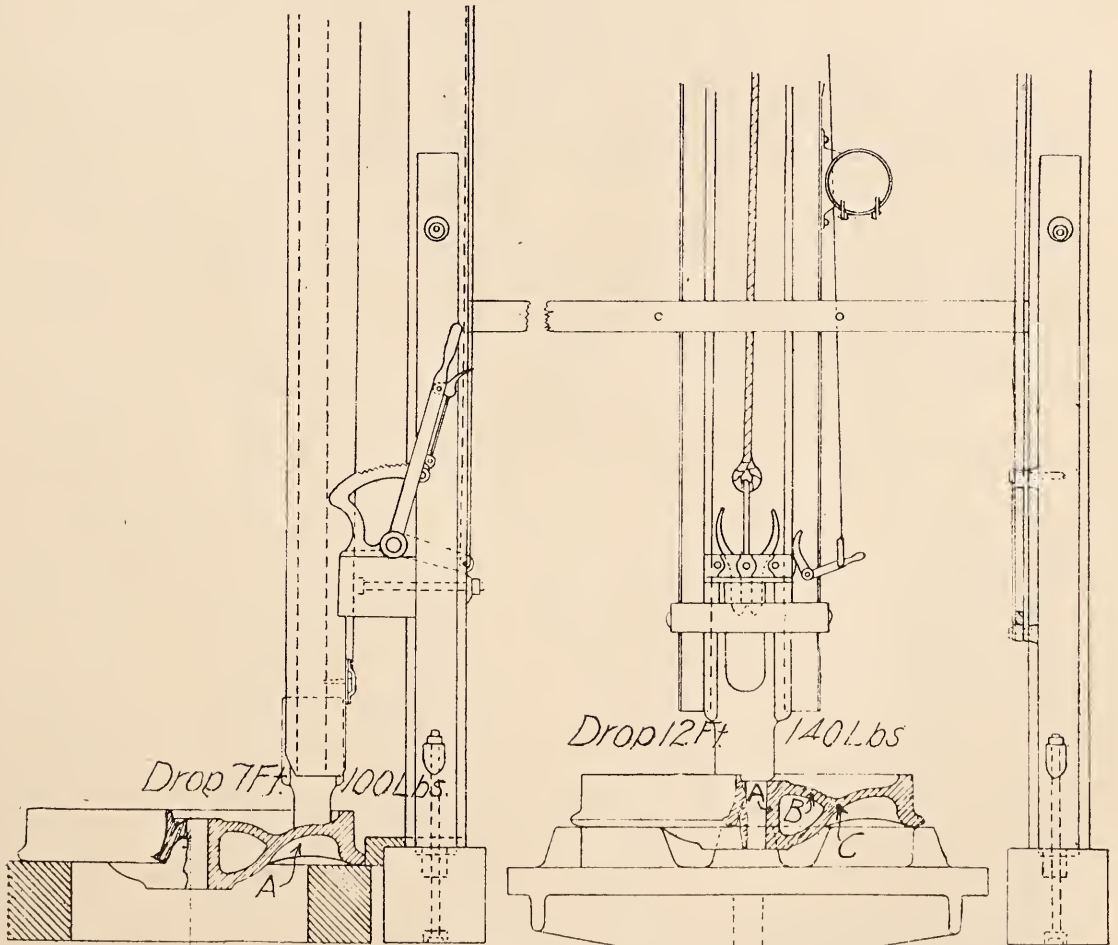


FIG. 4.

FIG. 5.

number of the wheel, and by mating two different makes of wheels we are quite likely to get a hard and soft wheel on the same axle.

The design of a pattern is one of the essential factors in the manufacture of the cast wheel, other than the thickness of flange, shape of hub, and tread. The designing of the pattern should be left to the discretion of the manufacturer. A large percentage of wheels that fail in the brackets can be ascribed to a poorly designed pattern; too light a bracket will crack because they cool more rapidly than the plate of the wheel, which would cause a strain on them; too heavy a bracket will throw the strain on the plates, causing the plates to crack.

For the benefit of those who are not familiar with the drop test used in testing wheels, Fig. 4 gives an illustration of the Barr drop; Fig. 5, the M. C. B. drop. It will be noted that the hammer of the Barr drop strikes the single plate of the wheel (see letter "A" on Fig. 4). The hammer of the M. C. B. drop strikes the hub of the wheel (see letter "A" on Fig. 5). A wheel rarely fails in service in the hub, double plates, or at the intersection of the plates (see letters "A," "B" and "C" on Fig. 5). If a crack does occur at these points, it does not necessarily cause the wheel to become dangerous. If a crack occurs in the single plate (see letter "A" on Fig. 4), we then have a dangerous wheel, and it will not run long before giving way entirely.

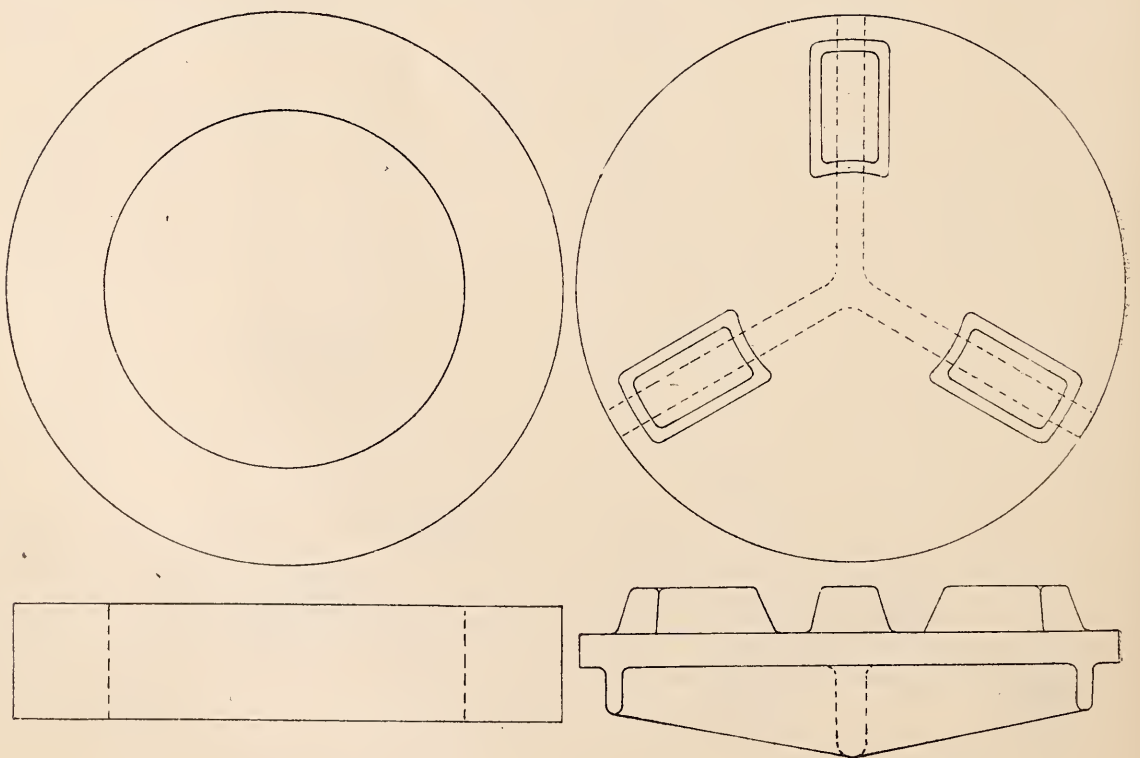


FIG. 6.

FIG. 7.

You will note that wheels tested under the M. C. B. drop are placed flange downward on an anvil block, having three supports for the flange of the wheel to rest upon (see Fig. 7). The hammer strikes the central part or hub, the whole of the wheel resists the concussion; while the wheels tested under the Barr drop are placed flange downward on a flat surface anvil block (see Fig. 6). The wheel receives the concussion at one point only.

The C., B. & O. Railroad specifications require wheels tested under the Barr drop to stand 50 blows without breaking out a piece.

The Pennsylvania Railroad Company specifications, I believe, require wheels tested to stand 12 blows under the M. C. B. drop without breaking out a piece. It would seem fair to assume that the Barr drop would find the weak or dangerous part of the wheel more readily than the M. C. B. drop.

The treatment and handling of the hot wheel has nearly as much to do with the strength as does the material used.

Cold iron will produce seams in the tread, internal strains, because the molten iron sets in the mold as fast as it is poured.

Hot iron, with slow and uneven pouring, produces sweat in the throat, uneven chill, and internal strains; delay in getting the hot wheel in the pit after being shaken out of the mold will also produce strains in the wheel by uneven contraction.

To overcome these undesirable results, it is necessary to have hot iron and fast pouring. The maximum limit of time in pouring up a 33 inch wheel should not exceed 12 seconds. Wheels must be gotten into the annealing pits expeditiously after being shaken out of the mold. The annealing pits should also be covered properly.

Table No. 2 gives the analysis of a number of wheels tested under the Barr drop and in the thermal test:

	Wheels that failed in thermal test.		Wheels that stood thermal test.		Wheels that failed under 50 blows, Barr drop.		Wheels that stood 50 blows and over, Barr drop.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Total .....	3.91	3.63	3.90	3.38	3.37	3.42	3.93	3.49
Graphitic .....	3.02	2.92	2.98	2.71	3.19	2.90	3.02	2.90
Combined .....	.89	.71	.92	.67	.68	.52	.91	.59
Sulphur .....	.090	.042	.10	.080	.080	.020	.070	.05
Manganese .....	.60	.49	.58	.48	.62	.40	.72	.47
Silicon .....	.82	.50	.91	.50	.97	.67	1.10	.68
Phosphorus .....	.48	.39	.52	.26	.58	.30	.53	.28

A part of the wheels failing under these tests cannot be ascribed to the composition.

## FAST RUNS ON THE LEHIGH VALLEY.

Appended is a statement showing some fast runs made on the Lehigh Valley Railroad, by trains Nos. 9 and 10, these trains being the famous Black Diamond Express, west-bound and east-bound respectively, during the period October, 1897, to July, 1900.

The regular schedule of this train is: West-bound, New York to Buffalo, 448 miles, 9 hours and 55 minutes, including ferry and 13 stops. Deducting time consumed by the ferry and stops, the actual running time of train between Jersey City and Buffalo, 447 miles, is 9 hours and 12 minutes.

The regular schedule of this train, east-bound, Buffalo to New York, 448 miles, is 10 hours and 3 minutes, including ferry and 13 stops. Deducting the time consumed by ferry and stops, the actual running time of the train between Buffalo and Jersey City, 447 miles, is 9 hours and 20 minutes.

Especial attention is called to fast run made by train No. 9, on July 21, 1900, Alpine to Kendaia, a distance of 34 miles in 23 minutes, or a speed of 89 miles per hour. Another instance is shown on November 3, 1899, where train No. 9 ran 43.9 miles in 33 minutes, this being 80 miles an hour.

FAST RUNS MADE ON LEHIGH VALLEY RAILROAD.

DISTANCES OVER 100 MILES.						
Train.	Date.	FROM	TO	Dist.	Actual time, mins.	Speed per hour.
9	July 20, '98	Sayre .....	Buffalo .....	177	169	63
9	July 24, '99	Sayre .....	Buffalo .....	177	170	62
DISTANCES 50 TO 100 MILES.						
Train.	Date.	FROM	TO	Dist.	Actual time, mins.	Speed per hour.
10	Oct. 11, '97	Easton .....	So. Plainfield ..	50.4	48	64
10	Oct. 16,	Easton .....	Parkview .....	65.6	60	66
10	June 6, '98	Easton .....	Parkview .....	65.6	61	62
9	Jan. 9, '99	Manchester .....	Buffalo .....	88	86	61
9	Mar. 22,	Manchester .....	Buffalo .....	88	85	62
10	Mar. 23,	Buffalo .....	Manchester .....	88	83	64
10	Nov. 2,	Wende .....	Manchester .....	69	61	65
DISTANCES UNDER 50 MILES.						
Train.	Date.	FROM	TO	Dist.	Actual time, mins.	Speed per hour.
9	May 15, '98	So. Somerville	Landsdown ..	19.5	16	73
9	May 20,	Laceyville .....	Rummerfield ..	18.9	14	82
10	June 24,	Wysox .....	Wyalusing .....	16.8	14	73
9	July 18,	Laceyville .....	Wysox .....	26	22	72
9	Aug. 19,	Laceyville .....	Homet's Ferry	15	12	75
10	Oct. 13,	Rummerfield ..	Laceyville .....	18.9	15	76
9	Nov. 3,	Alpine .....	Geneva Jct. ....	43.9	33	80
9	Feb. 12, '00	Hinman .....	Geneva Jct. ....	41.9	37	73
9	Feb. 19,	Alpine .....	Kendaia .....	34	25	82
9	Mar. 22,	Batavia .....	Depew Jct. ....	27.5	23	70
10	July 3,	Homet's Ferry	Laceyville .....	15	12	75
9	July 21,	Alpine .....	Kendaia .....	34	23	89
10	Oct. 5, '97	Musconetcong	Three Bridges	15.4	12	77
10	Oct. 9,	Three Bridges	Bound Brook ..	15.5	11	85
10	Oct. 13,	Homet's Ferry	Laceyville .....	15	11	82
9	Oct. 16,	Wyalusing .....	Wysox .....	16.8	13	78
9	Oct. 18,	Pt. Reading .....	Landsdown .....	21.9	18	71
10	Oct. 21,	Musconetcong	Bound Brook ..	30.9	26	71
9	Nov. 1,	Wyalusing .....	Wysox .....	16.8	14	72
9	Nov. 11,	Hector .....	Kendaia .....	17.6	12	88
10	Dec. 11,	Towanda .....	Laceyville .....	30	25	72
9	June 9, '98	Parkview .....	So. Plainfield ..	15.2	14	66
10	Jan. 13,	Musconetcong	Three Bridges	15.4	13	66
9	Aug. 6,	So. Somerville	Landsdown .....	19.5	17	69
9	Aug. 9,	Parkview .....	So. Plainfield ..	15.2	13	70
10	Aug. 31,	So. Plainfield ..	Parkview .....	15.2	13	70
9	Oct. 3,	Burdett .....	Kendaia .....	22.9	17	82
9	Oct. 17,	Alpine .....	Kendaia .....	34	26	79
9	Dec. 16,	Laceyville .....	Rummerfield ..	18.9	15	76

## LOCOMOTIVE DESIGN.

Mr. Waldo H. Marshall, superintendent of motive power and machinery of the Lake Shore & Michigan Southern Railway, gave the second in the series of lectures in the railway course at Purdue University, on Thursday, November 1. His subject was, "Locomotive

Design." Mr. Marshall discussed, first, the conditions which control the selection of a type of locomotive which is to render a given service. He urged the importance of making the machinery light, so that all available weight may be put into the boiler. The possibility of improving present designs by the adoption of steel for wrought and cast iron was carefully reviewed, and examples were given of recent achievements in this direction. In a similar manner, other problems of design which are general in their application, but which readily resolve themselves into matters of detail, were forcefully discussed.

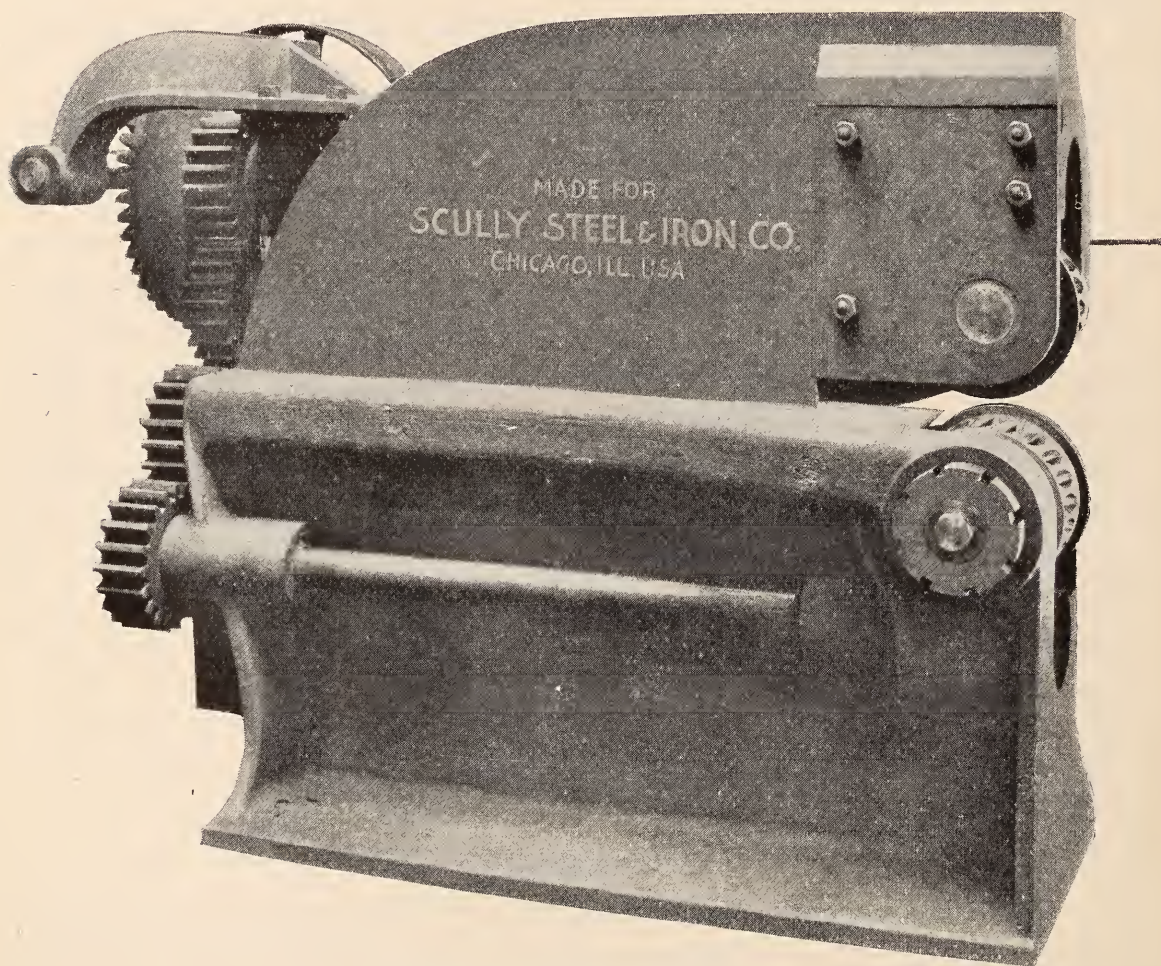
In conclusion, the conditions to be met in working up a design were defined as (1) safety; (2) efficiency and reliability in service; (3) economy; and (4) beauty of the whole design. Upon the last point, he said: "The modern locomotive, with its mammoth proportions and simple outlines, its great boiler indicative of power, and its well proportioned machinery, is altogether too magnificent and majestic a piece of work to leave the hands of the designer in a crude and unfinished state. A handsome locomotive hauling at high speed, and apparently with so much ease, a long passenger train, or dragging with slower motions many hundreds of tons of freight, is a sight which pays the designer for all his labor, and if we reflect upon the great work which the locomotive is doing, and will yet do for mankind in the development of the resources of nations and the extension of the bounds of civilization, we find inspiration for careful, conscientious work, in the assurance that whatever can be contributed to the perfection of the locomotive, is worth the best efforts of the mechanical engineer."

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## ROTARY SPLITTING SHEARS.

There has recently been brought into use a novel plate cutting machine which was especially designed to overcome the defects existing in other types of shears, and to reduce the cost of the labor and increase the speed with which plate could be cut. With the use of these shears it is possible, it is claimed, to cut a clean, straight edge 500 per cent faster than can be done with the old type of splitting shears, and to do this with only about 25 per cent of the former help required. The Kling rotary splitting shears, an excellent view of which we give herewith, will cut plate any width or length, as heavy as  $\frac{3}{4}$  inch thick and as light as No. 16 gauge sheet steel. In making a test of the

shears recently, the machine cut eight feet of  $\frac{3}{4}$  inch plate steel in one minute. With these shears it is possible to follow a convex, curved line with a fairly small radius, a distinguishing advantage of this machine which is not possessed, it is asserted, by any other splitting shears now in existence. The knives are made in such a way that they can be reversed and used on either side, thus prolonging the life of the cutters and permitting the user to secure full use of both sides before they need to be redressed. The knives are adjustable and can be regulated



ROTARY SPLITTING SHEARS.

for the different thicknesses of metal. The driving mechanism is so arranged that the belt can be run direct from the main line shaft and the tool placed in line with all others in the shop, the same as any other splitting shears, thus enabling it to be used in as small a space as is required for the old type of alligator shears.

The rotary cutters are each set on a worm wheel 12 inches in diameter and 7 inches face, and are each driven by a worm 7 inches in diame-

ter, at the ends of two horizontal shafts running parallel with the machine, one located in the lower part of the machine and the other located in the upper part of the machine, and arranged in such a way that they do not interfere in any way whatever with the cutting or handling of the plate during the process of shearing. At the end of each shaft are two pinions 10 inches in diameter, 4 inches face, connected with three intermediate pinions, all of the same size, which are driven by a bevel gear, 24 inches in diameter, with a spur pinion cast on the back on the bevel gear. The bevel gear is driven by a bevel pinion set on the pulley shaft and driven by a friction pulley 28 inches in diameter for a 6 inch belt. The floor space required is 30 inches on the ground and 4 feet at the top where the pulleys are located.

The machine will feed itself after the plate is once fed into the cutters, and on this account one man, in connection with the use of a trolley, can easily guide the plate along the cutting line and obtain a straight, clean cut where it has heretofore been necessary for three or four men to be employed, and only a ragged, irregular cut obtained.

In comparison with the alligator splitting shears, this machine has the following advantages claimed for it by its makers: It will cut 500 per cent faster; it only requires about 25 per cent of the help; it will cut a clean, straight edge; the cutters feed themselves after the plate is once fed into the knives. In comparison with other rotary shears the makers advance the following claims of superiority for it: It will cut any width or length of plate steel; the knives can be reversed and used on either side; it can be set in line with the other tools and driven from the main line shaft; it requires 50 per cent less shop room to operate it in; it will follow a convex, curved line.

These shears are manufactured exclusively for the Scully Steel & Iron Co., Chicago, Ill., who are prepared to furnish all information desired concerning same on application.

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## A MASTER MECHANIC EULOGIZES "THE TRAVELING ENGINEER."

Mr. T. M. Feeley, master mechanic of the Southern Railway at Birmingham, Ala., had a paper before the last meeting of the St. Louis Railway Club that voices a broad and candid appreciation of the value of the traveling engineer. Mr. Feeley said in substance:

The title of traveling engineer, taken in its broadest sense, implies that his duties are of a migrating character, limited by the boundaries

of the particular division or road on which he is employed. This to the inexperienced eye; but to the eye of experienced railroad men of any particular department, who are familiar with the multifarious duties of a traveling engineer, it implies much more, and to him they look for the successful handling of traffic from a mechanical standpoint while in transit, or, in other words, on the road. With the foregoing implications drawn from title alone, the next important question is, what character of man is best adapted to fill the position of traveling engineer successfully, and to the satisfaction of the company employing him. He should be possessed of the following essential qualities:

1st. A perfect man physically, in order to withstand the arduous duties of his calling.

2nd. A well-balanced intellect, with all his faculties sufficiently developed to enable him to think quickly, and reason with that degree of intelligence sufficient to overcome his prejudices and hobbies.

3rd. A man void of partiality and susceptible only to reason and justice.

4th. A progressive mind, coupled with determination and push.

5th. An extensive knowledge acquired by experience.

6th. The ability to manage and conduct the business he is engaged in with economy and success.

The qualifications set forth are very desirable in the traveling engineer. We have known and have been associated in the same field of labor with men who could not be induced to try anything new, preferring to remain in the old rut, contenting themselves with the idea that the old way is good enough.

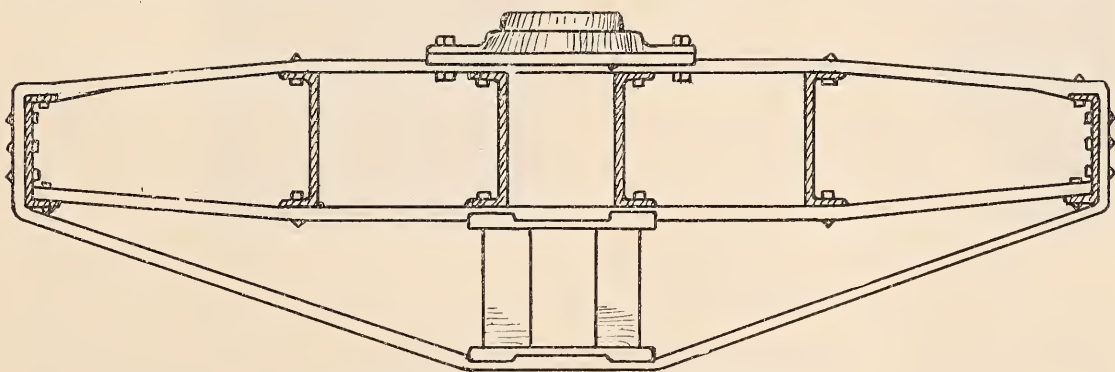
How much better is it for the traveling engineer himself, as well as for the company's interest, to establish the reputation among his subordinates of being a man open to suggestion, of any nature, emanating from any source, however humble? Keen perception, good judgment and common sense enable a man of experience to grasp an idea or suggestion at once, giving it such consideration as its merits deserve, creating a degree of confidence in the subordinate that will stimulate and urge him to further exertions in the line of progression, along the paths of improvement and advancement.

The qualifications mentioned above are not only desirable, but very essential to the successful co-operation of subordinates in all matters pertaining to the welfare of employers. The traveling engineer can, by his methods of handling men, impress them with all the responsibilities of their positions; and the importance of performing their duties intelligently will stimulate them to improve their time by study and investigation, in order to secure from the traveling engineer the recognition that comes to a studious, careful and economical employe.

The traveling engineer possessed of the qualities mentioned is not only a desirable official, but one well worth his salary, and of invaluable service to the company that employs him. Being in close touch with the enginemen, he exerts a powerful influence in the line of economical

management and care of engines. The benefits derived therefrom are multifarious. The use of oil and coal cuts quite a figure in the finances of the company. The care of machinery is another important matter, though not looked on in the same light as the use of oil, etc.; the careful engineer, who knows the condition of his engine, often saves both oil and coal in large quantities by a little attention at the proper time; not carelessly waiting until called on by the fumes of a hot box or pin, when he will be compelled to expend double the amount of labor and material to bring it back to its normal state. When the traveling engineer is conscientious in the discharge of his duties he is sure to give the same attention to one side of the engine as the other. And the fireman comes in for his share; and there is no one who can throw away money faster in the labor assigned him than the fireman, and that by the injudicious use of coal in firing. In this direction the traveling engineer can make himself one of the most useful of men, and, when many engines are in service, can, in one month, save his salary for the whole year.

And, again, the assistance rendered the master mechanic by the traveling engineer is of much importance. His watchful eye takes in the condition of all engines in service; he keeps tab on same, and can tell when called on, the exact condition and work needed on all engines. And, again, his regular reports keep all interested posted on the true condition of power at all times. He is also the authority on the qualifications and abilities of the men, as well as the machinery, and he is a very important factor in the welfare of any operating division, and, if his importance is carefully considered by his superiors, he would be to them as the rudder of a ship, the foundation of hope for safe guidance through troubled waters.



### A NEW PLATE BOLSTER.

It is generally admitted that the ordinary two-plate body bolster is not a sufficiently rigid nor, in other respects, a satisfactory device, so far as serviceability is concerned, no matter how worthy its claims may be for cheapness.

The accompanying drawings show how it is possible, in hopper bot-

tom cars, to provide a body bolster made of plates or a combination of plates and rods that will be very much more rigid and durable than the ordinary two-plate body bolster, and yet not so expensive as many of the patented body bolsters.

While the drawings show the car sills to be of channels, the construction is adaptable to wood sills as well.

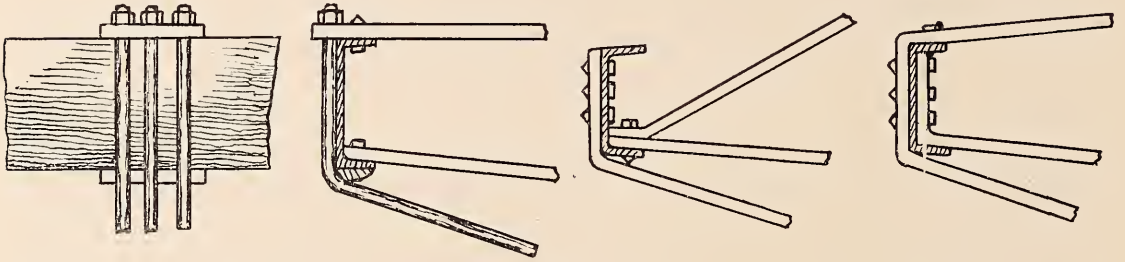


PLATE BOLSTER—VARIABLE DETAILS

The construction is made plain in the cuts here shown. The smaller cuts show different methods of making the end connections. This bolster was invented and patented by Mr. H. S. Bryan, the master mechanic of the Duluth & Iron Range Railroad.

## A NEW APPLICATION OF PNEUMATIC TOOLS.

The accompanying illustration shows a new application of pneumatic tools, just patented and put on the market by the Chicago Pneumatic Tool Company. As will be seen from the illustration, a saw blade is attached to the piston of a pneumatic hammer, and, running at the rate of 8 to 1800 strokes per minute, according to the size of hammer, it makes a very efficient device for use in connection with any sort of woodwork.

The saw shown in the illustration is an ordinary key-hole saw blade, and with it thus attached to a hammer the most difficult lines can be followed by the operator with no apparent effort. For use in the pattern shop it is especially economical and efficient, and it is adapted to cabinet work and intricate figure carving. The hammer to which the saw is attached is what is known as the Chicago Co.'s B. B. hammer—one of the smaller sizes.

This device has been put in practical operation by one of the largest of the packing houses at Chicago, (using a saw blade with finer teeth)



“SAWING WITH A HAMMER.”

for the purpose of sawing ham bones, and for this use it has proven exactly what is needed.

With a larger size of hammer this saw is used with great economy for sawing off the ends of car roofs.

This device is, in fact, a portable saw mill, so simple in operation and so free from danger that an apprentice can use it as readily as the most skillful mechanic.

## THE CAR FOREMEN'S ASSOCIATION OF CHICAGO.

### OCTOBER MEETING.

The regular meeting of the Car Foremen's Association of Chicago, was held in Room 1741, Monadnock Block, Chicago, Thursday evening, October 11. President Morris called the meeting to order at 8:00 p. m. Among those present were the following:

Beckman, H. J.	Gruhlke, Edw.	Keebler, C. F.	Saum, G. N.
Blackburn, D. W.	Gardner, L. S.	Kline, Aaron	Stimson, O. M.
Bourell, J. W.	Grieb, J. C.	Kline, J. C.	Stagg, C. S.
Buker, Jas.	Harvey, H. H.	La Rue, H.	Schoeneberg, C.
Bates, G. M.	Hansen, A. P.	Lutz, Jos.	Schultz, F. C.
Blohm, Theo.	Hedrick, Elias	Marsh, Hugh	Schutt, W. F.
Bannes, A.	Holtz, Chas.	Morris, T. R.	Smith, R. G.
Cook, W. C.	Hunt, T. B.	Mattes, J.	Sharp, W. E.
Cardwell, J. R.	Hughes, Chas.	McAlpine, A. R.	Shoemaker, C. A.
Constant, E. J.	Hagge, Wm.	Olsen, L.	Taylor, J. W.
Cather, C. C.	Hanson, W. L.	Peters, John	Van Drake, Chas.
Carey, C. H.	Isringhaus, G. H.	Perry, A. R.	Williams, T.
Chambers, Frank	Johnson, A. F.	Pettis, C. D.	Wessell, W. W.
Delsing, Fred	Julian, J. B.	Ruff, A. W.	Wolfe, Chas.
Deen, Chas.	Krump, M.	Reinhard, F. B.	Weschler, H.
Elkins, J. L.	Kroff, F. C.	Rieckhoff, Chas.	Wentsel, Geo.
Evans, W. H.	Kramer, Wm.	Richardson, Wm.	Wensley, W. H.
Earle, Ralph R.	Konze, Wm.	Roof, C. S.	Willcoxson, W. G.
Guthenberg, B.	Krischel, M.	Saum, C. L.	Wirtz, L. C.

The minutes of the previous meeting, as printed in the RAILWAY MASTER MECHANIC, were approved.

President Morris asked if the committee on labor charge for applying draft timbers to refrigerator cars was ready to report, and Mr. Grieb responded to the effect that it was not, because of failure, up to date, to receive sufficient replies from members upon which to base the report. The committee was accordingly granted an extension of time.

Secretary Kline reported the following new members: James Puddicome, C., L. S. & E. Ry.; Frank J. Zanone, L. S. & M. S. Ry.; Jno. L. Elkins, Shippers Ref. Car Co.

Secretary Kline read a communication from Mr. Taylor, secretary of the Master Car Builders' Association, regarding the use of the words "renew" and "replace," in the M. C. B. rules, as recommended by the Car Foremen's Association.

Mr. Grieb: I rather take it, from what I hear and from the endorsement of this association, also of the Western Railway Club, that

our recommendation was very well thought of. It seems to me very apparent that there is an error in the use of the two words in Section 22 of Rule 5, and it ought to be corrected.

Mr. Taylor: The arbitration committee referred all matters relating to prices to the committee on prices. Why it did not take action, I do not know. I suppose it was too busy to go into all the recommendations that were made.

Mr. Grieb: We had trouble last year, and some trouble this year, because of some misinterpreting of the word "replace" in the renewal of draft timber bolts and draft timbers; and because we failed to carry a change through last year, is no reason why we should in the future.

Mr. Taylor: The Western Railway Club thought favorably of it, and the arbitration committee too, but as the committee on prices failed to do anything with it, I think it is all right for the Car Foremen's Association to take the matter up again.

President Morris: The executive committee arranged for a sort of an informal meeting this evening, not having any subjects for discussion, intending to take up the time, rather, in attending to the annual business in the way of election of officers and listening to reports of the outgoing officers, and possibly to addresses from the incoming officers. We will now proceed to the election of officers. At the last meeting of the executive committee Mr. Geo. Wentzel, Mr. McAlpine and Mr. Goehrs were appointed the committee on nominations.

Secretary Kline: The committee has reported the following names: For president, W. E. Sharp; for vice president, J. C. Grieb; for treasurer, Charles Deen; for secretary, Aaron Kline.

Upon motion of Mr. Roof, the secretary cast the ballot of the association for the gentlemen named.

The address of retiring President Morris followed:

#### RETIRING PRESIDENT MORRIS' ADDRESS.

GENTLEMEN:—The Car Foremen's Association of Chicago tonight enters upon the fourth year of its existence, and I think we can look back upon the past three years with a certain amount of satisfaction. Beginning in 1897 with nine members, we have now on our books the names of 269, having added 98 during the twelve months ending in September.

As we stand today it has been demonstrated that associations such as ours are needed in the railway world. In a recent issue of the *Railway Age*, I read an article in which it was stated that our associations of car men throughout the country were taking the place of railway clubs to a certain extent, and that the M. C. B. Association would have to look to us in the future for suggestions and recommendations in regard to changes in M. C. B. rules. As this seems to be the opinion generally of the heads of car departments we thank them for their appreciation, but do not intend to be satisfied with that or to stop

at that point. We expect to go farther. We hope to broaden out, and make such good use of our practical knowledge that we shall be recognized as the equals of any association devoted to car department matters in the country.

The Car Foremen's Association of Chicago is the pioneer of the present existing associations in the United States, and we are glad that, by reason of the example we have set and the help we have given, numerous associations have sprung up in different parts of the country, most of which are in a flourishing condition.

Our finances are in fairly good shape. The executive committee has not considered it good policy to "lay up treasures," but rather, when an accumulation occurs, to devise some means of disposing of the same for the benefit of the members.

It was in pursuance of this policy that arrangements were made to furnish the RAILWAY MASTER MECHANIC to the members of the association without a corresponding increase in the yearly dues. It seems to me that this is the proper method to follow, as the association was formed for such profit only as may come from a higher education in the line of the business in which most of us are interested.

Before leaving the question of finance, I want to call your attention to the hearty support given us by the railway companies. We received a subscription of \$10.00 from each one of eighteen railways. The Secretary gives the names of those who contributed, in his annual report. I have reason to believe that in nearly every one of these cases the subscription will be continued annually. I would recommend that a resolution be passed by this association thanking these companies for their support and that copies of the same be forwarded to them.

The annual excursion which was the event of each of the two previous years was omitted this year, and, personally, I think this is to be regretted. It is a fact that the excursion over the Belt Railway in 1898 was of great benefit to the association, the result being a considerable increase in the membership and added interest taken in it by all. The attention of a large number of car department men was attracted to the association, followed in many cases by their joining us. The excursion to the West Milwaukee shops of the C., M. & St. P. Ry., in October 1899, was also greatly enjoyed by the members in the way of both profit and pleasure.

The attendance during the past year has been very good, a number of the members coming here from quite a distance and at considerable personal sacrifice.

The officers of the association regret that they have not been enabled to procure a hall for the monthly meetings for which we would not have to pay rent. It seems that in a city of the size of Chicago, there should be something in the way of a hall owned or controlled by a railway company that we could have rent free, but considerable time has been spent and inquiries made without bringing to light anything that would be suitable.

But, while congratulating ourselves, we must not close our eyes to our faults. One of the greatest of these, as seen from my point of view, is the backwardness of the members in speaking on the questions before us. There is scarcely a subject brought up for discussion that each and every one has not a more or less intelligent opinion upon, and there is no reason why the association should not have the benefit of it. When individuals are approached on this subject, they say they come here to listen and learn. It is to be hoped that we all come here to learn, but if each one confines himself to listening and does no talking, our meetings would be tame affairs I am afraid. Another fault is the poor support given the committee on subjects. I have called your attention to this matter so often that I hesitate in doing so again, and will only say that I hope that each one will do his share during the coming year in suggesting interesting subjects for our meetings.

Before resigning the chair to my successor, I want to thank you all very much for

the very kind treatment and support given me as president of your association during the past year, and bespeak for the incoming president the same cordial relations.

President Sharp and Vice-President Grieb made brief, but happily expressed, acknowledgment of their appreciation of the honor conferred upon them by the association in electing them to their respective offices.

The report of the treasurer was then presented, as follows :

### TREASURER'S REPORT.

YEAR ENDING OCT. 1, 1900.

#### RECEIPTS.

On hand Oct. 1, 1899 .....	\$ 10.05
From Entertainment Committee .....	17 20
From renewal of dues .....	136.00
From new members .....	101.00
From RAILWAY MASTER MECHANIC .....	50.00
Contributions by railways .....	180.00
Total.....	\$494.25

#### DISBURSEMENTS.

Rent of hall.....	\$ 82.50
Stationery.....	13.22
Stamps and postal cards .....	56.75
Stenographer.....	75.80
Secretary.....	98.50
Subscriptions to RAILWAY MASTER MECHANIC.....	98.50
Incorporating association.....	11.00
Miscellaneous.....	6.68
Total.....	\$442.95
Receipts.....	\$494.25
Disbursements.....	442 95
Cash on hand.....	\$ 51.30

The secretary's report was then presented, as follows :

### SECRETARY'S REPORT.

The meetings of the Car Foremen's Association of Chicago have been held regularly each month in room 1741 Monadnock Building. The average attendance during the year was 52, the highest attendance being 70, which was September, 1900.

We received in the year just closed, 98 new members. We lost, I am sorry to say, by reason of lapse of dues, 22, and by death 2—Mr. W. O. Davies, of Chicago, and J. F. Malloy, of Milwaukee. At the present time the membership is 269. Some of these are in arrears, but we hope they will all pay up before their membership expires.

At the beginning of the present calendar year a request was made on all the different railways and private car lines represented in the association, which includes all the principal ones entering Chicago, for a contribution of \$10.00 per year to carry forward the work laid out by the executive committee. This appeal met with very gratifying results, and contributions for 1900 were received from the following named roads and private car companies :

Burton Stock Car Co.; Wisconsin Central Railway; Chicago, Milwaukee & St. Paul

Railway ; Chicago, Burlington & Quincy Railway ; Continental Fruit Express Co ; Swift & Co. ; Belt Railway ; Armour Car Lines ; Lake Shore & Michigan Southern Railway ; Elgin, Joliet & Eastern Railway ; Baltimore & Ohio Railway ; Consolidated Cattle Car Co. ; Atchison, Topeka & Santa Fe Railway ; Illinois Central Railway ; Chicago Junction Railway ; Pennsylvania Co. ; Lipton Car Lines ; Live Poultry Transfer Co. A total of 18. The others either refused to assist us, or were not heard from at all.

These contributions have enabled us to place in the hands of all the members of the association the RAILWAY MASTER MECHANIC, in which our proceedings are published, without increasing the annual dues.

The association has also been incorporated under the laws of Illinois, and is now a full-fledged legal corporation. The legal services in this connection were performed by Mr. A. Richmond, one of our members, without cost to the association, the only cost being the statutory fees for incorporating and recording.

The auditing committee later presented the following report :

AUDITING COMMITTEE'S REPORT.

The auditing committee beg to report that the accounts of the secretary and treasurer for the past year have been audited and found correct, as submitted to the association by these officers at the last meeting.

ARTHUR R. PERRY,  
F. DELSING,  
LOUIS C. WIRTZ,  
Auditing Committee.

A vote of thanks was tendered to the railway companies which had contributed toward the support of the association.

A vote of thanks was tendered to Mr. Alexander Richmond for his gratuitous handling of the legal formalities connected with the incorporating of the association.

A vote of thanks was tendered to the retiring officers for the able manner in which they had conducted the business of the association during the past year.

Then followed a general discussion for the "good of the order," during which there was developed a strong feeling of interest in the work of making the association even more useful than it has been. The point was strongly urged that the members of the association should be more active in supporting the officers. All the speakers voiced a warm appreciation of the value of the association, and of its work, and all expressed an earnest belief in its prospective growth in numbers and in influence.

The spirit of this discussion is indicated by the following extracts therefrom :

Mr. Hunt: I am glad to know that the association has grown to the proportions that it is, in the last three years. I do not know why we should not go on in the years to come, as we have in the past. We

have been on the up grade right along and I do not think we have been going down at any moment. There is a great deal of interest taken by most of the members. We ought to all pitch in and bring this thing up to as high a scale as possible. As Mr. Morris has said, there are many things that occur with us almost daily that if brought before the association would be of general interest to all. But these things occur in a business way and we get through with them and are satisfied, and they do not get to the association, where they ought to come. I hope in the future we will all take more interest in that respect, and when something intricate occurs in our business, and after due consideration and study we arrive at some conclusion that possibly satisfies ourselves, that we will bring the matter before the association, so that all may have the benefit.

Mr. J. W. Taylor: I believe the Car Foremen's Association is a very good association. You gentlemen here are those that raise all the questions that cause the arbitration committee so much trouble.

Mr. Grieb: It occurs to me that we have a distinct and large field of utility ahead of us. I think we have every reason to feel proud of the little we are doing. It takes unity of action to make success. A good deal of our success has depended on the officers and the members of various committees. We ought to try to assist the officers and committees by giving them our hearty support. When there are 110 inquiries sent out and but 21 replies received, after a lapse of seven weeks, I think this show is very unflattering to the members that failed to respond. Of course there is much of the feeling: "If I don't attend to it, the others will." Every one ought to make this association of paramount interest to himself individually. He is doing good work for himself, as well as the interest he represents. It occurs to me that really something ought to be done this year toward getting suitable quarters. I believe that in the course of this year we will find the present quarters inadequate, if the individual members will take the right kind of personal interest in the matter. That is the keynote of the situation—personal interest in every meeting. I believe this association is the pioneer in its field. There is no reason why its influence should not be elevated and extended to a higher field. The amount of good we do depends on the amount of interest we take in it.

Mr. La Rue: I want to thank the association for the benefit it has been to me. I do know this, that on our trip two years ago, in the acquaintance I made with certain parties, there were ideas advanced

that, if worked out, would amount to a great deal in our own car business, and I think these social gatherings are the best features of the association.

Mr. Elkins: My reason for joining this association is, that I am a seeker after light. I have been wandering in darkness on a good many subjects in car repairing and car building, and I certainly have felt the need of this association for a year or two.

Mr. Cardwell: I am very enthusiastic over the results achieved by this association in the past, and over the future before us.

Mr. Evans: I cannot speak from experience in this association, but I want to say a word for the good this association has done throughout the country. It is my privilege to be a member of a similar association in Columbus for a number of years, and we derive a great deal of benefit in getting together once a month, exchanging ideas and discussing different points which arise between us, or new points that arise in the rules. There is another matter—the matter of subjects—that is pretty hard to get at. A person thinks of lots of subjects all through the month, but when the meeting time comes they are all gone. Unless he puts them down on a piece of paper to submit them before the meeting, he will not have them ready, and I think it would be a very good plan for each member to send in his subjects before the meeting. At the last meeting at which I was present, we had a discussion on buffer blocks, and I think there were as many as six or eight different names used for the parts known as deadwoods or buffer blocks. Now, I think one of the best things this association can do for the car departments of America, would be to designate a name for each part of the car, and all use the same name. There are, as you know, a lot of names on cars, derived from the canal boat or the steamer, or the early millwright—names which applied very well in those times to those things, but they have outgrown their use and do not apply very well to a modern up-to-date car.

Mr. Pettis: I have taken a great deal of interest in the proceedings as they come out, and have made it my duty to read them regularly, and I have suggested to my clerks that if they want to keep posted on car department matters and the M. C. B. rules, they should read the minutes of the Car Foremen's Association.

Mr. Grieb: I believe there are some cases brought before this association that, just by reason of their being discussed here, were not presented to the arbitration committee, as after the free and easy dis-

cussion we had here there was a better feeling all around, and everybody felt better satisfied.

A cordial and suggestive letter from Mr. S. P. Bush, superintendent of motive power of the Chicago, Milwaukee & St. Paul, was presented and ordered printed in the proceedings, and the meeting then adjourned. Mr. Bush's letter is appended:

WEST MILWAUKEE, Oct. 8, 1900.

*Mr. Aaron Kline, Secretary Car Foremen's Association of Chicago, Chicago, Ill.:*

DEAR SIR—I am in receipt of your notice to the effect that the annual meeting of the association will be held on Thursday evening, Oct. 11, at 8 o'clock. I regret exceedingly that business in the west will prevent my attending this meeting.

I take a great interest in the work of the association, and there is one question which I presume is always receiving more or less consideration on the part of the officers, namely, "What useful work can the association perform?" In reply to this I would state, as I have already stated at one of the meetings, that the best thing the association can do is to suggest to the railway clubs and the arbitration committee of the M. C. B. association anything which, in its judgment, will facilitate the movement or interchange of cars.

Great improvements have been made in this direction, owing to changes that have been made in the rules. Car foremen are more familiar with the things that cause delays to cars than anyone else; no doubt a great many delays at the present time, come more as a result of repairs to certain parts and having to hold cars, days at a time, waiting for material that is standard to the car.

The M. C. B. Association, as you know, has standards; possibly it has not carried the matter of standards as far as it might. Would it not be well to consider the question of adopting more and better standards in car construction, which may be substituted for parts or construction standard to the car that may fail in service? As an illustration of what I mean, I would ask the following questions:

Is there any reason why the M. C. B. Association could not adopt standard sizes of draft timbers and standard methods of securing same to the center sills, etc.? Also standard springs and followers and other parts, all of such design and dimensions as will meet modern conditions?

Is there any reason why owners of cars should always continue to use such an article as a 30 inch wheel, and the M. C. B. rules require that the same size wheel must be used in case it is necessary to make a replacement and have the road operating the car stand all of the expense and delay incident to applying a 30 inch wheel if it becomes necessary to do so?

It is such questions as these which I think the Car Foremen's Association can take up to great advantage, just as the M. C. B. Association can take them up to great advantage, and I believe that the car foremen, being closer to the work, can certainly make practical suggestions as to the best method of dealing with such questions.

There will, unquestionably, be opposition on the part of many toward carrying out suggestions that you may make. There was a great deal of opposition to the adoption of the new M. C. B. rules, under which we are working today, yet no one would think of going back to the old rules, so that opposition, in my judgment, should have no consideration, if reasonable and fair suggestions for improvement can be made.

If I can lend any assistance to the association, I shall be glad to do so. Yours truly,

S. P. BUSH,  
Superintendent Motive Power.

## A RECORDING ATTACHMENT FOR SCALES.

Those who use scales will find the Reed recording attachment to be not only a great convenience but a decidedly valuable safeguard. In a word, it gives a mechanical record of the weight shown on the beam, thereby avoiding all the dispute which so frequently arises in taking the weight from the beam in the ordinary manner. By the use of the Reed attachment, it is not necessary for the weighmaster to read the beam at all.

This attachment is shown, as applied to an ordinary railway track scale beam, in Fig. 1, and it will be seen that in construction it is simple as need be, and that the sliding poises are as free to move as without the attachment. The main beam is graduated by 1,000-pound marks, and the small beam, to 1,000 pounds, by 10-pound marks. Just above the sliding poise of the smaller beam there is a brass casting carrying a

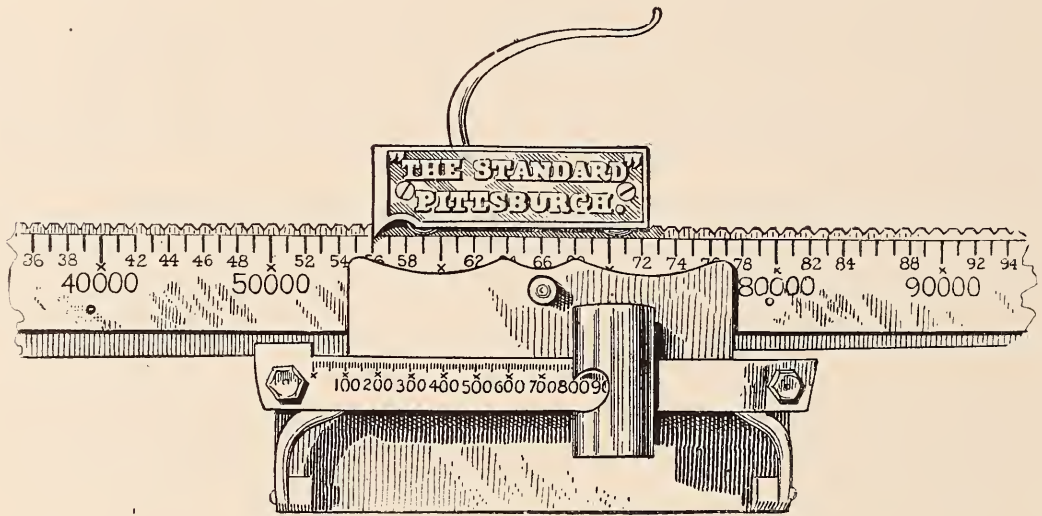
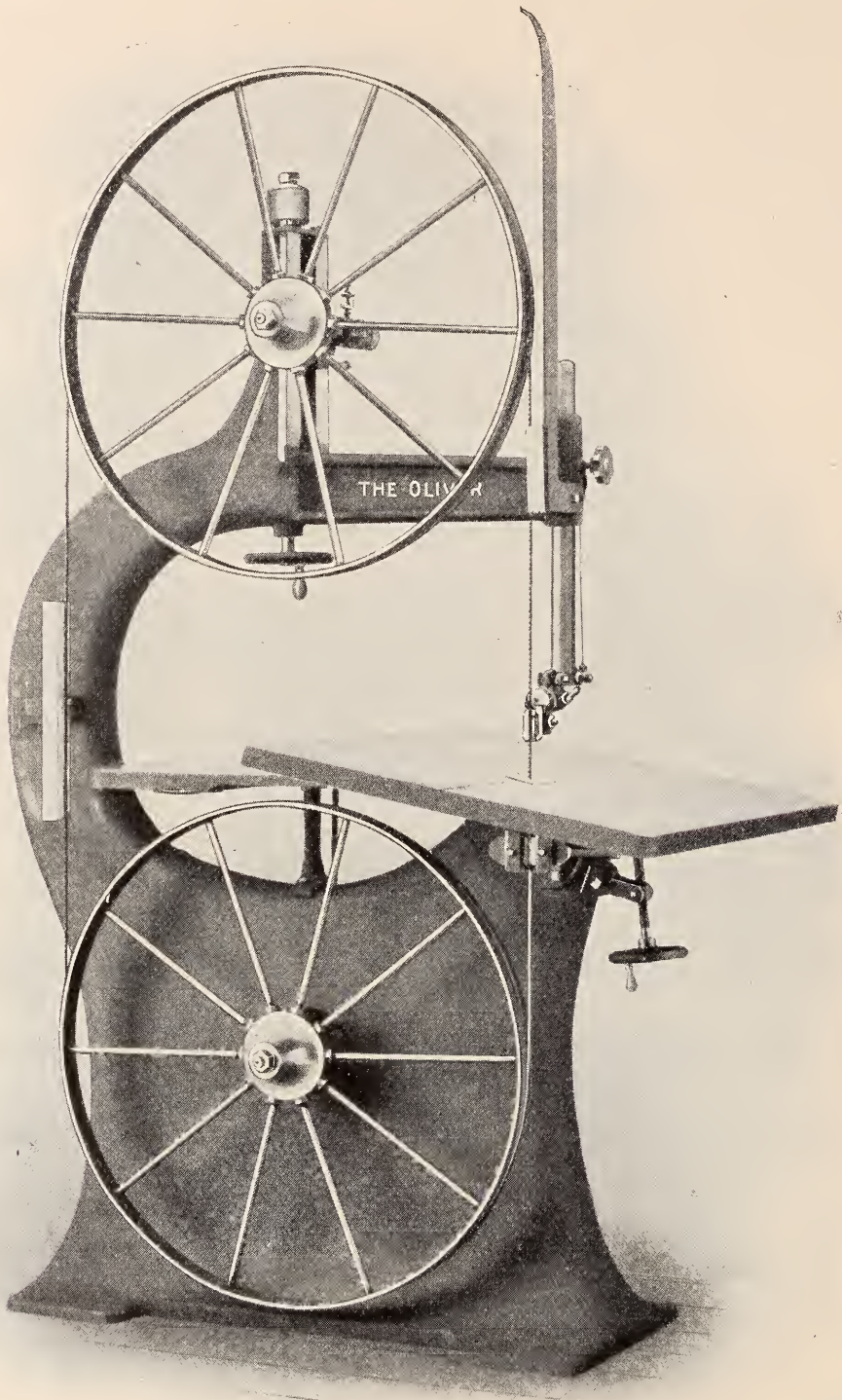


FIG. 1.

knob. This brass casting is a card holder, to hold cards similar to those shown in Fig. 2. This is the only extra movable part over that of the ordinary railway track scale beam. There are six puncturing pins on the face of the main beam, which are arranged on an incline, and correspond with the six different rows of figures on the cards. After the beam is balanced, a card like that shown in Fig. 2 is inserted in the card holder with the figures toward the face of the beam, and the record of weight is obtained by simply pressing the card holder against the face of the beam, when the puncturing pin on the face of the beam punctures the card; the puncturing pin which extends back of the card holder in connection with the small poise puncturing the weight less





### THE OLIVER BAND SAW.

The Oliver band saw, which is designed especially for pattern shop use, possesses, as one of its strong points, wheels of especial and superior design. These wheels, which are 36 inches in diameter, have forged

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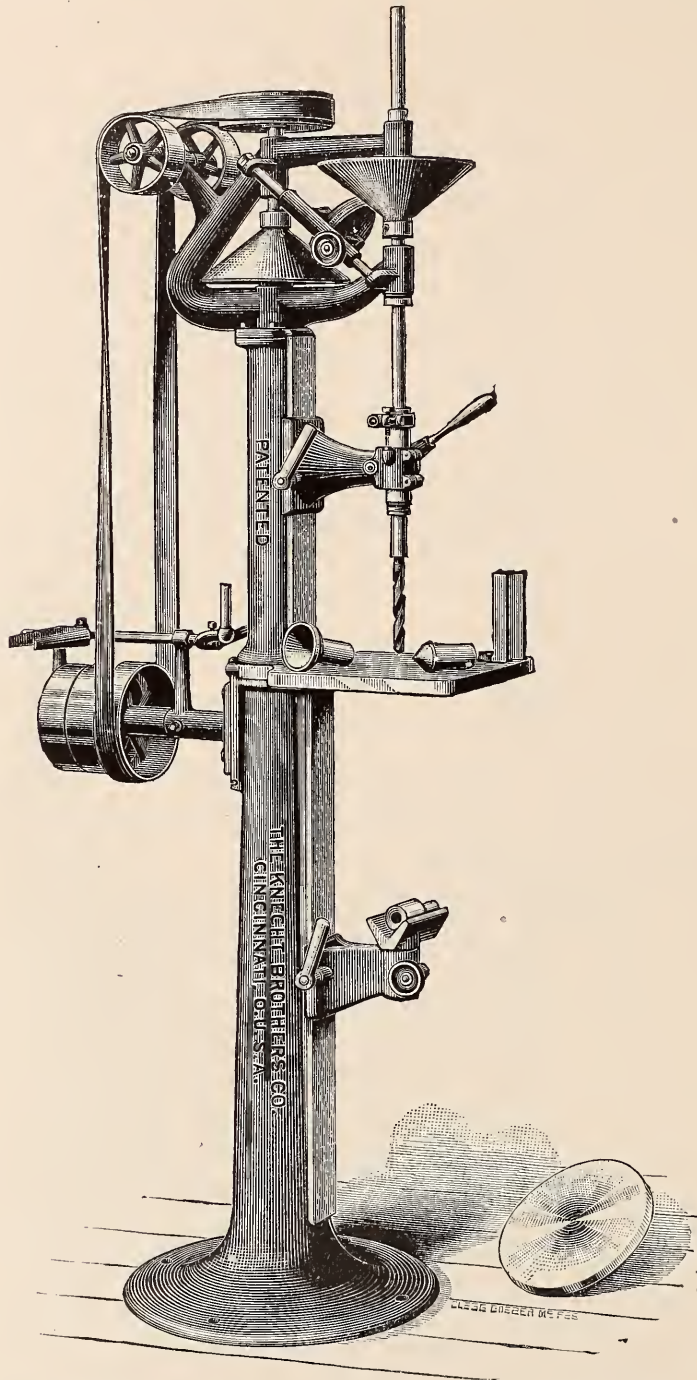
steel rims with steel spokes, making a light yet rigid wheel. A very large proportion of the weight is in the cast iron hub, which, being in the center, exerts a minimum centrifugal force. Owing to the peculiar construction of the hub, the path of the saw is directly over the bearing, thus doing away with the overhanging strain otherwise present. Motion is also imparted to the upper wheel with less strain on the saw than in any other make, it is claimed, thus making it possible to use the lightest saws without liability of breakage. At the same time, there is rigidity and strength enough to handle heavy saws with the utmost ease and safety. The use of forged steel rims obviates the trouble liable to be met with in wooden rims on account of warping and shrinking.

The wheels are fastened by means of a taper fit to a steel shaft. The upper one operates through double yoke boxes, thus giving 11 inches of perfect bearing, while the lower has three 5 inch bearings, making 15 inches altogether. The upper wheel may be instantly tilted to any angle, thus shifting the saw to the desired path. The upper wheel has a vertical adjustment of 12 inches, which is regulated by means of a hand-wheel. The tension is adjusted by means of an India rubber washer of 3 inch size, which has been found to give better satisfaction than any other device used.

The table is 30 inches by 39 inches in size, and it is a well ribbed, heavy casting, which is carefully planed to an absolutely true surface. The tilting device on the Oliver will readily appeal to any mechanic, for with it, it is possible to have a perfectly rigid table at any desired pitch. When it is desired to change this pitch it is unnecessary to loosen any screws or clamps; all that is necessary is to commence turning the hand-wheel. When this operation is stopped, the table is perfectly rigid in whatever position it may be left. The only way to move it is to turn the hand-wheel, which operates very easily. Our illustration shows the tilting table and the tilting device, which, it will readily be seen, are of the utmost importance in pattern making.

The Grand Rapids guide is furnished with these machines, unless otherwise specified. It provides universal adjustment, and any height up to 14 inches can be cut. The guide post has a coiled tension spring, instead of a clumsy counterbalancing weight, affording an efficient and compact arrangement.

The machines, which are made by the American Machinery Co., of Grand Rapids, Mich., are made either right or left hand, and weigh 1,480 pounds.



## THE KNECHT FRICTION SENSITIVE DRILL.

The friction sensitive drill made by the Knecht Bros. Co., of Cincinnati, Ohio, possesses a number of features commending it to use in the tool room and for light drilling. It is original in its design, which is very carefully worked out, and in its manufacture the highest standards of workmanship are employed. It is simple and convenient, and in its daily work saves drills, worry and labor.

The mechanism consists of two cones between which is held a fric-

tion roller. The power is transmitted from the lower cone to the friction roller, which in turn transfers power to the upper or spindle cone. The roller is adjusted radially with the cones.

The speed of the drill spindle is increased or diminished instantly without stopping the machine or shifting the belts, and without the operator changing his position, by simply sliding the friction roller frame, upon which is mounted the friction roller, from one extreme to the other, a distance of only  $4\frac{1}{2}$  inches. In this simple manner any imaginable number of speeds can be obtained for any size drill, from the smallest up to and including 9-16 inches.

More or less driving power is applied to the drill spindle according as the size of the drill or the nature of the work may require. In using very small drills, should the twist drill come in contact with a hard substance, the operator, if he is not very cautious, is apt to break it off, which is a very common occurrence to a drill in many so-called drill presses. In this machine this trouble is overcome, because the tension of the friction roller or transmitter between the two cones can be instantly adjusted to such a point of nicety by turning the hand adjusting nut. Should the twist drill bind, or be heavily strained, caused by imperfections in the material being worked, the drill will not break but the friction roller will slip, thus stopping the drill spindle. Through this arrangement any degree of power can be applied to the drill spindle as the nature of the work requires.

The cone that drives the spindle is mounted on a sleeve or bushing (having thrust bearings) which extends through both bearings in the frame, the spindle being relieved thereby from any lateral pressure; this enables the machine when properly oiled to run any length of time without heating.

On the bar on which the friction roller frame slides is marked the size of drills within range of the machine, so that the operator can get the proper speed for any drill without loss of time by simply placing the end of the roller frame at the figures on the bar corresponding to the size of the drill to be used, and holding it in position by a clamping screw. This is an important improvement, as it allows the operation of the machine and the manipulation of the work to the best advantage in running the speed of twist drills at just the proper speed—not too high to burn them, nor too low, which would cut down the rate of production. There are also graduations on the sleeve passing through the spindle head which indicate the depth to be drilled. The machine has an improved stop collar which is used on the spindle sleeve and which

may be removed when not in use by simply removing the binding screw. This stop collar can be adjusted and set so as to drill any number of holes a fixed depth without referring to the graduation on the sleeve.

The machine is especially convenient, for every operation about it can be accomplished from the front, the operator not being required to change his position. The main dimensions of the machine are: Distance from column to center of spindle,  $6\frac{1}{2}$  inches; maximum distance from end of spindle to round table, 42 inches; vertical adjustment of round table, 28 inches; vertical adjustment of spindle head, 13 inches; throw of spindle, 3 15-16 inches; hole in spindle, Morse taper No. 1; sizes of holes that can be drilled, 0 to 9-16 inches; square table,  $12\frac{1}{2}\times 14$  inches; round table, 10 1-14 inches diameter; total height of machine, 6 feet 4 inches; floor space, 20x34 inches; speed of counter-shaft, 460 revolutions per minute; driving belt,  $1\frac{3}{4}$  inches wide; endless belt,  $1\frac{1}{2}$  inches wide by 9 feet 8 inches long, slack of which is taken by drawing down the counter shaft by a small adjusting screw in the back of the column.

The square table swings on the column and can be swung aside, thus allowing the twist drill to be readily applied to work held in the lower knee. The attachments furnished with the machine and shown in the engraving all fit the lower knee, and are a cup center, used in drilling holes in the ends of shafts, mandrels, etc.; a center point, for supporting work when one center has been drilled; a V block, with stem, used for supporting shafts to be drilled at right angles to their axis. A supplementary V block is also furnished for drilling holes eccentrically or out of center in preparation for turning shafts eccentrically in the lathe.

The Knecht Company's aim has been to make the best and most convenient machine, and it feels confident that it has succeeded in developing a sensitive drill press for tool room and light drilling that can not be excelled. In fact, this friction sensitive drill press is a high grade machine tool in all respects. For complete description, those who are interested should write to the manufacturers, The Knecht Bros. Co., Beekman street and C., H. & D. R. R., Cincinnati, Ohio.

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Mr. G. M. Basford, editor of the *American Engineer*, gave an address before the engineering students of Purdue University, October 17, on the subject of "After Graduation, What Next?" It was not our privilege to listen to this address, but we feel assured, from our knowledge of Mr. Basford's especial fitness to handle this topic, that the students were given an abundance of good points that, if heeded, will help them in the battle of life.

## WHAT I DON'T KNOW ABOUT RAILWAY CLUBS.

I don't know why any railway officer should hesitate at recognizing the benefits derived from membership in a railway club.

I don't know but that the term club, is distasteful, and perhaps "association of railway men" might be preferable.

I don't know why traffic, auditing and claim department officers and men fail to join the railway clubs, or after joining, fail to attend the meetings.

I don't know why they say: "Oh, it's a mechanical crowd; don't interest us. There is nothing brought out of an interesting character to our departments."

I don't know why mechanics, operating, and the vast departments that move the traffic, and the affairs of the same, are not matters of vital interest to officers and men in other departments.

I don't know why department lines on railways are drawn so tightly. Salaries all come from the same pocket. Courteous interchange of ideas, which should exist, can be brought about by friendly intercourse and discussion, and if all were members of and attended railway club meetings, entered into the spirit of the discussion and papers, an elimination of departmental prejudice would come about, resulting in a kinder feeling and a new era in railway service as nothing else that I know of could produce.

I don't know why men who are bright in their respective lines of business, and who have good ideas on the subject under discussion in club meetings, fail so many times to "talk out in meetin'" and give their confrères present the benefit of their thoughts, even when called upon by the presiding officer. I believe every man should be willing to give others the benefit of the knowledge he has acquired in his line of business, especially if the subject under discussion is intricate and one demanding full knowledge of all the details.

I don't know why these same men will gather in knots after the meeting and discuss the topics fluently, and sometimes criticise those who did speak or take part in the discussion during the meeting. I don't know lots of other things. I DON'T KNOW.

The foregoing suggestive article appeared originally in the *Railway and Engineering Review* of September 8. It was read and commented on at the September meeting of the Northwest Railroad Club, and was published in its proceedings for that month. At the October meeting of the St. Louis Railway Club the article, together with the discussion which it occasioned at the Northwest Club, was read in full, and here again the lines of thought it suggested were followed out in quite an extended talk.

The article, it will be seen, has occasioned something of a stir among those interested in railway club work, and there has been considerable

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curiosity as to the identity of its author. We believe that no one possesses the secret but Mr. Bruce V. Crandall, manager of the *Railway Review*, and when he is asked about it he simply responds, "I don't know."

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## MAKING AND REPAIRING LOCOMOTIVE DRIVING SPRINGS.

At the recent Master Blacksmiths' Convention, Mr. George Lindsay presented the following paper on this topic:

Spring making in a small shop is on about an equal with the cobbler and the modern shoe factory, but as the cobbler has yet his place so has the spring repairer in spring shops, and in a great many of the large shops where modern tools are keeping pace with the times, we claim to compete with the factory. It may not have been the privilege for some to see the methods used in the large factories, and I have not myself for many years, but I will try to explain.

By the division of the work where large quantities of one thing are made, it seemed to be the most economical to have each operation in the hands of different men and special machines. I have a faint recollection of reading, thirty-five years ago at school, that it took nine men to make a pin; let us see how many operations there are in an ordinary driving spring for an engine. We find the steel lying at the shears in bars. One man or boy sets the gauge, to cut to lengths required and cuts off, say, 100 main, or long plates, and continues to cut 100 of the various lengths required to complete the spring. This is one operation; then the next takes the plate, and with a furnace suited to heat the center of the plates, and with the same shearing and punching machine presses the tit in center, or may have a special press for the purpose—conditions suggest themselves. This is the second operation.

Next, the plates are heated and tapered on ends by another machine, eccentric rolls, or it may be by hammer, but rolls are, I believe, still used; then they are cut square to lengths, using the impression for tit in the center as a gauge, and are so arranged to fit, thus all are equal in length, both ends being sheared neatly and accurately. This being the third operation, except the main or long plates, which are taken to another, who, with small furnace and drop hammer, makes the bearings and punches holes to fit hangers. As dies are used to form the ends, this part is done rapidly also.

The next operation begins, by another who has a furnace at the

proper heat, to set the plates with a press and formers to fit, after which the plates are re-heated and tempered in oil (fish oil being used). At that time another furnace was used as an oven to draw temper. As you are aware, I claimed at the last meeting this was unnecessary, if the plate was removed from the oil before being cooled and left to cool in the air. Then other hands go to assembling the plates, and if they do not fit, hammer them on a hollow block, though I believe that this has been abandoned. If it has not, it ought to be. After screw clamps are put on to hold the plates in place beside the band, which is made by another, the springs are then placed beside the band-upsetting machine, where the hot bands are put on and pressed solid, then cooled in water, being then ready for the testing machine.

All springs will, as a rule, take a little permanent set the first time they are pressed down, but should not the second, or they should be condemned. One is struck with the simplicity and order with which all the operations are performed, every one keeping up their own end of the work, and with close supervision good work is turned out and very cheaply. There is no waiting for heats, as the furnaces are being attended to, never allowing a plate to remain scaling too long in furnace. The furnaces should not be allowed to get too hot, as slow, even heating is important on all steel work.

As I have already stated, the spring repairer has a place in all railroad shops, and an important place it is. It is in the very smallest shops and there should be some good tools for him to use—a hammer (steam or drop) and dies to punch the slotted holes in the ends, and lever power shears to trim ends. It is almost incredible, but some years ago I visited a shop and found them repairing some springs, and to my surprise, at a drill press. They were boring three or four holes in the end of the main plates, afterward chipping and filing. I inquired of the foreman if he had no better way of doing this work. He informed me that they bought all of their springs, and they were sent to be repaired at the same factory; that he had no tools for spring work. They had a steam hammer in the shop, too. In another case, the foreman of the shop, on being asked to do some spring work said he could not, as he had no hydraulic press to put on the bands. This is not the rule, but exceptional cases, and I hope the only ones. It does not pay to allow a shop to run down so that it will be at the mercy of the crude methods. The average foreman smith is ingenious, and is called to solve some pretty knotty problems at times by his surroundings that, under favorable circumstances, would be very simple.

In spring repairing it is very essential to see that the surface of the plates is not dented by blows of the hammer, as that means bumps on the opposite side, causing the plates to wear unevenly. There are many springs broken from this cause. Some men thoughtlessly, in setting a plate, take it out of the furnace, grip it on the end and lay it on the floor, and then strike a few blows, often with the ball of the hammer, making bumps on the plate. They may not be much, but they are there and should not be. If he will use this method of setting a plate, use a mallet. It is as handy, and in the center when the tit is formed, particular care ought to be taken that the surrounding surface is even, to insure good bearing surface. Of course, there are many devices used for setting rolls, I believe, perhaps mostly in repairing, but whatever the method is, the result sought should be good bearing surface.

In the *Railway Review*, about the end of last year, there appeared an interview with a prominent spring manufacturer, he being asked "the secret of the success of his springs." He laid great stress upon the machine he had for putting on bands tightly and forcing the iron around the edges of the plates. Perhaps the fellow had read this that said, "he could not repair springs because he had no hydraulic press to put on the bands." We all agree that the plates ought to be kept in place, but we have seen springs running with bands not  $\frac{1}{8}$  inch thick, worn by the wheels, and doing good service, and we have members that have had springs in service without bands at all, for some years. Some manufacturers do make good springs, and lots of them, but repair shops can put on bands as tight as required that do not have expensive machines, some by screws, others by steam hammers.

I feel that constant guard is needed in heating. You may have seen a plate put in the fire, the blast thrown open, and heated rapidly on the edge before the center is red. Do not do that. It ought to be heated slowly and a furnace is by far the best. In tempering, my ideas are pretty well known from former reports, and I think that the idea I advanced a year ago, taking the stand that more soft springs break than hard ones, has been clearly demonstrated.

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## PERSONAL MENTION.

Mr. A. L. Moler, general foreman of the Brighton Park shops of the Chicago & Alton, has been appointed superintendent and master mechanic of the Macon, Dublin & Savannah Railway, with headquarters at Macon, Ga.

Mr. H. K. Bates, at one time master mechanic of the Kansas City, Fort Scott & Memphis, died at Fort Scott, Kan., October 24, of heart disease.

Mr. J. V. Slusser, division master mechanic on the Louisville & Nashville, at Memphis

died in that city November 3. Mr. Slusser had been master mechanic at Memphis since 1881, before which he was roundhouse foreman at Louisville. He was born at York, Pa., Aug. 20, 1840.

Mr. C. G. Potter, master mechanic on the Nashville, Chattanooga & St. Louis, at Paducah, has resigned.

Mr. John Hodge, master car builder of the Atchison, Topeka & Santa Fe, died in Chicago November 5, of heart disease. Mr. Hodge was born at Ogdensburg, N. Y., in 1853. He was master car builder of the Missouri Pacific from 1870 to 1886. Subsequently he was superintendent of the St. Charles Car Works, at St. Charles, Mo., and master car builder of the Chicago, Santa Fe & California, at Streator, Ill. Since August, 1887, he has occupied a similar position on the A., T. & S. F., at Topeka.

Mr. C. B. House has been appointed master car builder of the Nevada-California-Oregon Railway, with headquarters at Reno, Nevada.

Mr. F. P. Hickey has been appointed general foreman of the Atchison, Topeka & Santa Fe, at Topeka, vice F. J. Gunther, resigned.

Mr. August Wildes has been appointed traveling engineer of the Jackson division of the Mobile & Ohio, vice Thos. B. Duncan, promoted.

Mr. Oliver Galbraith has been appointed master mechanic on the Paragould Southeastern, at Paragould, Ark.

Mr. D. H. Speakman has been appointed general foreman of the Horton shops of the Chicago, Rock Island & Pacific, vice T. E. Merritt, resigned.

Mr. E. L. Doran, who was formerly master mechanic on the Northern Pacific, is dead.

Mr. J. T. Fite has been made general foreman car department on the Fort Worth & Denver City, at Fort Worth, Texas, succeeding C. G. Hailey, resigned.

Mr. J. H. Green has been appointed master mechanic of the Atlantic & North Carolina, with headquarters at New Bern, N. C., vice W. R. Warters, resigned.

Mr. F. N. Dean has been appointed assistant superintendent of motive power of the Chicago, St. Paul, Minneapolis & Omaha, with headquarters at Sioux City, Iowa.

Mr. N. Snyder has been appointed master mechanic on the Louisiana & Arkansas, with office at Stamps, Ark.

Mr. B. A. Gibbs has been made master mechanic of the Mason City & Fort Dodge, with headquarters at Fort Dodge, Iowa, succeeding E. H. Maute.

Mr. C. Skinner, formerly master mechanic of the Toledo, St. Louis & Kansas City, has succeeded W. J. Bennett as master mechanic on the Chicago & Alton, at Slater, Mo.

Mr. P. H. Cosgrove, heretofore general foreman car department on the St. Joseph & Grand Island, has resigned to go with the Colorado Midland in a similar capacity.

Mr. M. Goodrich, heretofore general foreman of the New York & Ottawa, has been appointed master mechanic of that road, with headquarters at Ottawa, Ont.

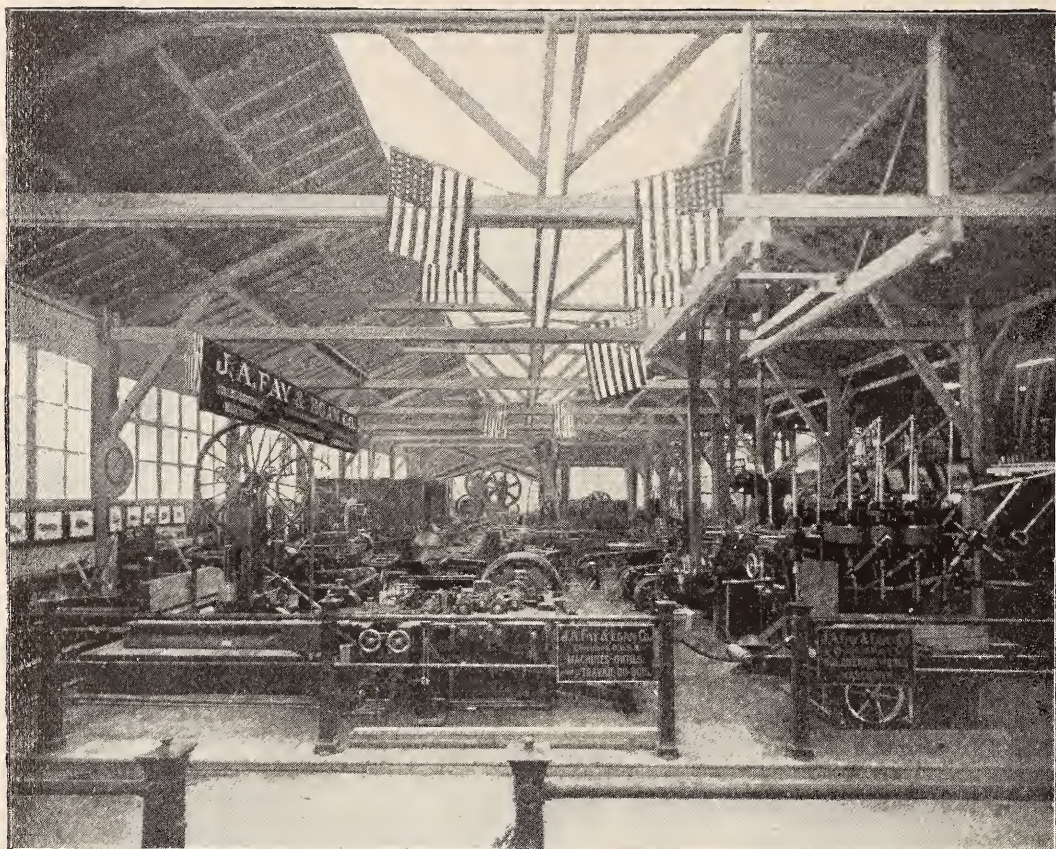
Mr. William Elmer has been appointed assistant to master mechanic G. W. Stratton, of the Pennsylvania, at Altoona. He succeeds J. T. Wallis, who has been appointed assistant to chief of motive power F. D. Casanave.

Mr. William Forsyth, formerly mechanical engineer of the Chicago, Burlington & Quincy, and later general superintendent of motive power of the Northern Pacific, has been appointed mechanical engineer of the Pennsylvania Coal Co., with headquarters at Scranton, Pa.

Mr. W. Cooke, formerly master mechanic on the Delaware, Lackawanna & Western, died at Wycoff, N. J., recently, aged 67 years.

Mr. S. D. Kinney has been appointed assistant mechanic on the Chicago & Alton, at Bloomington.

Mr. Charles H. Hogan has been appointed master mechanic on the New York Central & Hudson River, with headquarters at Buffalo. He has heretofore been road foreman of engines on the same road.



### THE FAY & EGAN EXHIBIT AT PARIS.

It is a well authenticated fact that the United States is unequalled by any nation in the entire world when it comes to manufacturing labor-saving machinery, both for the quantity and quality of work it will accomplish.

A most signal proof of this has just been given at the Paris Exposition, where J. A. Fay & Egan Company, the largest manufacturers of woodworking machinery in the world, of 216 to 236 West Front street, Cincinnati, Ohio, were awarded the "Grand Prix," the highest award given at the exposition.

As this is the third time this firm has been similarly honored, they having received the same award at the Paris Expositions in 1878 and 1889, it demonstrates that J. A. Fay & Egan Company are conceded to be leaders in the woodworking machinery industry, not only in this country but abroad.

We are illustrating a view of their exhibit at Paris, which, owing to its completeness, and the manner in which the machines perform their work, has created admiring comment in Europe among machinery manufacturers.

The exhibit occupies the largest space of any foreign exhibit, and contains a full line of machines for working and cutting wood in every manner, all in operation; and the company's skilled corps of representatives explain the working of the different machines, and illustrate what they will accomplish.

Among the more important of their machines exhibited are the following: New band sawmill and self-feed band rip saw with knife edge balance, patented February 27,

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1900; new triple drum sand papering machine; new planer with center geared rolls, patented December 19, 1899, February 6, 1900, and May 8, 1900; new spoke lathe, with automatic lift to vibrating frame, patented December 19, 1899; new automatic gauge lathe: new band re-saw, patented February 27, 1900; new and improved methods of gearing; fixed knife planer, patented June 26, 1900; vertical car boring machines, patented January 30, 1900, and February 6, 1900; heavy double cylinder dimension planer, matcher and jointer, patented January 9, 1900, and March 20, 1900; new box board matcher, patented December 19, 1899; new circular saws, patented April 24, 1900; variety woodworkers; "lightning" floorer, patented March 20, 1900; double end tenoner, patented June 5, 1900, and many others. .

Where so many excellent specimens are shown in one firm's exhibit, it would be difficult to know which machine to describe, and lack of space prevents our going into their merits on an extended scale; suffice it to say, therefore, that J. A. Fay & Egan Company are entitled to the highest praise for again upholding the prestige of the United States for the superiority of its manufactures.

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### SIGNAL FLAGS FOR RAILWAYS.

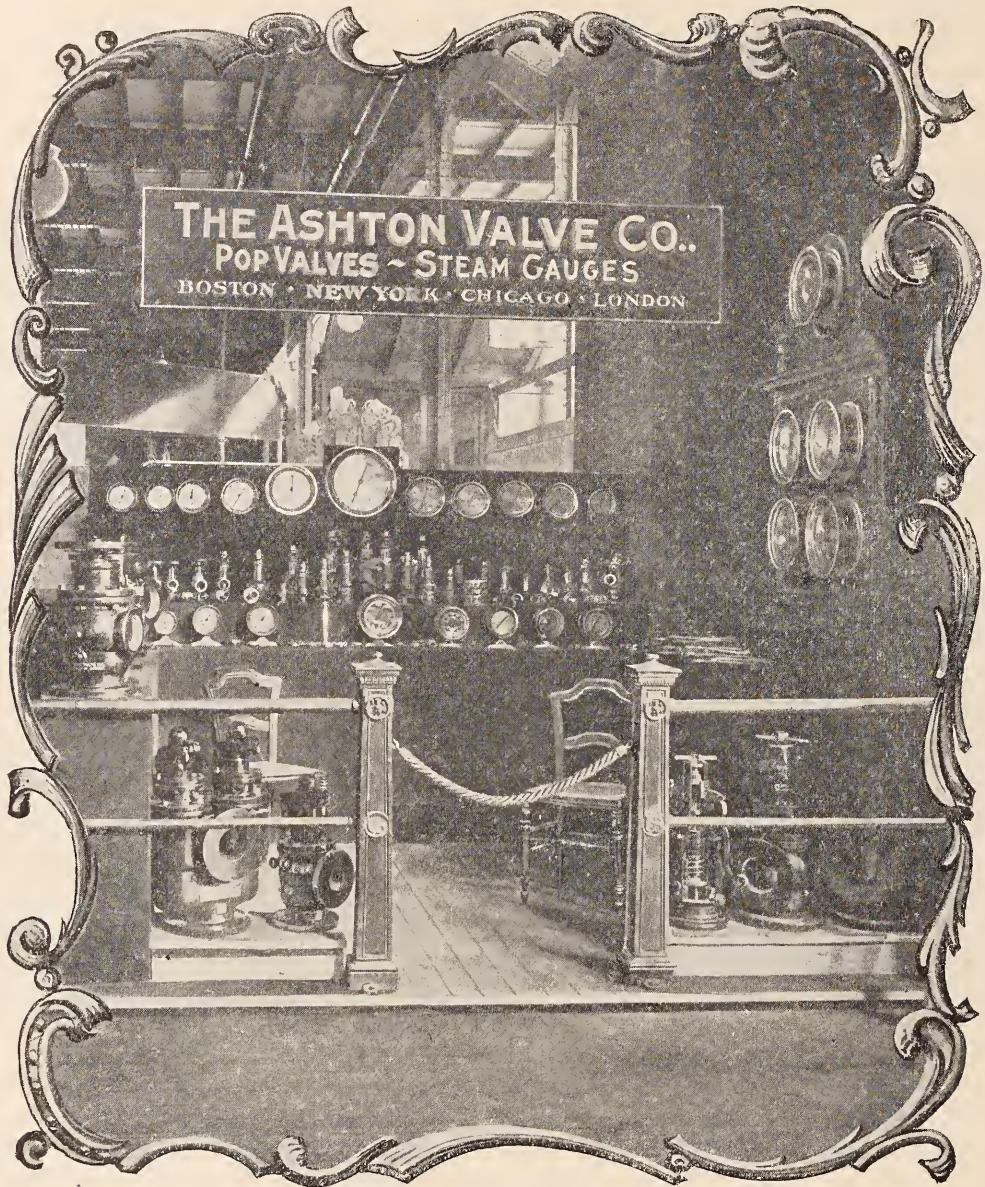
R. J. Patton & Co., 224 East Fourth street, Cincinnati, Ohio, have been manufacturing signal flags for 14 years, and during that time have sold flags to railways through all parts of this country and Mexico. At the time the firm began making these flags, it readily met with success in selling well sewed flags to railways, on account of the latter not being fixed to sew the ends of their own flags. The railways bought bunting by the bolt, cut off flags, and placed them in service without hemming; these flags, of course, frayed out rapidly, making the item of expense of flags a large one. The railways quickly accepted the Patton company's proposition to furnish them well hemmed flags. Mr. R. J. Patton made a trip through all parts of the country, and met with such success that he had to return three times a year to attend to the increasing of his facilities for turning out the flags to keep up with orders. The company was at that time located in Hartford, Conn., and as it found its business to be largely throughout the center and western section, it decided, in 1890, to move to the more centrally located city of Cincinnati, where it would be more in the midst of its trade. The firm has been very successful in this branch of its business, and is now patronized by the greater part of the railways of the country. Since coming to Cincinnati the firm has added different lines, principally cotton duck, rubber, and enameled ducks and drills, which are used extensively by the railways. As proof of the quality of its flags, the firm points with pride to the fact that its first customer, Mr. J. W. Sprong, purchasing agent of the Delaware & Hudson Railroad Company, has ordered his flags from it continuously since.

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### SUPPLY TRADE NOTES.

Mr. James T. Goodwin has resigned as foreman boiler maker of the Rogers Locomotive Works, to take charge of the new boiler shop of the Richmond Locomotive Works, which is now nearing completion.

Mr. Christopher Murphy, who for many years has been connected with Joseph T. Ryerson & Son, of Chicago, has left that company to engage in the supply business under the firm name of Christopher Murphy & Co., with office at 1012 Marquette Building, Chicago. The new concern will handle sheet and bar copper, copper wire and rivets, boiler and bridge rivets, railway and boat spikes, staybolt iron, etc.



THE ASHTON VALVE CO.'S EXHIBIT AT PARIS.

The above view shows how admirably the Ashton Valve Co. rose to the occasion at Paris and put up an exhibit fully retaining America's reputation for taste and thoroughness.

The Magnolia Metal Company, of New York, has opened a new branch office in Philadelphia, at rooms 411 and 412 Hale Building. The taking of this step is evidence of the continued prosperity and growth of this widely known firm.

The Standard steel platform, sold by the Standard Coupler Company, of New York, is now in use on 100 railways throughout the United States, Canada and Mexico. This fact indicates a very remarkable growth in the popularity of this device since its first introduction in 1897.

Mr. Thomas P. Egan, president of J. A. Fay & Egan Company, of Cincinnati, Ohio, returned from abroad in October. Mr. Egan had been abroad nearly five months, having during his visit taken an active interest in his firm's exhibit of woodworking machinery at the Paris Exposition. The fact that J. A. Fay & Egan Company received the "Grand Prix," the highest award, over all competitors, speaks not only volumes for the excellence of their machinery, but reflects great credit on Mr. Egan and his able corps

of assistants in charge of the exhibit, which was the largest of all those in the foreign section. While abroad, Mr. Egan made an extended tour of England and the continent, visiting all his firm's agents and, incidentally, getting nearer to the wants of the various countries.

The Richmond Locomotive and Machine Works has just received orders for six locomotive boilers from the Central Vermont Railway, and for one locomotive boiler from the Cincinnati Northern Railway.

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### *Notices of Publications.*

The handsomest souvenir publication that ever came to our desk is that issued recently by the Grand Trunk Railway System. It is devoted to the Victoria Jubilee bridge. It has a noble subject, which it would almost seem were treated all too briefly. But there is, of course, a limit of length at which a writing of this kind must be kept to command an interested audience. The story of the old way of crossing the river, from Montreal, to reach the trade and the society of the States, is interestingly told. Then comes a recital of the undertaking and completion of the world-famous Victoria tubular bridge, which was opened to traffic some forty years ago. Time told, and one of the wonders of the world became inadequate for its purposes, and the Grand Trunk management, some years ago, set about the work of replacing the obsolete structure. And the souvenir book tells about this step; how the old structure has been replaced by a new open work steel bridge, with double tracks, carriage ways and foot walks—all placed upon the piers which supported the old Victoria bridge for so many years. It is an interesting story, well told, and replete with suggestive engineering data. The book is beautifully bound in aluminum covers with silk ribbon lacing. The body stock is heavy plate paper bound up in album style. The illustrations, which are lavishly used, are beautifully done in photogravure, and many of them possess a historical value. The two views—one of the old Victoria tubular bridge and that of the new Victoria Jubilee bridge—must be of especial interest to all those who have passed east through Montreal. And the frontispiece—showing the terminus of the St. Lawrence & Atlantic Railroad (now a part of the Grand Trunk System), opposite Montreal, as it was in 1855, will appeal to many who remember the odd looking rolling stock and station buildings of years ago. This beautiful art publication has been issued through the office of Mr. W. E. Davis, passenger traffic manager of the Grand Trunk System. It is a decided credit to all those who had to do with its conception and execution.

The Paris Exposition catalogue of the Chicago Pneumatic Tool Company is even more elaborate than any previous publication, of like nature, issued by this company. In addition to showing the tools made by them, and scenes of their three distinct exhibits at the Exposition Universelle, the back cover of the book is embellished with embossed facsimiles of the two gold medals (highest awards) received at the hands of the International Jury of Awards. This feature of the work displays great enterprise and unusual promptitude, and is the first instance of facsimile medals which has come to our notice. Incidentally it may be remarked that the more recent specially designed advertisements, books and circulars of this company display the handiwork of an adept in the art of advertising.

The Joseph Dixon Crucible Company, of Jersey City, N. J., has recently sent out a new paint folder, illustrating the use of Dixon's silica-graphite paint for the protection of steel viaducts, bridges and buildings exposed to sulphur fumes of locomotives. It bears a half-tone view of a locomotive passing beneath the Park street bridge over the Big Four Railway, at Cincinnati, Ohio. The girders of this structure are painted with Dixon's silica-graphite paint, which has successfully withstood the action of engine fumes for five years. An average of 500 engines pass under this bridge daily.

Manning, Maxwell & Moore, of 85-89 Liberty street, New York, recently issued a new illustrated catalogue of machine tools and attachments, containing over 700 pages of imperial quarto and bound in a substantial and convenient manner for the use of the trade. This book, as its title indicates, illustrates only metalworking and woodworking machine tools and their attachments. Owing to the greatly increased scope of its business, this company has found it advisable to separate the metal and woodworking machine tools and their appliances from what are termed general supplies. In its previous catalogue these were combined. The company is now compiling a very complete illustrated catalogue of railway, steamship, machinists' and contractors' tools and supplies which will contain some 800 pages of imperial quarto. In the present catalogue the company has followed the same general method of designating by figure numbers the articles illustrated, as it did in its previous catalogues. The purpose of this is to enable its correspondents, in transmitting orders or inquiries, to use the figure numbers rather than the titles of the tools. This catalogue is also supplied with a telegraphic code, by the use of which telegraphic and cable communications may be greatly condensed. For customers who find it more convenient to communicate with any of the branch offices, the company calls attention to the fact that it has a large store in Chicago, in charge of Mr. A. J. Babcock as manager, at 22, 24 and 26 South Canal street, where there is carried a full and complete stock of the latest improved machine tools, ready for quick delivery. The company also has a large office in Pittsburgh, at 1005 Park Building, in charge of Manager Robert A. Bole; and in Cleveland the office is at 1620 Williamson Building, in charge of Mr. F. B. Ward. In New York the company has three large warehouses, outside of its commodious store, filled with machinery for prompt delivery.

The Cleveland Pneumatic Tool Company, of Cleveland, Ohio, has issued a handsome little catalogue showing its line of hammers, riveters and drills.

The November issue of *Graphite*, the sprightly little monthly issued by the Joseph Dixon Crucible Co., of Jersey City, N. J., closes the second volume. While this publication has for its aim a certain advertising of the productions of the Dixon Company, it has been the endeavor of its editors to present facts and statements concerning graphite in as interesting a manner as possible, and in a form combining readableness with instruction. The editors have well succeeded in their purpose, each issue containing matter of decided interest regarding the different forms of graphite and their respective uses.

POSITION WANTED—By master blacksmith. An experienced, practical foreman blacksmith wishes to correspond with any railway official desiring the services of a competent and practical foreman blacksmith. Best of reference furnished. Address R. A. M., care of Railway Master Mechanic.

WANTED—Situation as foreman locomotive repairs, by a practical man. Have had several years' experience in this kind of work. Good references furnished. Address S. E., care Railway Master Mechanic.

WANTED—Position as chief clerk in motive power department of a railway. Thoroughly competent and best of references. Address Q., care of Railway Master Mechanic.

SITUATION WANTED—By a capable general foreman of locomotive repairs. Address G. F., care of Railway Master Mechanic.

WANTED—Position as mechanical engineer or master mechanic by experienced mechanical engineer, now employed. Address P. R., care of Railway Master Mechanic.

POSITION WANTED by a thoroughly competent mechanical man who is experienced in directing work in a railway shop and in manufacturing establishments. Particularly well up in car work. Now employed, but wishes to make a change. Address the editor of the Railway Master Mechanic.

# RAILWAY MASTER MECHANIC

WALTER D. CROSMAN, EDITOR.

WILLIAM E. MAGRAW, MANAGER.

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CHICAGO, DECEMBER, 1900.

No. 12.

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RARELY has anything better appeared in the proceedings of the Car Foremen's Association of Chicago, than Mr. J. C. Grieb's discussion of the decisions of the Arbitration Committee, and we would direct particular attention to his paper on this subject, which appears in this issue of the RAILWAY MASTER MECHANIC. It seems that the Arbitration Committee has, up to date, rendered 603 decisions, its first decision being given in 1888. This shows an average of about 50 decisions a year, but there is a strong tendency at present toward reducing this number of cases. It is no doubt a fact, as intimated by Mr. Grieb, that the work of the Car Foremen's Association of Chicago, and of similar associations which have of late sprung up, has already had a tendency to reduce the number of cases taken to the Arbitration Committee. Mr. Grieb shows that there has been a considerable range in the frequency with which different roads have appealed to the Arbitration Committee. There is one company that has been involved in 38 cases, and there are 90 who have had but one case. It further appears that those roads who have had the larger number of cases have lost more cases than they have won. There are 85 companies who have won all the cases in which they were interested, and 134 roads which have lost all the cases in which they were interested. Mr. Grieb further points out the interesting fact that of the 603 cases adjudicated, a large number were disposed of by reference to the findings in previous cases. The large amount of work involved in preparation of these cases thus unnecessarily brought up, and the usual large amount of correspondence leading up to these cases, would probably have been obviated had there been in existence a thoroughly efficient and comprehensive index of all decisions of the committee kept up to date. Mr. Grieb rightly urges that such an index should be prepared despite the expense and labor involved in its preparation, and he says, in this connection, that he is "not afraid to assert that there is not a piece of literature printed that would

be more acceptable to all of us than just such an index." Disavowing any intention of criticising the past work of the Arbitration Committee, Mr. Grieb maintains, and, we think, with some justice, that it would be better were the decisions published in not quite such brief form. In other words, that there should be more given in the way of explanation of the basis and the rule upon which the decisions are founded. He says, in this connection: "It seems quite desirable to be favored with the views entertained by the Arbitration Committee when the decision is rendered, so that the same may be thoroughly understood, and the principle established therein more cogently applied to other cases, where the circumstances are of a slightly different nature." Mr. Grieb's suggestions are worthy of careful consideration. Than Mr. Grieb, there are few men in the country better qualified by reason of present and past environment and connection, to intelligently approach a consideration of the interchange rules, and of the work of the Arbitration Committee in interpreting these rules.

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## THE DROP TEST AS A MEANS OF SHOWING RELATIVE STRENGTH OF DRAFT GEARS.\*

BY R. P. C. SANDERSON.

It is better to find out the weakness of things, if possible, beforehand, than after they have been used in many thousand cars. We cannot reproduce service conditions in the laboratory, but we can submit the designs and parts to proof tests, which will strain them somewhat along the lines of service strains, and using our knowledge of the endurance of certain designs in actual service as a basis, we can, by testing such a design and others in competition therewith, draw conclusions by comparison that will lead us to far safer results than we can reach in any other way.

With the increasing weight and power of locomotives, double-head service, heavier trains and heavier cars, the draft rigging problem has forced itself more and more on our attention. Designs that for years have given good service and were, by the best authorities, looked upon as the most advanced practice, have failed utterly and miserably to meet modern service. The expense for maintenance of draft gears is becom-

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\* From a paper read before the Western Railway Club.

ing daily a larger factor in the total cost of car repairs, and something must be done to meet and better the conditions. Designs that stood well with trains of 2,000 tons, made up of 60,000 and 50,000 pounds' capacity cars, went to pieces when used in 80,000 and 100,000 pounds' capacity cars in trains of the same weight.

When the time came for preparing designs for new cars, the draft gear proposition presented itself and had to be faced seriously. The arguments of the advocates of each draft rigging device presented for consideration were all very convincing as to the undoubted success of the advocate's own rigging, and at least suggested doubts as to the merits of the other fellow's gear. Faith being out of place, it was decided to test them all and trust to the survival of the fittest.

Having reached the conclusion that in modern train service the train shocks were of such momentum as to be quite beyond the power of any reasonable springs to absorb (and assuming we had spring capacity to do this, the recoil would itself cause break-in-two's), the malleable iron dead block becomes a necessity to protect the couplers. There is trouble enough with the M. C. B. coupler today without making it act as a collision buffer. It is too expensive to be used to take up shocks that are beyond the capacity of the draft springs.

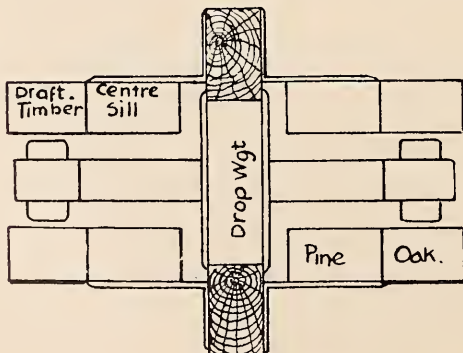
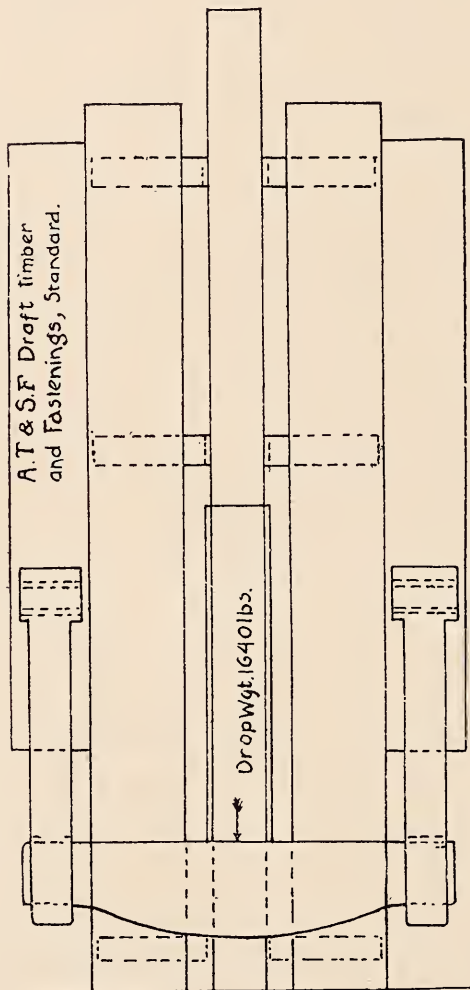
With malleable iron dead blocks to protect the couplers and draft gear from being driven under the cars, and assuming that we can make the draft gear equally strong in both directions, it resulted that the tests most suitable for the occasion were jerk tests, or such as would correspond to the forces at work in freight trains that tear out the draft gears, not by steady pull of the engines but by jerks or train shocks. The decision was therefore reached to use the usual 1,640 pound drop test, setting a pair of center sills upright on each side of the weight guide posts, and to these center sills, which were firmly supported on the foundation, were attached draft beams, just as they would be attached to the cars. The draft gears to be tested were attached to these in the usual way, but, instead of couplers, heavy forged loops were secured to the yokes or pockets. This was done to avoid any troubles or uncertainties that might be introduced by the breakage of the couplers. We were after the draft gears, not the couplers. In the eyes of these loops rested a heavy cross bar of forged iron, on the center of which the drop weight struck, and which transmitted the jerk blow to each draft gear equally. The whole arrangement is roughly indicated in Fig. 1 (see next page).

Here let it be said for the benefit of those who have not tried it; that

the cross bar, as shown or indicated in the M. C. B. jerk test apparatus, is utterly inadequate for such tests as will be described in the following:

Bearing in mind what happens to a car axle when struck by 10 or 15 feet drop blow of a 1,640 pound weight, it will be easily understood that a cross bar, to stand a long succession of such blows, must be proportionately strong and of the best tough iron obtainable.

There are a few points which developed during the tests that do not



DRAFT RIGGING DROP TEST MACHINE.

refer to any particular draft gear, but which are of importance, that should be referred to before taking up tests of the different gears.

1st. The lug or turndown lip of the yoke or pocket to grip the shoulder of the coupler, is an absolute necessity. This was demonstrated by the fact that set after set of bolts sheared off, blow after blow, when the pocket strap was not lipped over, but depended entirely on the strength of the bolts or rivets. Further, even when so lipped over, there was a continual tendency of the ends to open and pull off the shoulders, stretching the end bolt at every heavy blow.

2d. The breakage of the yokes not only in the corners and through the bolt holes but also at the sides through the solid iron, demonstrated that nothing less than good iron  $1\frac{1}{8} \times 4$  inches should be used with large radius and easy bends at the back corners.

To have a basis to draw comparison with, the first tests were made with a single spring pocket draft gear of ordinary style, but having heavy malleable iron cheek plates very securely fastened to the draft timbers, and having lugs or thumbs bearing against the end sills, the back of them being supported by an oak block bolted between the center sills. While this gear is giving very good service in heavy trains with cars of 60,000 pounds' capacity and under, it is not believed to be strong enough to absorb the impact and momentum jerks produced by cars of 80,000 and 100,000 pounds capacity. [Tests of this gear were followed by tests of eight other gears; the very full data regarding these tests we omit, our purpose being merely to make record of this method of testing draft gear.—ED.]

The testing was done under the direct supervision of Mr. E. Grafstrom, mechanical engineer of the A., T. & S. F. Railway, and was watched by the representatives of the different gears with some nervousness and apprehension at the earlier parts of the tests, but with courage and confidence (in one or two cases a little misplaced) toward the end.

As there was no precedent to follow and nothing with which to compare these tests, it was thought best to commence with the M. C. B. jerk test for couplers—3 blows at 5 feet, then 5 blows at 10 feet. The draft gear should certainly be stronger than the coupler. As no results of any consequence were reached with this, 5 more blows at 10 feet were added. It was evident at this stage that it would take an endless number of such blows to break up some of the gears under test. The cushioning action of the springs, even though they went solid at the 5 foot blows, so mitigated the shock that it was decided to remove the springs

and substitute hollow metal cylinders, repeating the test with these in place of the springs. We were searching for the weak places in the gears, and not testing springs.

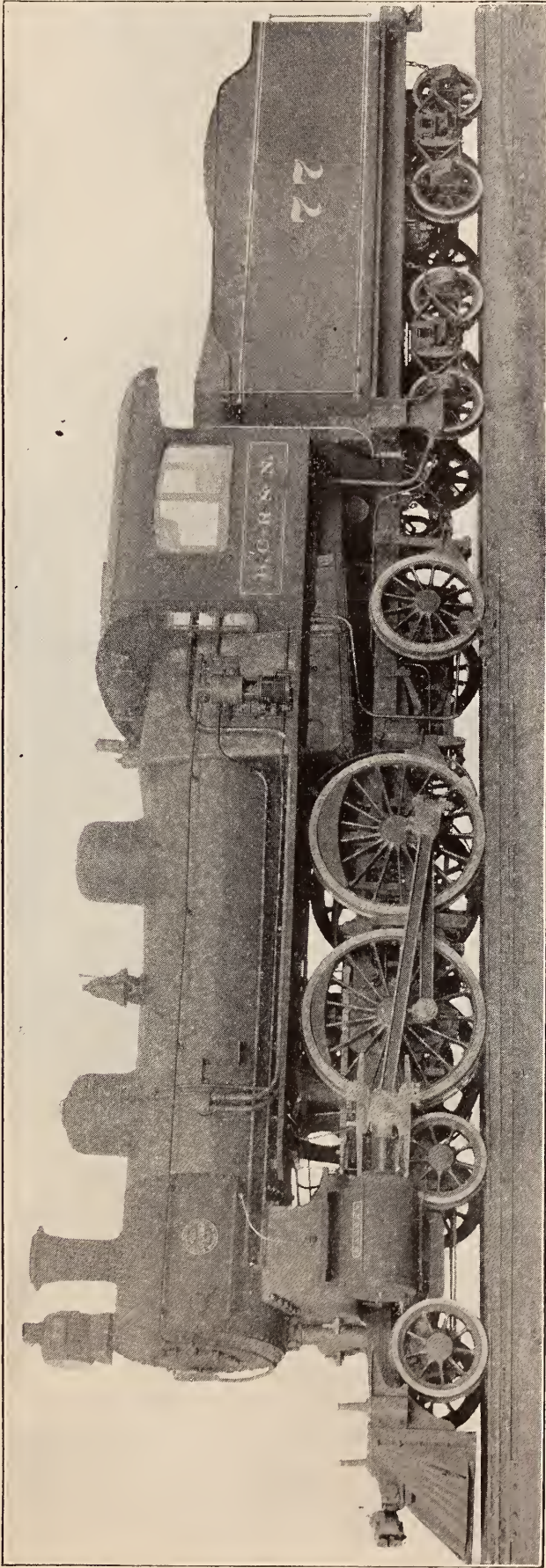
The blows struck in this series were very wicked, ugly jolts, but even after the series was completed still further tests were needed to enable us to reach results. It was then decided to replace the springs, as the drop testing machine itself required a little cushioning, and blows were struck commencing at 10 feet and raising the drop 1 foot per blow, up to 20 feet, at which height 3 blows were struck.

The series of blows were, therefore :

- 3 blows at 5 feet, with springs in place.
- 10 blows at 10 feet, with springs in place.
- 3 blows at 5 feet, with metal blocks in place of springs.
- 10 blows at 10 feet, with metal blocks in place of springs.
- 1 blow at 10 feet, with springs in place.
- 1 blow at 11 feet, with springs in place.
- 1 blow at 12 feet, with springs in place.
- 1 blow at 13 feet, with springs in place.
- 1 blow at 14 feet, with springs in place.
- 1 blow at 15 feet, with springs in place.
- 1 blow at 16 feet, with springs in place.
- 1 blow at 17 feet, with springs in place.
- 1 blow at 18 feet, with springs in place.
- 1 blow at 19 feet, with springs in place.
- 3 blows at 20 feet, with springs in place.

It may be said that the results of the tests as given are inconclusive, and that we should have gone on smashing at them until the one fittest survived. Perhaps; but it was plain that we were able to select three or four gears that were all probably stronger than the framework of the cars; anyhow, they were a long advance on what had been used before, and it left the field open to the purchasing department to get rival bids from several firms, whose product had stood a most severe test successfully.

It was further evident, that, even had we gone on to the utter destruction of each gear tested, still this would have settled nothing, even for a short time, because each maker would have immediately strengthened up his gear where it showed weakness and justly claimed that the test made, should not condemn his revised design.



BROOKS "CHAUTAQUA" TYPE LOCOMOTIVE FOR THE BURLINGTON, CEDAR RAPIDS  
& NORTHERN RAILWAY.

Total weight—158,600 pounds; weight on drivers—88,000 pounds; weight on truck—35,600 pounds; weight on trailer—35,000 pounds; cylinders—19½ x 26 inches; drivers—75 inches; heating surface—2,551.8 square feet, of which 155.8 square feet is firebox and 2,396 square feet tube surface; grate area—45.32 square feet; fuel—bituminous coal; working steam pressure—210 pounds; Player-Belpaire boiler—64 inches; tank capacity—water 5,000 gallons; coal 10 tons.

AMONG the newer railway clubs, the Rocky Mountain Railway Club is making a good name for itself. This club is doing good work, and is giving a record of this work to the public through the medium of handsomely printed monthly Proceedings. The club now numbers something like 140 members, who represent all branches of railroading, from general manager to car repairer. This is certainly a strong showing in numbers for a point like Denver, and indicates the existence of a spirit to do that good work which can come only through associational effort. The October Proceedings of this club contain an extended discussion on the Brown discipline system and a particularly suggestive talk on train delays, extracts from which are given elsewhere in this issue.

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A RECENT ISSUE of the *Jernbanebladet*, a railway journal published in Sweden, reports that the 20 and 31 x 24 inch two-cylinder compound ten-wheeled freight locomotives, which the Swedish state railways purchased from the Richmond Locomotive Works during 1899, are so satisfactory that the Railway Administration has decided to adopt the Richmond system of compounding on their lines, and have ordered 29 compound engines of that type to be built in their own shops. This is a great achievement for American locomotives, which are gradually working their way into all countries of the world.

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## BROOKS' CHAUTAUQUA TYPE LOCOMOTIVE, FOR B., C. R. & N. RY.

The Brooks' Locomotive Works recently built some engines of the "Chautauqua" type for the Burlington, Cedar Rapids & Northern Railway. These engines are designed for passenger service. They weigh 158,600 pounds. The drivers carry 88,000 pounds of this, the truck 35,600 pounds and the trailer 35,000 pounds. These engines have 19½x26 inch cylinders; 75 inch drivers; a Player-Belpaire boiler, 64 inches in diameter, and designed to carry 210 pounds working steam pressure; a firebox sloping over the trailer, 90¼ inches long, 74 inches wide, 68 inches deep at front and 57 inches deep at back; a grate area of 45.32 square feet; and heating surface of 2,551.8 square feet, of which 155.8 square feet is firebox and 2,396 tube surface. The fuel will be bituminous coal. The tank has a capacity of 5,000 gallons of water and 10 tons of coal.

The special fittings and equipment include, cast steel driver centers, piston valves, Westinghouse automatic and American brakes, Nathan sight feed lubricators, Crosby safety valves, Metropolitan and Ohio injectors, French springs, Jerome metallic piston rod packing, Brooks' special valve stem packing and Pyle electric headlights.

## THE WEAKEST LINKS IN MACHINERY.

The annual report presented by Mr. Michael Longridge to the Engine Boiler and Employers' Liability Insurance Company, Limited, of England, has just been issued, and contains, as usual, some instructive comments on the principal breakages occurring during the twelve months, to machinery insured by the company. In the case of steam engines 33 per cent of the accidents were due to weakness or faulty design, 32 per cent to accident, and 18 per cent to negligence of owners or attendants, while the remainder are classified as arising from wear and tear. With gas engines, on the contrary, no less than 40 per cent of the accidents arise from negligence, and but 14 per cent from weakness or bad design or workmanship. The enormous difference between the percentage of accidents directly due to negligence in the two classes of motor is mainly, no doubt, due to the fact that gas engines are very largely in the hands of men with little technical knowledge, and the negligence arises as much from ignorance as anything else. The following table shows what parts of the engines have been most liable to breakdown :

	During 1899.	Numbers during pre- vious 17 Years.	Total.
Valves and valve gear .. ..	44	456	500
Air pump buckets and valves ..	9	209	218
Spur gearing .. ..	16	427	443
Cylinders, valve chests, and covers .. ..	14	95	109
Air pump motions .. ..	16	262	278
Columns, entablatures, bed- plates and pedestals .. ..	12	184	196
Parallel motions, links, and guides	8	130	138
Main shafts .. ..	8	125	133
Connecting-rods .. ..	10	42	52
Piston-rod crossheads .. ..	7	58	65
Pistons .. ..	10	64	74
Air pumps and condensers .. ..	4	48	52
Flywheels .. ..	2	50	52
Governor gear .. ..	9	63	72
Crankpins .. ..	0	33	33
Bolts .. ..	4	147	151
Piston-rods .. ..	3	48	51
Gudgeons in beams .. ..	1	26	27
Beams and side levers .. ..	1	32	23
Cranks .. ..	0	33	33
Total wrecks, cause unknown ..	0	6	6
Second motion shafts .. ..	0	3	3
Main driving ropes .. ..	0	3	3
	178	2534	2712

DETAILS OF ENGINE BREAKAGES.

The most gratifying feature of the list is the continued decrease in the failures of spur gearing. This, however, is not to be attributed to any improvement in the manufacture; but mainly to the fact that rope

gearing is being used instead, in spite of its smaller efficiency, since the greater security afforded fully offsets the greater loss in friction.

Valves and valve gear still maintain their bad pre-eminence as the most delicate portions of steam engines. This is particularly the case with Corliss engines, where the number of separate pieces is numerous, and the constant jar loosens nuts and pins. Simpler forms of valve gear are, however, by no means exempt from failure, and Mr. Longridge instances an engine with piston valves in which one of the cotters securing a valve to its rod came out and caused a smash. Fortunately, accidents to valve gear have seldom very serious consequences. The air pump failures during the year were much fewer than usual, so it is to be presumed that builders are at length taking to heart Mr. Longridge's repeated exhortations to them to abandon the use of packing rings on the buckets, to place the pumps in accessible positions, and so far as possible to do away with all loose parts inside the pump barrel. Indeed, as Mr. Edwards has shown, it is quite possible to construct efficient air pumps with absolutely no loose parts inside the barrel since packing rings are unnecessary, the bucket can be riveted to its rod, and foot valves and bucket valves may be entirely dispensed with, leaving only the head valves, all loose parts of which are or may be outside of the barrel. Air pumps are but too frequently placed down below the engine-room floor, where they soon get in a filthy state, making an examination of them a very unpleasant undertaking, and if under these conditions the pump has any loose interior parts a breakdown is generally only a matter of time.

Most of the failures to cylinders and valve chest seem to have arisen from the use of high pressure steam in old engines. Frequently such old engines have large flat surfaces, to the strength of which theory gives little guidance, unless the pressures producing the strain are alternating, and even then the effect of casting and temperature strains, and of stiffening ribs, is very difficult to estimate. Experience accordingly is the only guide available, since these plates, exposed to a steady pressure, are safe with loads much in excess of those dictated by the mathematical theory of elasticity. The safe working pressure is consequently largely a matter of opinion, and the millowner wishing to at once increase his power and diminish his coal bill is naturally somewhat optimistic. One cylinder accident of a somewhat unusual nature is recorded by Mr. Longridge. An engine fitted with a jet condenser had to be stopped unexpectedly, and the engineman, in his hurry, forgot to shut the injection

cock or destroy the vacuum. The water accordingly accumulated in the condenser and passed up the exhaust pipe into the cylinder, causing a smash when the engine was started. Another curious accident is recorded by Mr. Longridge. A rod  $1\frac{7}{8}$  inches in diameter was secured by a cotter  $1\frac{3}{4}$  inches long by  $\frac{1}{2}$  inch wide; the cotter hole was square-ended, and extended to within  $\frac{7}{8}$  inch of the end of the rod. Breakage occurred by a plug of metal being forced out of the end of the rod, back of the cotter hole, the surfaces sheared through being 1.4 times as great as the cross section of the rod through the cotter hole. This accident illustrates the wisdom of piercing cotter holes, especially those with square ends, not too near the end of a rod. The distribution of stress at the corners of such a square-ended hole must be very unequal, and a crack once started is likely to proceed.

Failure of foundations seems to have been the principal cause of broken bedplates, and the like. Oil from the engines gradually soaks into the foundations and disintegrates the mortar. Apparently this occurs both with lime mortars and cements, though more definite information as to the oil-resisting qualities of the latter materials would be of value. In new engines oil can be prevented from leaking into the foundations by casting suitable lips on the bedplates and connecting the oil channels thus formed to a proper receiver.

Coming to boilers it has to be noted that almost every accident is now seen to be due to preventible causes. The Board of Trade investigations are having a wonderful educative influence, though no doubt for some years to come we shall continue to find in the reports instances of almost criminal recklessness and ignorance. Generally speaking the small steam user is the worst offender, but as time goes on, the gas or the oil engine will more and more be substituted for the steam engine where but moderate amounts of power are needed, and this substitution of one motor for the other will of itself do much to diminish the number of boiler explosions. Neglect and ignorance will doubtless be still responsible for many smashes, but the injury to persons and the danger to the public will be substantially diminished. The annual statistics show clearly that makers and users of steam boilers are on the whole more careful than formerly, even although the Board of Trade reports classify under the head of "boiler explosions" many accidents to steampipes, heating keirs, and the like.—*London Engineering*.

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## MECHANICAL DEPARTMENT OF THE SOUTHERN RAILWAY.

The operating department of the Southern Railway was on November 1 reorganized. Under the arrangement, the third vice president and general manager is assisted by an assistant general manager, a general superintendent of transportation, two general superintendents, a superintendent of motive power, an engineer of bridges and buildings, and a superintendent of telegraph. The assistant general manager assists the general manager, especially in all matters pertaining to maintenance of way and equipment, and in the direction of new construction and improvements upon operated lines. He passes upon all requisitions for the purchase of supplies for the operating departments and also exercises general supervision over supplies and materials on hand in the several departments. He keeps the general manager informed as to the amounts of supplies used and on hand from time to time, in all departments; and, to avoid the purchase of unnecessary amounts, he must, with the approval of the general manager, order such transfers of materials from point to point, as may be for the best interests of the service. He then performs such other duties as the general manager directs. The general superintendent of transportation, among other duties, has general supervision of the distribution of locomotives and cars. The general superintendents, among other duties, have charge of the shops, structures, motive power and rolling stock, and are responsible for the maintenance of equipment and for the amount of supplies consumed.

The master mechanics report to the division superintendents, and have charge of the machine and car shops and of the maintenance and repair of locomotives, cars, tools and machinery at their respective shops.

The purchasing agent makes all purchases of material required for the company's use, except those otherwise specifically provided for. He may make purchases only upon written requisitions, approved by either the president or one of the vice presidents, or by such other officers as may be authorized in writing by the president to give such approval. Contracts for supplies covering a period of more than sixty days, or costing more than \$5,000, must have the written approval of the general manager. Such contracts, when made, must be reported by the purchasing agent to the president and the second vice president. He has charge of the sale of all old materials, equipment and machinery, and advises the auditor and treasurer in detail of all sales made. He must

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keep himself and the general manager (and also the president and other vice presidents when so required) advised as to general condition of markets, probabilities of fluctuation in prices, and delays in deliveries, etc., etc., and, when practicable, he must consult freely with the president or vice presidents on these points before making large or important purchases or sales. He is held responsible for the economy and efficiency of his department.

The superintendent of motive power has the supervision of the motive power department in so far as may be necessary to insure uniformity of standards in equipment and of shop practice upon different portions of the system. He must keep himself informed as to the condition and capacity of the shops and their facilities for the proper maintenance of the equipment of the company, and make to the general manager from time to time such reports and suggestions in connection therewith as may be necessary. He must visit the various shops from time to time, and make such suggestions to the general superintendents and to the division superintendents as he may deem necessary for the efficiency and economy of the shop service. He may furnish to the general superintendents copies of all standard drawings required by the mechanical department, with such instructions as may be necessary to insure uniformity in the construction and repair of all the company's rolling and floating equipment and machinery. He must keep himself informed as to all leases or purchases of equipment, and keep a record of all the equipment furnished thereunder. He must keep a record of the numbers and condition of all the locomotives, cars, floating equipment and machinery owned or leased by the company, wherever situated, and to enable him to do so, the general superintendents make to him such reports as he may require. He is assisted by a general foreman of car repairs, whose duty it is to keep him promptly and thoroughly advised in all matters pertaining to the general condition of cars in use on the company's lines.

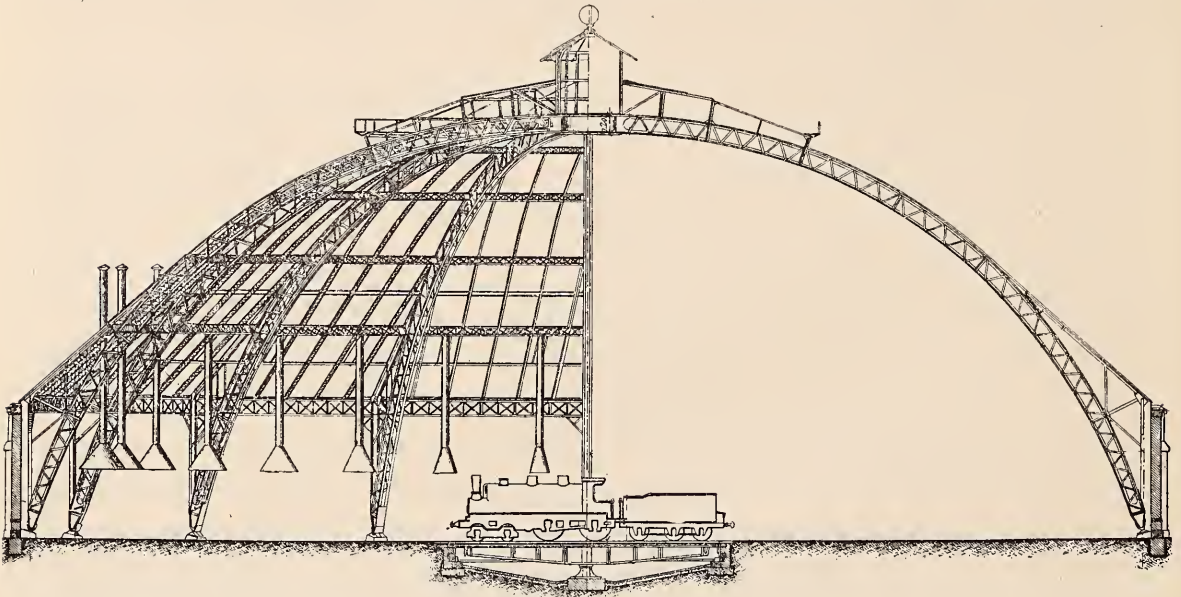
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THE BOSTON & ALBANY RAILROAD having been leased to the New York Central, the mileage of the Albany road will now be added to that of the New York Central, and hereafter a thousand mile ticket of the New York Central & Hudson River Railroad will be good on the Boston & Albany Railroad. This will prove a great convenience to the traveling public who desire to reach points in Massachusetts on or reached via the Boston & Albany, including, of course, Boston. The holder of

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a New York Central thousand mile ticket will now have the privilege of riding over lines aggregating more than 6,000 miles of railway on a ticket costing only two cents per mile, good for the person presenting it and good until used.

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### A FRENCH ROUNDHOUSE.

At the Paris terminal of the Eastern Railway, of France, two odd looking, dome covered roundhouses are used. We give a sectional view of one of these, which are duplicates. The house is 221 feet in diameter, has 32 pits, and is served by a turntable 55 feet in diameter. The graceful steel arches spring from brick side walls, and the dome is capped by a ventilator. The engines, as will be seen, head toward the brick wall, and lie under adjustable smoke jacks. The two roundhouses are connected by a rectangular repair shop building, which has a full complement of pits and traveling cranes, and whose pits are served by a transfer table. The shop building is heated by the hot air system, and locomotive cinders form the large bulk of the fuel used for the heating system.

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THE set of patterns of the horizontal boring mill made in the mechanical department shops of the University of Illinois several years ago, have recently been loaned to Mr. L. L. Dawson, master mechanic of the Illinois Central shops at McComb, Miss., and he will build a duplicate of this machine for the shops there.

## SPRING PLANT AT ALTOONA MACHINE SHOPS, PENNSYLVANIA RAILROAD.\*

All kinds of P. R. R., class "E" (elliptic), single, double, triple and quadruple locomotive and car springs are manufactured at this plant. Other classes of springs furnished here are manufactured by hand at forge.

The tools and machinery in use at this plant consist of four iron tanks for storing tempering fluids; six oil furnaces for heating plates and bands; two tables for spring fitters; two machines for spring forming or cambering, operated by belting; one comb punch and shears, operated by belting; two comb nibbing roller and shearing machines, operated by belting; one hydraulic spring banding machine; one hydraulic spring testing machine; one hydraulic spring stripping machine; one air hoist for transportation of finished work; one air spraying machine for painting.

All bands and pads are manufactured by blacksmiths at forge. Manner of working steel in spring shop is as follows: The steel bars are delivered to the comb punch and shears, where they are sheared cold into plates in lengths as per blue prints. These plates are then heated in the adjoining furnace and transferred to the comb nibbing, rolling and shearing machine, which tapers the ends, shears them and nibs the plates. This rolling and tapering process is accomplished by means of two horizontal cam-rollers, which revolve against each other, and contain grooves at one end facing each other. The plate is inserted between the grooves, butted or upset at the corners during the revolution of the rollers, moved to center of rollers, inserted there between the rollers and fattened or tapered by the stroke from the cam of the upper roller during the next revolution. A shear attachment, in continual motion with the rolls, trims or shears the end in one movement. The entire operation of drawing or tapering the ends, nibbing and shearing, is thus accomplished in three consecutive movements.

Plates requiring gib-slabs are now brought to the comb punch and shears while hot. The slab is punched in one movement. All plates are not transferred to the spring forming machine for formation of set or camber. The first leaf (or pad-leaf) is heated and given its standard set, whereupon it is plunged into the tempering bath, cooled off and placed in the machine between two vertical rollers, which operate in rotary motion against each other. The next leaf is then placed against the former

\* From paper presented by H. A. Falk at the Master Blacksmiths' Convention.

(cold) leaf and both leaves are now run through the rollers, the latter (hot) leaf thus assuming the camber required by the pressure against the former (cold) leaf. This (second) leaf is now tempered, cooled off and used, in the same manner as base-leaf, for the cambering of the next leaf in the spring, etc., until the entire spring has been formed or cambered. All cambered plates are now passed into the hands of the fitters, who examine the set and temper, fit the plates, and re-temper or anneal wherever needed.

These men use a wide open furnace, kept at an even low temperature, to which all plates are exposed before accepted by the fitters. The spring is then delivered to the banding machine. Here the bands are pressed on hot, by use of movable clamps connected at top and sides of spring and forced against it by means of hydraulic pressure. Being banded the spring is transferred to the hydraulic testing machine, subjected to the load specified on blue print, and deflection and permanent set noted. The spring, if acceptable in test, is now painted and delivered to the store-keeper ready for market. The furnace is used jointly by two fitters.

In repairs to old springs the bands of these springs are heated somewhat in a small oil furnace having cavity in center about large enough to admit the band, this being done in order to soften the iron and save the old bands, if possible, for further use. The springs are then introduced to the hydraulic stripping machine and clamped fast by straps in an open space between two side pieces, so as to admit springs of different widths. These side pieces are parallel and are fastened to the sides of the springs by being clamped at the top. The strap is now moved forward by means of hydraulic power, received from a reservoir placed at end of strap and operating the strap through a piston attached to the straps. The movement causes the side pieces to force the band off by pressing against it. The plates are then assorted, examined and passed forward to the cambering machine and the two fitters, etc., in order heretofore described.

All tempering is done by immersion in a bath, consisting of 500 degrees fireproof petroleum. This oil is stored in an oil tank suspended within a tank of larger size, thus allowing a space between the two tanks, which is filled with water in order to keep the oil in the inner tank at an even, low and permanent temperature. This oil is not mixed with any other substance.

All heating is done in oil furnaces having the Walton & Rees patent oil burners, which were invented in this department and are manufactured in the Altoona machine shops. These burners are placed inside of the furnaces, and are worked by fan-blast and produce an even distribution

of oil over the surface of the furnaces, thereby perfectly atomizing the oil and reducing the cost of fuel to a minimum.

All machines and fixtures used in connection with this plant are designed in this department and have been manufactured at these shops. The working force of the plant consists of fifteen men and one gang leader. This force does not include smiths making pads and bands.

The output of springs for twelve months, ending June 30, 1900, is as follows:

5,306 new locomotive and car springs . . . .	1,039,226
5,305 repaired locomotive and car springs . .	855,435

Total 10,611 springs.	1,894,661
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or about 884 springs per month.

All operations are covered by piece work prices, and are paid for by the plate. Cost of springs are made up monthly per pound.

Cost of new springs average . . . . . 4.7 cents per lb.

Cost of repaired springs average . . . 1.1 cents per lb.

These prices cover all labor (shop and pro rata) and material furnished, and have only varied .1 cents occasionally during the period here mentioned, owing to the fluctuation in cost of material.

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## THE CAR FOREMEN'S ASSOCIATION OF CHICAGO.

### NOVEMBER MEETING.

The regular meeting of the Car Foremen's Association of Chicago, was held in Room 1741, Monadnock Block, Chicago, Thursday evening, November 8, being called to order at 8:00 p. m. by President Sharp.

Among those present were the following:

Bell, W. A.	Elkin, J. L.	Kline, Aaron	Sanderson, S. P.
Bates, Geo. M.	Gruhlke, Edw.	Longfellow, Fred	Stimson, O. M.
Bundy, C. L.	Grieb, J. C.	Marsh, Hugh	Schramm, Chas.
Bannes, A.	Hunt, T. B.	Morris, T. R.	Schultz, F. C.
Bossert, Chas.	Hedrick, Elias	McAlpine, A. R.	Sharp, W. E.
Chadwick, A. B.	Husband, E.	Olsen, L.	Wolfe, Chas.
Cook, W. C.	Johannes, A.	Perry, A. R.	Wentsel, Geo.
Depue, Jas.	Krump, M.	Prickett, Jas.	
Earle, Ralph	Kroff, F. C.	Ruff, A. W.	

President Sharp: The executive committee, at its meeting last week, authorized the officers to procure a more suitable meeting place.

We made a thorough canvass of the down-town district and have secured a hall which is much more desirable than this, in the Masonic Temple, and we will have the hall for our next meeting. To do this, however, the meeting night will have to be changed to Wednesday in place of Thursday night.

Secretary Kline: The committee appointed to revise the Constitution has reported the following changes: Change Article II to read: "The objects of the association shall be to bring together those interested in car department matters for the purpose of exchanging ideas, discussing questions of interest, with the object of facilitating the movement of cars, and educating the car man to a keener knowledge of economy in maintenance of equipment, and for the settlement of disputes that the members may wish brought before it."

Section 2 of Article IV to read: "The board of directors shall consist of one member from each railroad company and private car line represented in membership, and shall be chosen by the president."

The only other change is substituting the term "board of directors" for "executive committee," where the latter appears in the Constitution and By-Laws.

Mr. Morris: You will see that about the only change is in the section which refers to the objects of the association. It was thought better to make this a little more distinct for the benefit of those who would be apt to make inquiries about the objects of the association.

Mr. Bates: I move that the proposed changes be accepted and the committee discharged. Carried.

Secretary Kline: The following have made application for membership:

NAME.	EMPLOYMENT.	PROPOSED BY.
W. M. Harvey . . . . .	C.C.Fuel Record, C.,M.& St.P.Ry., W. Milwaukee, Wis.	J. C. Grieb.
J. A. Kershaw . . . . .	Supt. Air Brakes, " " " " " "	" "
Jas. J. Connors . . . . .	R. H. F. " " Savanna, Ill. . . . .	" "
F. J. Cooledge . . . . .	Clerk, C., M. & St. P. Ry., W. Milwaukee, Wis. . . . .	" "
W. H. Applegate. . . . .	" " " Marion, Iowa. . . . .	" "
Robt. Widger. . . . .	Derrick Foreman, C., M. & St. P. Ry., Marion, Iowa. . . . .	" "
Thos. Murphy. . . . .	Car Foreman, " " " " " "	" "
A. B. Chadwick. . . . .	Foreman, Armour Car Lines, Chicago. . . . .	W. E. Sharp.
Chas. Yaeger. . . . .	Inspector, N. Y. C. & H. R. R. R., New York, N. Y. . . . .	T. R. Morris.
Edw. J. Graessle . . . . .	Foreman, Arms Palace H. C. Co., Chicago. . . . .	W. E. Sharp.
J. Hirlehey . . . . .	Foreman, Wabash Ry., Chicago. . . . .	W. A. Bell.
J. T. Harrahan, Jr. . . . .	Salesman, Scott Spring Co., Chicago. . . . .	A. R. Perry.
C. M. Mileham. . . . .	M. M., Streets W. S. C. L., Chicago. . . . .	W. E. Sharp.
J. F. Lockrey. . . . .	Chief Clerk, Streets W. S. C. L., Chicago. . . . .	C. M. Mileham.
C. K. Knickerbocker. . . . .	Repr. Griffin Wheel Co., Chicago. . . . .	A. R. Perry.

A. T. Herr.....	Repr. The Sargent Co., Chicago.....	W. E. Sharp.
Geo. H. Sargent.....	“ “ “ “ “ .....	“
J. W. Taylor.....	Sec'y Master Car Builders' Ass'n, Chicago.....	A. Kline.
J. E. Widner.....	Salesman, Gould Coupler Co., Chicago.....	A. R. Perry.
C. W. Gould.....	Manager, “ “ “ “ .....	W. E. Sharp.

President Sharp: These names have been passed upon by the executive committee and will be enrolled as members.

Before we take up the regular program of the evening, I will appoint Mr. C. L. Bundy as a member of the committee on subjects, in place of Mr. Roof, who has left the city.

The first number on our regular program is a review of recent decisions of the arbitration committee. Mr. Grieb has very kindly prepared a paper on this subject:

#### DECISIONS OF THE ARBITRATION COMMITTEE.

The title of the first number of our program this evening, "Review of recent decisions of arbitration committee," conveys the idea of a thorough, critical examination of the subject matter under consideration. While I had no choice in the selection of this title, I am of the opinion that it may have led you to expect considerably more than is my intention to present, and, therefore, almost feel called upon to apologize for the introduction of the few scattering notes I am offering.

The minutes of the meetings of the arbitration committee contain at all times valuable and important information for all of us, and it would seem to me that if it were made a regular practice by this association to discuss the decisions as they are issued, we would probably arrive at a better and more thorough understanding of their import.

In connection with the most recent issue, I would direct attention to the large number of cases on which decisions have been rendered, there being a total of 603 cases. In doing this from a retrospective point of view, we note the following which may be of interest to you: The first decision was rendered in 1888, so that we have been favored with an average of about fifty decisions per year. There is a decided feeling manifesting itself indicative of a desire on the part of a great many to reduce this number to the minimum. We have seen a number of cases presented in the past for which it would be difficult to assign any reason for their existence. It is not very flattering to bear the reputation of a disputant, nor is it just to sacrifice principle as a means of avoiding referring questions to the arbitration committee. We can hardly hope to reach the millennium when there will be no more cases submitted for arbitration; although I am sure you will agree with me in saying that some controversies which might ultimately have been presented to that committee have, by being brought before such associations as ours, been disposed of in a direct and friendly manner, and as a result a better understanding of the questions, as well as the individuals, arrived at and

harmony fully restored. I am of the opinion that as associations similar to ours become more numerous, and a better personal understanding prevails at the interchange points, and the small matters of dispute are better ventilated, they will disappear, making reference to the arbitration committee less frequent than heretofore.

Again, in view of the slight and unimportant changes made in the rules during the past few years, it would seem but natural that the number of cases to be arbitrated should be reduced.

The total number of companies appearing before the arbitration committee in the cases submitted to date amounts to 244, being an average of 2.47 cases per company represented. There is, however, considerable variation, and some roads lead the procession by notable odds. In analyzing this, I find that there is one company that has been involved in 38 cases, two others each having 37 cases, the next two having each 31, and so on until we reach the long list of companies who were interested in but one case, there being 90 in this category. I would particularly refer to the companies so heavily involved, because three of them are large trunk lines running into Chicago who have a representation in this association, and possibly among the members here this evening. Especially would I refer to these, as in the case of two of these three roads the minutes show that they have lost more cases than they won, the ratio being 22 and 15 for one, and 20 and 11 for the other. Two of these three roads appear again in the last issue of decisions. There are 85 companies who have won all of the cases in which they were interested, and 134 companies who have lost all the cases in which they were interested. This showing affords considerable food for thought, but it is not my purpose to dwell on this phase of the subject this evening.

Of course, in these 603 cases are represented a large number which are disposed of by reference to the findings of previous cases; this cannot be avoided when two or more cases involving the same point are submitted at the same session of the arbitration committee. However, there is a good representation in each lot of decisions issued which are disposed of by a mere reference to decisions already rendered, and to these I would direct attention. There are various ways for accounting for this phenomenon. It certainly is difficult for anyone to carry in mind the purport of the subject matter involved in these 603 decisions. This has often led me to think of the great need of having a thoroughly efficient and comprehensive index prepared of all the decisions thus far rendered. To do this properly, certainly will involve considerable expense and a large amount of painstaking labor. Still, I am not afraid to assert that there is not a piece of literature printed that would be more acceptable to all of us than just such an index. I believe that this matter will soon receive attention on the part of the M. C. B. Association, and I would expect that it will result in reducing the number of cases submitted.

The decision in case 602 is one to which I would direct special attention. It decides the question of allowance for credit for brasses replaced on defect card. While the question is thoroughly in accord with the

last recommendations for changes in the rules made by this association and would, if adopted then, have resulted in at least one case less for arbitration, it is not apparent from the decision how the evident contradiction in the rules is reconciled. We frequently find a disposition on the part of the committee to adhere rigidly to the letter of the rules, and, again, in other cases, that the question of equity plays a very prominent part. Someone has truly said that "Brevity is the soul of wit," but it would illy apply in these decisions which represent the interpretation of the law as laid down in the M. C. B. rules of interchange. While each decision may fully cover the particular case to which it is applied, this same decision will of necessity be applied to a number of other cases involving the same principle, but where the circumstances may represent a shade of difference just sufficient to found the stamping ground for another dispute. Looking upon it from this standpoint, it certainly seems to me very desirable to have these decisions a little more at length, and explanatory of the basis and rule upon which they are founded. We have no desire to appear over-officious, but it seems quite desirable to be favored with the views entertained by the arbitration committee when the decision is rendered, so that the same may be thoroughly understood, and the principle established therein more cogently applied to other cases where the circumstances are of a slightly different nature. This would aid in reducing cases of dispute and also result in a better diffusion of knowledge on the points involved.

Mr. Morris (C., M. & St. P.): The paper seems to have covered the ground pretty thoroughly. It certainly is brought to us in a way that probably very few of us have considered. I think it would be a very good thing for this association to take up these decisions as they are issued, with a view of discussing them and getting a uniform understanding as to what they explain. I therefore move that this association make it a point of reviewing the decisions each time that they are issued. I think that the committee on subjects could take proper action if the association put itself on record.

Mr. McAlpine: I am in favor of the motion, but there are a great many of the members, no doubt, who never see these decisions. Is there any way in which the club could be provided with copies to be distributed among those who do not receive them?

Mr. Bates (C., B. & Q.): On the C., B. & Q. R. R. every car inspector that it employs is furnished with a copy of the decisions as they are printed, and I think all roads ought to do the same. It is very important that the car inspectors familiarize themselves with the decisions, and it seems to me that the heads of the car departments of the several roads ought to be interested enough in the decisions to give each inspector a copy.

Mr. Grieb (C., M. & St. P.): The same practice that Mr. Bates speaks of prevails on the Milwaukee system, and we have always been favored with as many copies as we desired to procure, by making request on Mr. Taylor, secretary of the Master Car Builders' Association. It seems to me, if any one has been unable to get the decisions, it would be well for this association to ask Mr. Taylor if he could not undertake to furnish a specified number of the decisions for distribution among the members of this association.

Mr. Marsh (C. N. Y. & B.): We have always been provided with those copies. By discussing them here, we will get a better insight into them, and will all understand them the same way, and be benefited accordingly.

Mr. Morris: I will say from my own personal knowledge that there are a great many inspectors who do not get the proper information in regard to the decisions of the arbitration committee. It is well known that the M. C. B. rules alone do not afford all the information necessary in regard to the interchange and repairs of cars, and that the arbitration decisions are in the way of an interpretation of those rules, and I have come across a great many inspectors who are working according to the rules, regardless of the interpretations of the arbitration committee, and it seems to me it would be doing a very good work for the Car Foremen's Association to see that each one of its members is supplied with copies of the decisions.

Mr. Morris' motion was here put and carried.

Mr. Bates: I move that we reaffirm our recommendation to the M. C. B. Association last June, in regard to allowing an arbitrary scrap credit for journal bearings renewed on defect cards.

Mr. Grieb: The committee appointed by this association made a recommendation to the effect that all brasses removed, where bill is permissible, should be credited at the arbitrary weight of one-half. This recommendation was not acted upon by the Master Car Builders' Association, and we see that the arbitration committee has decided it as we had recommended. I think if there is any credit due any one, this association should have the benefit of it.

Mr. Bates' motion was here put and carried.

#### A CASE IN DISPUTE.

President Sharp: We will now pass to the second subject, which is a case in dispute:

A receives one of his cars home with B's repair card attached cover-

ing one bottom arch bar. A finds that arch bar is wrong, it being wrongly shaped so that pillars did not fit properly; also, that this arch bar had been cut by wheel between oil box and pillar bolt, previous to its application to this car, which made it unfit for anything but scrap, for which A procured joint evidence card and made request on B for defect card. B replies that the arch bar applied by him was new and of proper shape and dimensions when applied, and declines to issue defect card. A states that car bore no evidence of other recent repairs to any of the trucks, and desires to know whether the joint evidence in this case is final and makes it obligatory upon B to issue card.

Mr. Kroff: I don't think we can get at this case, as there no dates given when the car was repaired, or when it was delivered home to the owner. As the man that made repairs claimed he applied a new arch bar, it might have been that someone else put in the second-hand arch bar, and I think if the dates were given when the car was repaired and delivered home we probably could have gotten at it in different shape.

President Sharp: I do not know as I can give the dates, but it was in a space of two weeks from the time the repair card was applied by one company until the car was delivered home to the owner. There was only one repair card on the car showing arch bars applied and no indications of any other repairs made to other parts of the other truck.

Mr. Morris: As the M. C. B. rules are very plain in stating that the joint evidence card is final, I do not see what grounds the party who made the repairs has for refusing to pay the bill. It seems to me very arbitrary action on their part.

Mr. Bundy (S. R. L.): I believe that B is responsible for the arch bar and should furnish defect card covering it.

Mr. Bell (Wab.): In looking over this notice I concluded at once there was no case at all. The rules are specific in those cases where joint evidence is procured, no matter under what conditions—the joint evidence is final and defect card is due in that case.

Mr. Bates: If the party making these wrong repairs made a bill on the owner, it seems to me the owner does not need a defect card. The M. C. B. rules say that "a joint evidence card accompanied by a proper repair card, upon which a bill has been made, shall be used as authority for rendering bill." And in my opinion, all that is necessary is for the owner to bill back on the party making these wrong repairs.

President Sharp: They argue that they applied a new arch bar and that it fitted the car properly, regardless of the fact that the arch bar which was on the car when it arrived at its home, shows that it had been cut. The rules are very plain as to the power of the joint evidence card

in this case, but this man making the repairs claims also to have done the work properly. What protection has the car owner, in justice to the man who made the repairs, if he made them properly?

Mr. Hunt (P., F. W. & C.): The case seems a little difficult to decide, for the reason that the man who made the repairs claims he applied a new arch bar on the truck, and when A receives the car home finds it is an old arch bar. If such is the case, then it would seem that this was not the arch bar which B put on. There is a possibility, of course, that someone else made repairs, although this is hardly likely, and at first glance we would say that B was in for it, but if B positively says that he put a new arch bar on, if B is an honest man we would have to say, naturally, that someone else made repairs to that car, and that this was not the arch bar that B put on. That being the case, should we hold B for this arch bar?

Mr. Kroff (P., F. W. & C.): I would like to know whether A and B signed this joint evidence card?

President Sharp: B did not sign the card, but the joint car inspector at the delivering point signed the joint evidence card with A.

Mr. Kroff: It seems to me a case where B ought to have something to say. I would say that if A and B both signed the joint evidence card it should be final.

Mr. Grieb: It seems to me that after we obtain joint evidence card, properly signed, there is no more room for argument. It might be that B is not responsible in this case, but how are you going to tell? His repair card is on the car showing that he applied an arch bar. There is no evidence, as there surely would be, of any other arch bar being removed. It is very important on our part to hold the joint evidence card supreme in matters of this kind. It would be very difficult to get anyone, after putting a repair card on a car for a new arch bar, to acknowledge that the bar he applied was defective. As a proper joint evidence card was procured and his repair car attached, there is no room for any further argument.

Mr. Wentsel (Belt Ry.): In my opinion, the joint evidence card is sufficient, it matters not whether B signed it or not. We had a case, I believe, with the St. L., I. M. & S. Of course, we would not have anything to do with signing a joint evidence card at St. Louis, but we considered that the joint evidence card was final and issued card.

Mr. Prickett: In my opinion, B applied the arch bar which he claims by the repair card he placed on the car. Whether the arch bar was changed again afterward or not, before the car reached home, we

are not able to say. I think B is responsible for the wrong arch bar, and should issue a card or pay for it without a card.

Mr. Marsh: I believe that B is responsible. He has put on an arch bar, and the joint evidence card shows it is a defective bar, and I think he is in for it.

Mr. Stimson (S. R. L.): The ground has been so thoroughly covered that I can only emphasize what has been said, with the possible exception that, as the rules do not hold a road responsible for repairs that it did not make, and B positively claims that he did not make those repairs, my opinion of the case would be that I would hold the delivering company responsible for accepting the car in that condition, and he would have to look to B or some other road for his protection. I think that A is out of the case entirely, and think, were it my case, I would insist upon protection from the delivering line and let him fight it out with B or anybody else.

Mr. Marsh: As I understand this case, B acknowledges that he made repairs to this truck—put in a bottom arch bar—and when the car is delivered home to the owner it is found that that arch bar is cut and unfit for service, and evidently was that way when it was put in. B says he put in a new bar, while the owner says it is defective. It certainly must be the same bar that B applied, as the car bore only his repair card, showing arch bar applied, and I think the joint evidence card should be final.

Mr. Grieb: It seems to me to be a very dangerous principle to admit that a mere denial of having made wrong repairs to the car, after a joint evidence card is procured, should relieve the party whose repair card is on the car, from responsibility for the wrong repairs. It is very poor policy, indeed, to admit anything in the shape of an argument after a joint evidence card is procured. We ought to firmly establish the position here, this evening, that a joint evidence card, duly executed, is inviolate, otherwise there would be nothing to prevent any one, after he was presented with a joint evidence card, to say that he made proper repairs, and thus get out of it. This may be an exceptional case; but as there was no other indication of any repairs being made to any of the trucks, we must firmly adhere to the joint evidence card as settling questions of this kind.

Mr. Hunt: I think Mr. Grieb's view of the matter covers the ground and covers this case. There has been an arch bar put in, covered by B's repair card, and no evidence of any other arch bar being applied and no other repair card. Such being the case, the joint evi-

dence card ought to be final in the case. While there is a possibility of somebody else putting in the bar, still there is no evidence of that, and I think, as Mr. Grieb says, the joint evidence will have to be final.

Mr. Morris: I would make a motion that in this case B is responsible, in view of the joint evidence card, which must be considered binding and final, and should pay for the renewal of the arch bar.

Carried.

President Sharp: The next topic for this evening is: "If an air hose is torn off and car offered in interchange, what is the delivering company responsible for?"

Mr. Bates: In my opinion, an air hose torn off is an owner's defect, and I believe it has been decided so by the arbitration committee. When delivering a car with defects of this nature, in interchange, it seems to me all that is necessary is to card for the good parts that are missing, which would be the air hose coupling. I believe section 22 of rule 3 says that any defects to the brake rigging, etc., caused by fair usage, are chargeable to the owner, and I do not see any necessity for carding for a hose torn off in a case of this kind.

Mr. Grieb: I would like to ask Mr. Bates how he gets around the word "defective" in the same section he has quoted, as relating to delivering line in case of cars interchanged, as here represented?

Mr. Bates: Section 22 says: "Defective, missing or worn-out parts of brakes which have failed under fair usage, except missing material on cars offered in interchange, owners responsible." Now, I claim that hose torn off is chargeable to the owner, while the coupling that is missing is in good order, and is not chargeable to the owner. Now, I do not believe any road would ask for a card for a broken coupler, if the knuckle was missing, and I do not see how he would do any different with an air hose torn off.

Mr. Prickett: I take the view the other way. An air hose torn off is owner's defect, providing that you make the repairs yourself; but if you tear an air hose off and deliver it to some other line, I think you become responsible, because you do not make the repairs.

Mr. Bates: Under the 1899 rules we had to card for hose torn off, because that section relating to this matter stated that even worn-out brake shoes had to be carded for if the car was offered in interchange. But that section has been changed and does not read that way any more, and I do not see how anybody can take an opposite view.

Mr. Marsh: I do not know whether I understand Section 25 or not, but it says: "Missing air brake hose and fittings, angle cocks, cut-out

cocks, triple valves, release valves and pressure retaining valves, or parts thereof, delivering company responsible." Now, this speaks of a hose as being missing. If torn off, it must be missing. It seems to me Section 25 covers this case, and delivering company is responsible for the hose and coupling.

Mr. Hunt: Another point comes in there. There may be part of the hose left on. I think that is the way most of them are torn—leaving a little of the hose on the car. Now, if some of the hose is left on, it is not a missing hose, strictly speaking. But the point is now, whether that can be counted a missing hose or a damaged hose. If missing hose, delivering company would be responsible. Then that term can be used, possibly, in the way of a hose pulled off, not torn. In that case, it would be a case of missing hose, and delivering company responsible.

Mr. Morris: The point Mr. Bates raises in regard to a broken coupler and a missing knuckle, is well taken. A broken coupler is an owner's defect. Any one will take a car with a broken coupler and a missing knuckle, and hold the delivering line only for the missing knuckle. Section 25 says: "Missing air brake hose, etc., delivering company responsible." This air brake hose is not missing; it is damaged. Section 26 says: "Damage to any part of the brake apparatus caused by unfair usage, derailment or accident." This hose was not broken by unfair usage. It was fair usage, and I do not see how you can make a broken coupler alone an owner's defect and not a broken air brake hose. They seem to me to be parallel cases.

Mr. Grieb: In reply to the remarks made by Mr. Bates, will say, I think we can well afford to look upon this matter from a basis of equity and be a little broad-gauged in the matter. Why not hold the delivering company responsible for offering a car with air hose in defective condition? If it wants to avail itself of the privileges for billing under the rules, it should make the repairs before delivering car. If, however, it chooses to deliver the car with air hose in defective condition, it ought not ask the delivering company to make two bills, one against the owner of the car for the air hose rubber and another against the line who delivered car to them for the missing coupling. It would be well, as a matter of penalty, to hold the delivering line responsible if it delivers a car with air hose torn.

Mr. Bundy: I agree with Mr. Grieb on the subject. I believe that while the owner was responsible, in the first place, for the broken air hose, if the delivering company had applied a new hose, yet when delivering the car to connecting line that made the delivering line responsible for the air hose.

Mr. Bates: I do not see how you can hold the delivering line responsible when there is nothing in the rules which says that you can. As I stated before, in the '99 rules there was specific mention for cases of this kind, but that has been changed, and a broken air hose is not a missing hose by any means, and it has been decided by the arbitration committee that an air hose that fails to part automatically does so because of some imperfections in the hose coupling and is chargeable to the owner, and I do not see why it is not equitable, because it works both ways. Now, on our road we have not been carding for torn hose since these rules took effect, and we have not been asking for any cards.

Mr. Hunt: It seems to me that that is about right. Take the M. C. B. coupler on a car. Suppose the head is broken off the coupler and the car goes to you with the shank in the draft rigging. You certainly will not call that a missing coupler. That would be an owner's defect. And why would it not hold good with the hose? I would like to see it generally understood one way or the other, and it may be well to take a vote on it.

Mr. Cook (S. R. L.): I think you have got to hold the delivering line for part of the defects anyway. You cannot bill the car owner in any event for the missing coupling. It seems to me that the proper way to handle it would be to bill the owner for the value of the hose and hold the delivering line for the missing coupling. If you did not do that, you would be giving the coupling to the road that damaged the car, and the road who made the repairs would be out the value of that part; so in order to even up it would be necessary for the road who made the repairs to get a card for the coupling, which can properly be termed a missing part.

Mr. Morris: I move, that in case of one company giving a car to another, with an air hose torn off and coupling missing, the delivering line be responsible for the missing coupling and the owner for the air hose rubber.

Carried.

This closed the discussion, and Mr. L. C. Bundy, of the Swift Refrigerator Line, read the following paper on hot boxes, their causes, the best method of treating them:

#### **HOT BOXES—THEIR CAUSES AND PREVENTATIVES.**

Doubtless the members of the Car Foremen's Association of Chicago will agree with me in saying that nothing has caused so much delay to trains, and annoyance to railway officials, as hot boxes. Much time has been devoted to the discussion of this important subject, yet I believe

there is room for further discussion, and the writer will endeavor to point out some of the most frequent causes. I hope the members of the Car Foremen's Association will enter into the discussion freely, so that the subject may be gone over thoroughly, and possibly some good may result. If I should succeed in advancing any ideas that will assist in bringing about the least improvement, I shall feel that my efforts have not been entirely in vain.

Owing to the close competition between railways, the speed of fast freight trains has increased to almost, if not equally, as fast time as passenger trains, and as the speed is increased, the more liability there is of having hot boxes. It is important and necessary to make fast time. It is the duty, therefore, and is expected, of the mechanical department of railways to reduce hot boxes to the minimum, and at the same time to accomplish this result as cheaply as possible.

I will call your attention to some of the most frequent causes of hot boxes that have come to my observation during my railway experience, and will take up each in their respective order :

#### *Causes.*

- 1st. Brasses not fitting journals properly.
- 2d. Defective journals due to seams or other defects in axles.
- 3d. Defective dust guards and oil box lids.
- 4th. Uneven bearing on brasses due to trucks out of square.
- 5th. Improper packing.

There are various other causes, yet I believe the above the principal ones.

Taking up cause No. 1 : "Brasses not fitting journals properly." I favor a solid brass with a soft lining, babbitted on a mandrel 1-16 inch larger than the journal on which the brass is to be used. Special care should be taken that the brasses fit the fillets of the journal properly.

Cause No. 2 : "Defective journals due to seams or other defects in axles." Axles with defects of this kind should be rejected. In turning journals, care should be taken to get a good smooth bearing with the proper radii to the fillets. I believe rolling journals a good practice.

Cause No. 3 : "Defective dust guards and oil box lids." It is a well known fact that boxes with defective dust guards, or with lids missing are liable to run hot, for the reason that sand, dust and grit get into the boxes.

Cause No. 4 : "Uneven bearing on brasses due to trucks being out of square." It has been my observation that a great many brasses are worn thin at back end, due to truck being out of square ; this being the case, the bearing on journal is not properly distributed, and as a result hot boxes occur.

Cause No. 5 : "Improper packing." More hot boxes are due to improper packing than any other cause. Waste for packing boxes should be mixed at least three days before being used, and kept under oil during that time to insure its being thoroughly soaked before being used, after

which it may be put into another vat with a false bottom of wire netting and the oil allowed to drain off. In packing, the box should be filled to about  $\frac{1}{2}$  inch below the edge of the brass, or a little above the center of the journal. The waste should not be put in too tight, as a box can be packed too tight as well as too loose. On cars with new trucks, or new cars, I believe it to be a good practice to add a little loose oil along each side of the journals the day the car is put in service.

I believe the following good practice, to prevent journals from running hot:

All boxes should have the waste removed every six months and run through a picker, then it can be applied to boxes again.

Oiling stations should be established every 500 miles.

Use a long spout oil can and get oil well back to rear of journal.

In extreme cold weather use the oil hot.

From April 1 to November 1 use a light oil.

From November 1 to April 1 use a heavy oil.

In caring for hot boxes on the road, I have found from practical experience that if a box is packed once and does not run cool, the brass should be changed. It does not pay to waste time packing it. The journal is liable to be cut, and the result is that the car is set out for a new pair of wheels.

On account of the lateness of the hour, discussion of this paper was deferred until the next meeting.

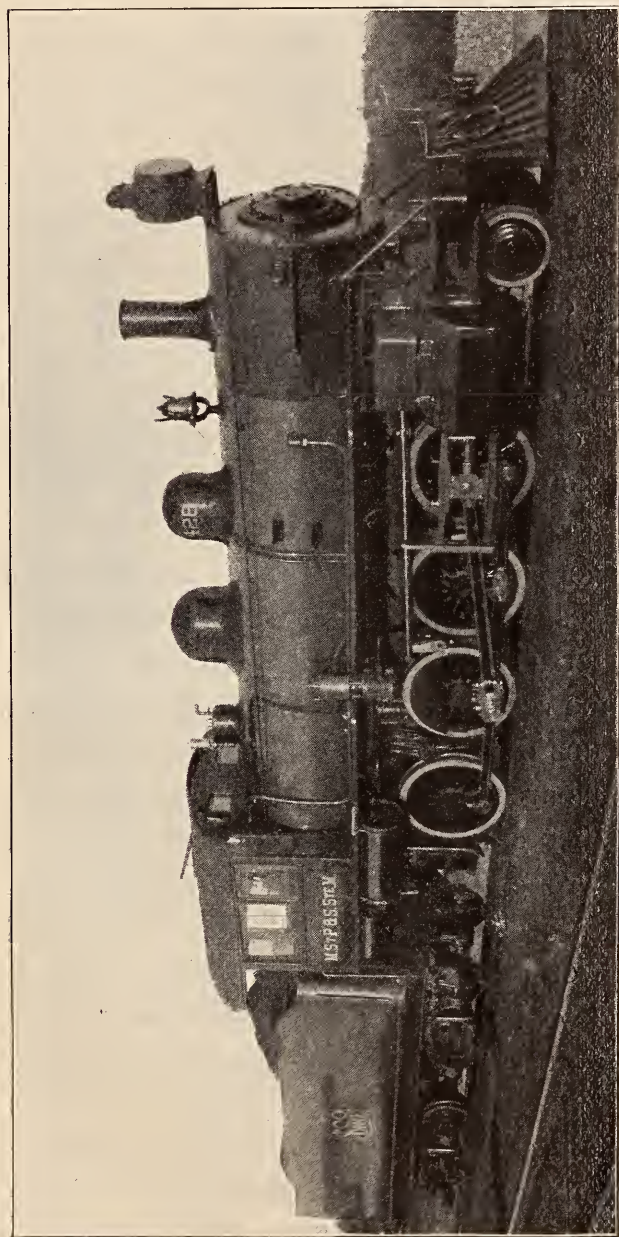
The meeting then adjourned.

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## SCHENECTADY COMPOUND CONSOLIDATED LOCOMOTIVES, M., ST. P. & S. STE M. R. R.

The Schenectady Locomotive Works recently delivered some new two-cylinder compound consolidated locomotives to the Minneapolis, St. Paul & Sault Ste Marie Railroad. We give a reproduction of the photograph of one of these engines. They were designed to haul 1,692 tons of freight, exclusive of the engine and caboose, up a 42 foot grade 10 miles long, working compound. Our latest information is to the effect that on the trial trips the engines worked very satisfactorily.

These engines weigh 176,000 pounds, of which 154,500 pounds are on the drivers. They have compound cylinders  $22\frac{1}{2}$  and  $25 \times 30$  inch stroke; 55 inch drivers; a straight top, radial stayed boiler  $73\frac{1}{2}$  inches in diameter, and designed to carry 210 pounds working steam pressure; a firebox  $41 \times 120$  inches; a grate area 34.16 square feet; and a heating surface of 2,549 square feet, of which 193 square feet is firebox and 2,356 square feet tube surface. These engines will burn bituminous coal. They have tanks of a capacity of 6,000 gallons of water, and 10 tons of coal.



SCHENECTADY COMPOUND CONSOLIDATED LOCOMOTIVES, MINNEAPOLIS,  
ST. PAUL & SAULT STE MARIE R. R.

Total weight—176,000 pounds; weight on drivers—154,500 pounds; weight on truck—21,600 pounds; cylinders—22½ and 35 x 30 inches; drivers—55 inches; heating surface—2,549 square feet, of which 193 square feet is firebox and 2,356 square feet tube surface; grate area

—34.16 square feet; fuel—bituminous coal; working steam pressure—210 pounds; boiler—straight top, radial stayed,

73½ inches; tank capacity—coal 10 tons;  
water 6,000 gallons.

## TRAIN DELAYS.

At the last meeting of the Rocky Mountain Railway Club a valuable topical discussion was had on train delays, of which the following is an abstract:

Mr. G. W. Rhodes (Assistant General Superintendent B. & M. R. R., Lincoln, Neb.): One of the ways to remedy train delays is to encourage the habit among railway men, from the superintendents downwards, of practicing close observation.

Then having that end pretty well in hand, the next thing to do is for those in authority, when a cause for delay has been clearly shown, to issue the proper instructions to prevent its recurrence and see that those who are receiving orders carry them out.

The art of close observation is one that we can all practice. We usually give a superficial look into the reasons for the delay; we do not go into details; we do not find out what is the real cause of the delay; in too many cases a plausible excuse for a delay seems to be all that is required.

During one of our meetings I was quite interested in Mr. Bunn's very excellent paper on hot boxes, their causes and remedies.

When he concluded his paper he said, in a jocular kind of way, "but don't follow my advice; continue reporting dry packing, lack of oil, bad waste, and pour in oil until it runs out both ends of the box."

Now, that is what most of us are doing, and that is why our railway experience is so expensive. When anyone tells us we have made a mistake, we say, "I know it is all wrong," but we continue following in just the same old way.

With a great deal of our work on a railway we do not look into enough details. We have a delay from some cause, but instead of applying a remedy, we are content even when we find the same cause given for the next delay.

There is another thing that has a direct bearing on "train delays," and I want to impress upon you the importance of it, that when you discover something that ought to be remedied on a railroad, and give an order, be sure to see that this order is carried out. How many of us give orders, and take it for granted that they are being carried out?

Foremen, especially, should see that the work is being done in the way it was instructed it should be done. Some foremen, in their zeal to have the work done, will do as hard work as the men who are paid by

the day, quite overlooking the more important matter of seeing that things are done exactly as directed.

I think "train delays" could be very materially reduced if we could get all the men to work together, keeping their eyes open, and reporting to their superior officers all defects noticed, who in turn would apply the proper remedy.

Mr. Chas. Dyer (General Superintendent, C. & S. Ry.): I want to indorse everything Mr. Rhodes said in regard to "close observation." It need not be made applicable only to the mechanical department; it extends to all departments.

An accident happened on our road recently that resulted very unfortunately—we all deplored it. The report came to my office that the accident was caused by track spreading. I know personally that the track had been properly repaired during the summer. I had walked over it two or three times myself. I felt that it could not be possible that the track had spread.

I received a second telegram from the conductor later on, saying that he was mistaken. The section gang had got there with a gauge, and everything in the track was in perfect line and surface. He acknowledged that the accident was not due to that.

It is not necessary to say what the accident was due to; it simply shows that the conductor did not exercise his observation, or he would not have made an incorrect report. We cannot remedy these things, unless we are given correct reports of their cause, and here is where the lack of observation spoken of by Mr. Rhodes causes so much trouble.

Mr. Frank P. Roesch (Traveling Engineer, C. & S. Ry.): I was given instructions a short time ago to find out what was the matter with a passenger train that was being badly delayed, so I rode the train to see what was the trouble.

After we had gone a little way we stopped. I asked the engineer what he was stopping for. He said it was to pick up section men, and take them to another place. We went on a little bit further, and the engineer said he was going to stop at the next station for water. I asked him why he took water there. "Oh," he said, "you can't make the next tank unless you take water here." I said: "Well, try it, anyhow." "All right. Will you take the responsibility?" I told him I would, and we had 15 inches of water when we reached the next tank.

Every time the train stopped where they had to unload express and baggage, I saw it was taking them an unaccountably long time. I found that the section foreman was having his household goods moved on the

passenger train. There were plenty of freight trains, but he seemed to prefer to move his things by passenger.

The next place we stopped at to unload a little express. After they unloaded it they pulled up one car length to take water, because the platform was just half a car too short.

We went a little bit further and took water again, but instead of taking it in two minutes it took us ten, because the pumper would not let the valve of the pipe be opened wide. He said that when the valve was wide open it wasted the water, and the water was very scarce. (He had to do the pumping.)

Going a little bit further, at the next station, we unloaded passengers and express; we then pulled two or three, or possibly four, car lengths to the water tank, and then pulled up a little bit further again and picked up section men at the same station.

At first it was hard to tell why this train was continually delayed; it had big engines on it—new engines—and the train was carded about thirty miles an hour. That is not very fast average time, but when you go to making stops like I have mentioned you would have to go pretty fast between stops to average anything like that time. I think this goes to show how many causes there are for delays which do not even appear on the surface.

Mr. F. S. Harris (Assistant Superintendent, D. & R. G. R. R.): A great many of these delays could be overcome if the management and the proper officials are told about these things, but it is very rarely on an occasion of this kind that they get this information. I am on the road continually, and every once in awhile I pick up information about various delays that would never be brought to the attention of the proper officials. It is absolutely essential that we go into the most minute details, and find out exactly what is causing these delays in order to prevent a recurrence of these train delays. It would make our service very efficient if the employes and officials would do this, but if we can not find out the exact trouble we lay it on to a hot box, and the proper remedy for that is to jack up some poor car repairer at the other end of the road.

Engineer Bennett (D. & R. G.): I know of one cause of delays that has not been spoken of tonight. The other day I was pulling a train that had seventeen loads and eleven empties, and they had put the loads behind and the empties ahead. Of course, they pulled very hard. We had two engines that morning. When we got to the top of the hill they broke in two, and we had about an hour's delay chaining up there.

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In pulling out of the side track, they broke in two again—the chain broke.

I spoke to the conductor about it, and asked him why he could not put the loads ahead and stop the trouble. He said they were that way when he got them and that it was not his fault. We had another break in two from the same cause, that delayed us thirty minutes, before we made the trip.

Engineer Cook (D. & R. G.): I can give two other causes for delays which are a little bit out of the regular run. I was on a train the other day and had thirty-seven minutes, just time enough to make the meeting point. I reached the side track on time, but was held there eight minutes waiting for a man to throw the switch.

On another train I arrived at a station on the line three minutes ahead of time. We had four minutes dead time on that train. I stopped at the tank, took water, and did my oiling inside of that time, and then I had to pull up to the depot, because the time card says it is an eating station. You have got to pull up there and make another stop in front of the lunch counter, and when you have a heavy train and have to stop at the water tank and do the necessary work there, and then pull up to the eating house and make another stop, it makes us lose a lot of time. On the train I was speaking of we left there fourteen minutes late.

Chairman Quereau: I have compiled the following table from the telegraphic reports of train delays, covering a period during the middle of September of this year. It will be understood that this period was one of the very busiest during the year, that for this reason the yards were sometimes blocked, and locomotives worked to such an extent that there was a shortage of power. Possibly for these reasons the statement may not be a fair one to represent the average during the year.

You will notice that the table shows the delays chargeable to the motive power department and to all other departments. The delays charged to the Motive Power Department comprise hot boxes on engines and cars, air brakes, no steam, poor coal, waiting for power, and dead engines. I did not take the time to determine definitely whether the cases of poor coal and waiting for power are justly charged or not. Most of the delays charged against all other departments are included under the items—meeting trains, waiting for orders, blocked in yard, way switching, unloading freight, sawing by, time lost on account of heavy trains. The delays tabulated are for regular trains only, both passenger and freight, because the reports contain no particulars for special passenger or extra freight trains. Delays caused by waiting for connec-

tions, either at the terminals of the road or district terminals, were not included.

The results of the compilation are as follows :

TABLE "A."

PASSENGER SERVICE.

Total number of delays.....	133
Delays due to Motive Power Department.....	21
(1 poor coal.)	
Per cent delays due to Motive Power Department.....	15.8
Total time lost, minutes.....	1,773
Total time lost, due to Motive Power Department, minutes....	349
Per cent due to Motive Power Department.....	19.7
Average time lost by one delay, minutes.....	12.7
Average time lost by one delay, due to Motive Power Dept., min.	16.6

FREIGHT SERVICE.

Total number delays.....	166
Total number delays, due to Motive Power Department.....	7
(5 waiting for power.)	
Per cent delays due to Motive Power Department.....	4.2
Total time lost, minutes.....	4,350
Total time lost, due to Motive Power Department, minutes....	255
Per cent time lost, due to Motive Power Department.....	5.8
Average time lost by one delay, minutes.....	25.8
Average time lost by one delay, due to Motive Power Dept., min.	36.4

FREIGHT AND PASSENGER SERVICE.

Total number of delays.....	299
Total number of delays, due to Motive Power Department.....	28
Per cent delays, due to Motive Power Department.....	9.4
Total time lost, minutes.....	6,123
Total time lost, due to Motive Power Department, minutes....	604
Per cent time lost, due to Motive Power Department.....	9.8
Average time lost by one delay, minutes.....	20.4
Average time lost by one delay, due to Motive Power Dept., min.	26.6

To me the most significant facts in connection with the statement are that, in passenger service the average time lost by one delay chargeable to the Motive Power Department is only 46 per cent, and for all other departments only 49 per cent of that in freight service; also that, while in freight service the delay chargeable to all other departments is

96 per cent of the total number, and 94 per cent of the total time lost in passenger service it is appreciably less, all other departments being charged with 84 per cent of the total number and 80 per cent of the total time lost. I believe this is correctly explained by the fact that better supervision is given passenger service, both as to equipment and occasions for delays. If this is the correct explanation, it follows that we may reasonably expect a considerable reduction in the number of delays and the time lost, by closer and more systematic supervision of our equipment and methods of handling trains, in both passenger and freight service. It would be interesting to analyze the delays charged to all other departments and determine the per cent for each class, but the necessary time required for this has not been at my disposal. I have, however, separated the delays due to waiting for and meeting trains and get the following:

PASSENGER SERVICE.

Number of delays.....	47
Per cent of total delays.....	42
Time lost, minutes.....	780
Per cent of total time lost, minutes.....	55
Average time lost, minutes.....	17

FREIGHT SERVICE.

Number of delays.....	70
Per cent of total delays.....	44
Time lost, minutes.....	1,739
Per cent of total time lost, minutes.....	43
Average time lost, minutes.....	25

TABLE "B."

STATEMENT OF OVERTIME PAID ENGINEMEN, SEPTEMBER, 1900.  
DIVISION "Z."

	District Y.	District X.
Waiting for foreign connections.....	5.8	1.0
Waiting for trains.....	12.6	7.8
Waiting for orders.....	7.0	10.7
Meeting trains.....	48.7	39.7
Station work.....	18.4	21.9
Wrecks and washouts.....	0.9	14.1
Motive Power Department.....	3.4	1.6
Miscellaneous.....	3.2	3.2
Total.....	100.0	100.0

Table "B" contains the delays to extras, as well as regular trains, while Table "A," as will be remembered, contained the data for regular trains only. It seems quite probable this difference will account for the smaller percentage charged to the motive power department in table "B." Table "B," as well as Table "A," shows that there is room for improvement in the way of supervision. It would be very interesting and profitable if a statement could be made showing the delays due to poor facilities:

There is one matter which, it occurs to me, does not receive the attention it deserves when studying the causes for delays during such a period of unusually heavy business as is covered by the tables presented, when yard, siding and roundhouse facilities are taxed to their utmost and there is a chronic shortage of power. During such seasons as the facilities, including cars and locomotives, are sufficient to easily handle the business, it is a wise policy to load engines with a tonnage adapted to a speed of ten miles an hour; but I question very much the wisdom of this policy when the business offered has increased to a point where it is a constant struggle to handle it with the cars and locomotives available. I am satisfied that if the trains are reduced so that the speed becomes fifteen miles an hour instead of ten, that more business can be moved with the same power. This may seem a strange conclusion, but I believe an examination of the reasons for it will prove its soundness.

Under the conditions named, the paramount issue, to borrow a current political phrase, is to handle the business offered and to prevent a blockade almost regardless of cost; in short, to handle the largest number of cars with the power and facilities available. Assume a division 100 miles long, another 200 miles long, and that the time required to get an engine from its train, through the yard to the roundhouse, clean the fires, furnish the necessary supplies and have the engine on its train again, is four hours. Assume, also, that a 20-car train will make the speed ten miles an hour. Then, according to the accepted formula for train resistance,  $T = 1/6 V + 3$ , a train of seventeen cars will allow a speed of fifteen miles an hour; that is, a reduction of 17 per cent in the train load will permit an increase in speed to fifteen miles an hour. From recent observations I am very much inclined to believe that a reduction of 12 per cent in the train load will secure an increase in speed from ten miles an hour to fifteen miles an hour. This because the heavier train is more difficult to start, more liable to hang up on the hardest pulls, to break in two, makes it necessary to sawby more frequently, and does not

accumulate the speed through the sags that the lighter train does. These assumptions give the results in Table "C."

TABLE "C."

	100 Mile Division.		200 Mile Division.	
Speed, miles per hour.....	10	15	10	15
Hours between terminals.....	10	6.66	20	13.32
Hours at terminals.....	4	4	4	4
Hours for one trip.....	14	10.66	24	17.32
Trips in thirty days.....	51.4	67.5	30	41.6
Cars handled per trip....	20	17.0 for 15% red.	20	17.0
Cars handled per trip.....		17.6 for 12% red.		17.6
Cars handled per month.....	1028	1147 for 15% red.	600	707
Cars handled per month.....		1188 for 12% red.		732
Gain in cars handled, per cent.....		12 for 15% red.		18
Gain in cars handled, per cent.....		16 for 12% red.		22

These figures show an increase in the number of cars handled per engine of from 10 to 22 per cent, by decreasing the train so that the speed will be increased from ten to fifteen miles an hour, the increase depending on the necessary reduction of the train and the length of the division. When we consider the lighter train will undoubtedly have less delays in meeting trains, because it can make meeting points with much more certainty, and that its engines will unquestionably require less time and work in the roundhouse than the engine on the drag, because the latter will be laid out more, remain on side tracks longer, and require more flue work at terminals, and be more likely to die on the road, it seems reasonable to conclude that the number of cars handled by the engine on the lighter trains will be a greater per cent than shown by the table. My observations, both in the roundhouse and on the road, during the past two months and during the heavy months of preceding years, have proved to my satisfaction that the engines on drag trains, especially during the cold season, require more time and work at the roundhouse than those on lighter trains. In addition, the fact should not be overlooked that the longer the hours between terminals, the less efficient the services of the train and engine men, and the greater the chances of delays and accidents from this cause.

It seems to me evident from this discussion, when business is such that the locomotives available are insufficient to handle it, and freight blockades are imminent, and the tonnage ratings are based on a speed of ten miles an hour, the number of cars handled per locomotive during a month can be increased from 10 to 20 per cent by reducing the weight of the trains from 10 to 15 per cent, thus increasing the speed to fifteen miles per hour.

It might easily be assumed that, following this line of argument, still more cars would be handled in the course of a month by still further reducing the train and increasing the speed, but investigation will show that there is an economical limit to the process. With a 100-mile division, four hours at terminals and twenty cars for the ten-mile-an-hour train, Table "D" gives the figures for fifteen and twenty miles an hour:

TABLE "D."

	100 Mile Division.	
Speed, miles per hour . . . . .	15	20
Hours between terminals . . . . .	6.66	5
Hours at terminal . . . . .	4	5
Hours for one trip . . . . .	10.66	9
Trips in 30 days . . . . .	67.5	80
Cars handled per trip . . . . .	17	14.7
Cars handled per month . . . . .	1147	1176

Gain in cars handled only 2.5 per cent, a gain not sufficient to warrant the increased hazard due to the higher speed. Quite elaborate tests have been made by the Northern Pacific to determine the most economical speeds at which to handle freight, the results of which were reported in the *Railroad Gazette* for March 2, 1900. The speeds varied from about twelve to eighteen miles an hour, according to the class of engine and other varying conditions, averaging 15.4 miles per hour.

I will not be at all surprised if a careful examination will show that, under the conditions for which I have advocated, a moderate lightening of the train resulting in an increase of the speed, will show a decreased cost per ton per mile, because of decreased overtime, break-in-two's, and car and engine repairs. The following figures, which show the relation of overtime-paid enginemen with the total wages paid them for June, when there was no special rush of business and there were enough engines to handle it easily, and the same figures for September, when there was a decidedly heavy business and shortage of engines, show quite clearly that the overtime paid increased three to four times as much as the amount of business done, as determined by the wages paid enginemen:

## JUNE, 1900.

	Division Y.	Division X.
Overtime, per cent of total enginemen's wages . . . .	1.8	2.0

## SEPTEMBER, 1900.

Overtime, per cent of total enginemen's wages . . . .	5.3	4.6
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At a recent meeting of the Pacific Coast Railway Club this same subject of train delays was considered. From a committee report then presented we extract the following, which has relation to the overloading of locomotives :

Within the past few years the tonnage system of handling trains has taken the place of the old style of number of cars to train, and the prevailing idea with railway managers seems to be that tonnage must be hauled irrespective of time schedule or the movement of power, and, so far, we have been made better acquainted with the resulting evils than with the great benefits that are said to accrue from the change. It is the same as with the law and the criminal, if the pursued criminal is caught we hear all about it; if not, we hear nothing about it.

We know of and are constantly getting reports of delayed trains, "poor engines," "incompetent engineers," "poor coal," etc., being the alleged causes for delays. An investigation often discloses the fact that some overloaded engine has given out; flues have started leaking, and it has been necessary to take some intermediate sidetrack to avoid delaying some passenger train.

After getting fire fixed and using blower vigorously for a couple of hours, it is discovered that they will have to run for water before moving train, or probably the engine on account of reduced steam pressure has got to leaking so badly, that train will have to be given up and engine towed to destination; whereas, had the train been properly estimated for the capacity of the engine, with due regard to the time to be made according to time schedule, and sufficient allowance made for the customary delays at stations, no difficulties would have been encountered.

Too much attention cannot be given this question, as on it often depends the successful operation of trains and power over the entire system of very large railroads.

Many causes have come to the observation of your committee where, on account of excessive tonnage rating, trains have consumed from 24 to 36 hours, and sometimes even more than this, in getting over a division of 250 miles. The natural consequence of this kind of railroading was, and always is, yards blocked with cars, trains strung all along the division, engine and train crews worked to death, which necessitates the hiring of a lot of tramp railway men, whose only interest in their work consists of inquiries for the "pay wagon."

An epidemic of accidents follow, engines and cars are damaged, freight destroyed, and the plaintive cry of the superintendent and master mechanic is heard for more power. The merchants are complaining

about delays to freight, especially those who always want their freight "yesterday."

The shortage of power resulting from delayed trains, as above referred to, is both serious and costly. When we consider the question from a practical standpoint, and see clearly how much of this could be avoided, it is startling. The wonder is that such a policy is followed, when the evidence plainly shows that it is both extravagant and demoralizing. Probably no better illustration of the loss than that of the overtime paid to engine and train crews, and consumption of coal while lying on sidetracks, can be given.

The following figures are an approximate of what might accrue by delays to trains, the cause for which can be attributed to overloaded trains:

Overtime paid to engine and train crews for one month, 20,000 hours:

Engineers, at 40 cents per hour.....	\$8,000
Firemen, at 25 cents per hour.....	5,000
Conductor, at 30 cents per hour.....	6,000
Brakemen, at 20 cents per hour.....	8,000
	-----
Total.....	\$27,000

A total for 12 months shows 140,000 hours, or, at the same rates, an expenditure of \$189,000 paid out to crews for overtime for one year. Taking the question of fuel consumption into consideration, we find, by allowing 100 pounds of coal per hour of delay (which is a very conservative figure), that for the 20,000 hours overtime in one month, 1,000 tons of coal were consumed; this, at \$4.50 per ton, amounts to \$4,500, or for the period 12 months above quoted, there was consumed \$31,500 worth of coal. A total expenditure for overtime and fuel for one year of \$220,500.

Taking 14 hours as a day's work for an engine, which, at 18 miles per hour, will cover a division of 250 miles, we find that for 20,000 hours of delay we have 14 engines out of service for one day; or for the period of 12 months, with 140,000 hours overtime, we have 100 engines out of service for one day. Figuring 25 cars to the train, and one train moved over the division every 14 hours, we have 2,500 cars that could be moved. Had trains moved promptly and the overtime been avoided, we are satisfied no complaints would have been heard about shortage of

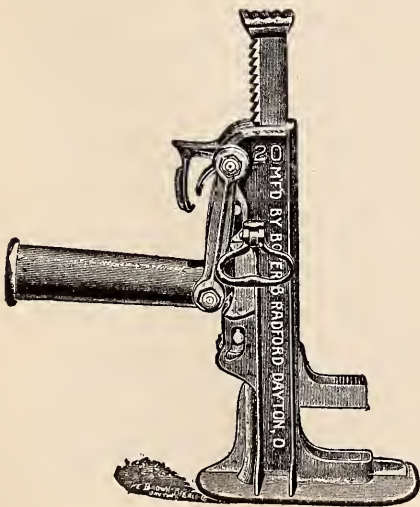
power, but had there been, the \$220,500 paid out in overtime and wasted fuel would purchase 18 locomotives, costing \$12,000 each.

For fear of a misconstruction of this question, we will say that it is quite probable an investigation would show that with the rating of some trains it would be quite impossible to make time as scheduled on some roads, consequently it would be necessary to so adjust time card and rating that the time could be made, tonnage hauled and overtime avoided.

We frequently hear of certain engines not hauling its rating as well as other engines of the same class. An investigation would probably show that there was some difference, in diameter of drivers, size of cylinders, steam pressure or tractive power. That the tonnage rating system is, under some conditions, the best method for obtaining the total efficiency of power employed, is not doubted. There are many features about it, however, that need careful scrutinizing in order to avoid making it very costly and unsatisfactory.

## BOYER & RADFORD DROP TRACK JACK.

Our illustration shows the No. 20 drop track jack made for railways by Boyer & Radford, of Dayton, Ohio. This jack was designed by practical roadmasters, who thoroughly understood the requirements, and it has been tested in service with entire satisfaction. The No. 20 has a rise of 11 ½ inches, weighs 50 pounds, and has a capacity of 10 tons. The bar has 7-16 inch teeth and can be raised or lowered one or two notches at a time. The floating hook attached to the upper pawl is for the purpose of holding the retaining pawl out of position by pushing it down and in, so that it will fasten the floating hook.



The operator can then step back out of danger and raise the lever the least bit, which releases the lower pawl and the bar drops easily, making a perfect, sure drop track jack that can be relied upon in any emergency.

Boyer & Radford control the Maxon patents on lever and ratchet screw lifting jacks for all kinds of lifting.

## FRICITION DRAFT GEAR TESTED BY A COLLISION.

The Westinghouse friction draft gear was recently given a severe test of its capability of resisting shocks. In the yards of the Butte, Anaconda & Pacific Railway, at Anaconda, Mont., a collision occurred. The circumstances were about as follows: It seems that a switch engine was coupled to seven loaded pressed steel ore cars at the east end of the yard, being on a side track. A man had been left to open the west switch, and, under the assumption that the track was clear, the engineer was given a signal to come ahead (west), pushing the cars. Twenty-nine similar cars (loaded) were at the other end of the siding, about three-quarters of a mile from where the seven were coupled to. As a result, a collision followed. No time for warning was had, and the seven cars and engine were moving at about thirteen miles per hour, with the engine working steam. Under ordinary circumstances the air brakes would have been set on the 29 cars, and it is, therefore, assumed that such was a fact, though the number of cars showing evidence of having received a very severe shock gives rise to some doubt on this point.

The resultant injury to equipment consisted of the colliding ends of the two cars being considerably damaged, the worst being the seventh, or last car from the engine. The damage to the other car was so much less as to enable it being readily repaired by straightening the longitudinal sills and applying a new end sill. To facilitate this work (as repair material had to be ordered from Pittsburg), the end sill was removed from the car. Our illustration gives a good idea of the way in which the cars were damaged.

At the colliding ends, one coupler was broken in the shank, close to the head, and the other had the guard arm broken off.

All of the cars were fitted with the Westinghouse friction draft gear, not one of which attachments, even on the colliding cars, was damaged in the least. The opposite from the colliding ends of the two cars mentioned had slight kinks in the center sills, near the body bolster; the striking plate and end sill were bent in about 7-16 inches just back of the coupler head and the coupler locking pin was wedged from the blow received through the knuckle of the opposite coupler. In 29 cars, 37 locking pins were so wedged. These were driven out, slightly ground, and returned to their couplers. About twenty cars had the center sills injured as described, but in no instance was the damage sufficient to require any repairs.

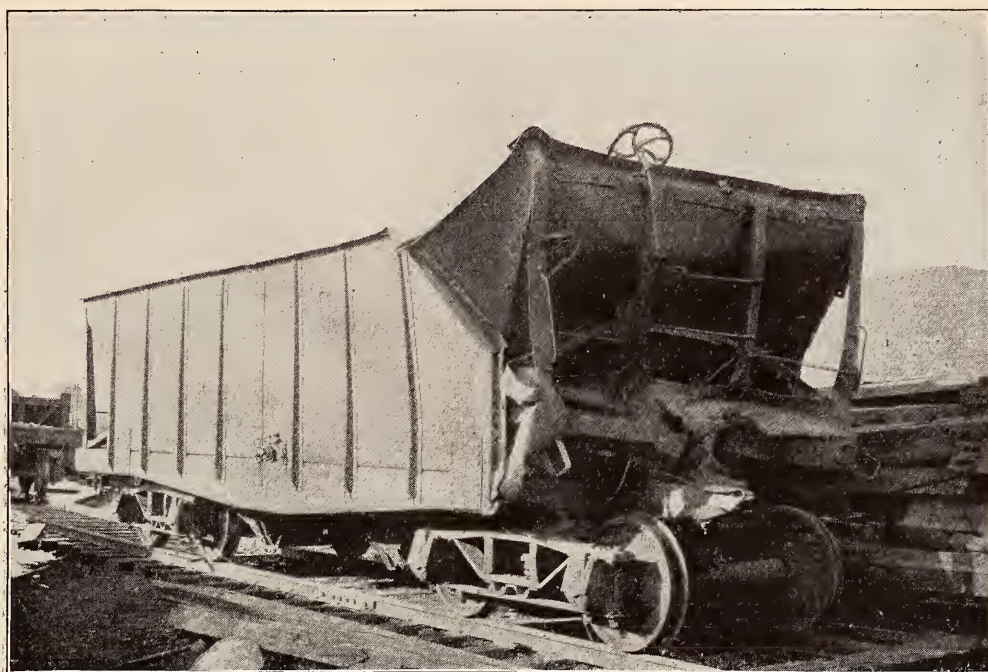


FIG. 1—FRICITION DRAFT GEAR IN A COLLISION.

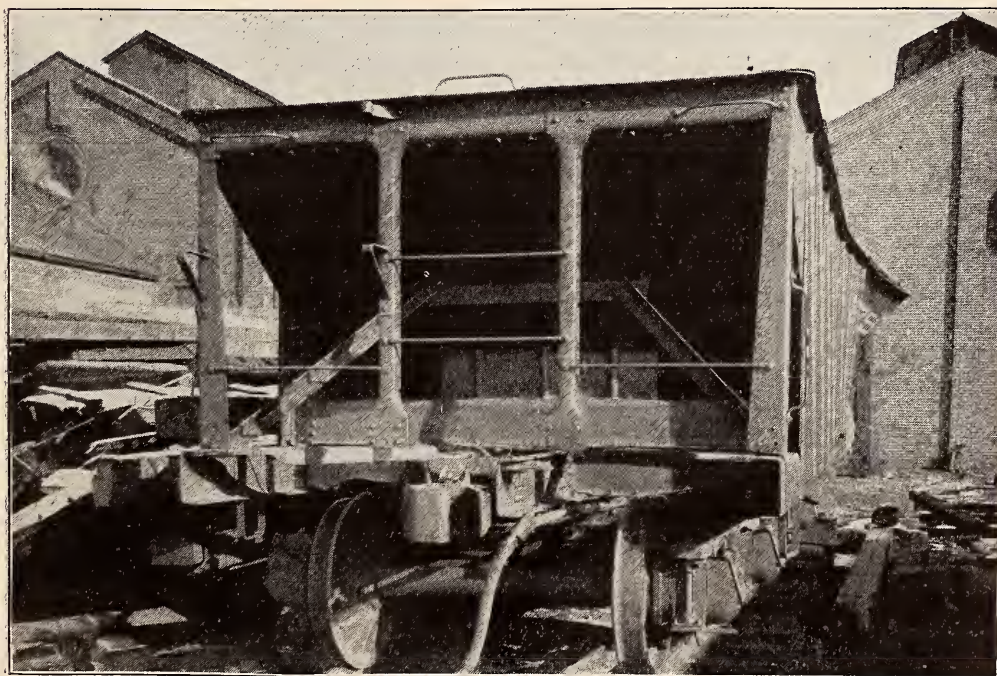


FIG. 2—FRICITION DRAFT GEAR IN A COLLISION.

The average load of these ore cars is 110,000 pounds, their light weight is 34,800 pounds, and the engine, with tender, weighed about 150,000 pounds. For the engine and 7 cars, this makes a total of

1,163,600 pounds. At 13 miles per hour, and neglecting the effect of the steam being used, this represents a striking force of 6,575,000 foot pounds, which is equivalent to the blow one of these 110,000 pound capacity steel cars, fully loaded and weighing 72 ½ tons, would strike if dropped freely from a height of 54 feet. Even though no brakes were set on the 29 standing cars, yet their great weight and small amount of slack between them insure that the enormous amount of energy in the engine and 7 cars moving must have been dissipated in an exceedingly short distance.

That this was followed by such comparatively slight damage is a splendid tribute to the Westinghouse friction draft gear, to which Master Mechanic A. Harrity gives unbounded praise. While reducing greatly the consequent damage, it came out unscathed.

Nor should the strength of the car or coupler pass unnoticed, though the weakest points in each, under buffing shocks, were demonstrated to be as described. The coupler has a 6 inch shank, in this being out of the ordinary.

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## A NEW AUTOMATIC RECORDING MACHINE.

Mr. E. C. Oliver, of the mechanical engineering department of the University of Illinois, has just succeeded in perfecting an automatic recording machine which is not only a credit to the college of engineering but to the University as well. For several years Mr. Oliver has been at work under the advice of Professor Breckenridge on a machine which would record automatically different lines of data with regard to the speed and power of engines. He has at last designed and constructed this universal recorder, which can be applied to either gas or steam engine or to a dynamometer car, and which is capable of taking any one or all of eight readings by means of ink tubes passed over an endless roll of paper. The ink tubes are attached to the armatures of electro-magnets and these magnets are electrically connected with the different parts of the engine to be tested and are actuated by the electric current. The recorder gives faithfully the speed of the engine, the number of the horse power exerted, the rate of the occurrence of the explosions, and the number of revolutions per minute of a gas engine. The machine is very carefully worked out, and should prove of great value in experimental as well as practical work.

## LOCOMOTIVE DRIVING SPRINGS.

In the course of a paper on making locomotive driving springs, read before the last Master Blacksmiths' Convention, Mr. Geo. Lindsay said :

I sent quite a number of letters to different parties, trying to get information on certain points as to specifications and chemical contents demanded thereby, as was suggested at our last convention. I applied then to a well-known steel firm, who very kindly informed me that a certain extensive railroad demanded the following chemical analysis :

	Per cent.
Carbon . . . . .	1.00
Manganese . . . . .	0.25
Phosphorus, not above . . . . .	0.05
Silicon, not above . . . . .	0.10
Sulphur, not above . . . . .	0.05

It is understood that all good steel makers try to get as low as possible in phosphorus, silicon and sulphur, these being detrimental to all good steel—a few points in carbon not being so essential.

I have tried to get some data as to the cost per year per engine from quite a number of roads and got one reply only, through the kindness of Mr. B. Burgess, C. & E. I. R. R. He gives all his engines in classes, taking the worst and the best of each class on springs, the hours of labor and cost, the amount of steel used and cost. Forty-two engines of all classes are represented; the average cost ranging from \$3.22 to \$48.46, or total of \$558.34.

Steel used, 793 pounds at $3\frac{1}{2}$ cents . . . . .	\$277.85
Labor . . . . .	280.49
Cost per engine per year for steel . . . . .	\$ 6.61
Cost per engine per year for labor . . . . .	6.67
Total . . . . .	<u>\$13.28</u>

I received a letter from Mr. W. Young, Wabash Railroad, Springfield, Ill., regarding his spring bath. They use the air blast in a pipe in the bottom of their oil tank, the pipe having  $\frac{1}{4}$  inch holes to cool the oil. He informs me that he likes it better than water to cool the oil.

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## NOTICES OF PUBLICATIONS.

Blackall's "AIR BRAKE CATECHISM" has just been published in its 12th edition. The new edition is revised and enlarged. Our readers will recall our favorable notices of previous editions. Mr. Robert H. Blackall, the author (who is now air brake inspector and instructor of the Westinghouse Air Brake Company), was well fitted for the work of writing this Catechism when he sent out his first edition. In this last edition he brings to bear his riper and more varied experience, and now, in a thoroughly up-to-date work, he presents a book that is invaluable to engineers, firemen, air brake instructors, shop men, and all interested in the technicalities of the mechanical department of railroading. We are assured that Mr. Blackall's book has been indorsed and used by air brake instructors and examiners

on nearly every railway in the United States. This success of the book is due to the fact that the author—an experienced, practical man himself—handles his subject in a distinctively practical way. The book contains over 1,000 questions with their answers. It is completely illustrated by engravings, besides three large folding plates of the Westinghouse quick-action automatic brake and the 9½ inch improved air pump, and a folding plate showing increased brake efficiency for heavy freight trains. These engravings were all specially made for reference in the study of the various parts and workings of the air brake. This book, which has 264 pages, handsomely bound in cloth, is published by Norman W. Henley & Co., 132 Nassau street, New York, N. Y. Price, \$1.50.

“COMBUSTION OF COAL AND THE PREVENTION OF SMOKE,” by William M. Barr, M. E., is a book that should be in the hands of all who are interested in subjects covered by the title above given, which admirably indicates the nature of the contents of the book. Mr. Barr is well known as the author of “Boilers and Furnaces.” He has taken up the present subject of coal combustion in his usual thorough style. The presentation of his topic is systematic and progressive. The arrangement of the book is in a series of practical questions to which are appended accurate answers, which describe in language, free from technicalities the several processes involved in the furnace combustion of American fuels; it clearly states the essential requisites for perfect combustion, and points out the best methods of furnace construction for obtaining the greatest quantity of heat from any given quality of coal. The subject is handled with direct reference to stationary and locomotive steam boiler practice. The book has just been published by Norman W. Henley & Co., 132 Nassau street, New York, N. Y. It is in one volume, containing nearly 350 pages and 85 engravings; and its price is \$1.50.

THE POWER QUARTERLY (gas engine edition) contains a complete synopsis of the gas engines in foreign countries, as shown at the Paris Exposition, including a description of a gas engine operated by blast furnace gas (18 pages, 49 illustrations), a technical description of the leading American gas engines (23 pages, 77 illustrations), a reprint of the serial in POWER on the principles of the construction and operation of gas engines (20 pages, 30 illustrations), an illustrated description of a producer plant for the manufacture of gas for gas engine purposes; editorials on the efficiency of the gas engine and its commercial advantages, and other matter relative to the industry. Additional copies can be had for 25 cents each. Address, The Power Publishing Co., 145 to 148 World Building, New York.

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## PERSONAL MENTION.

Mr. D. J. Durrell has been appointed mechanical engineer of the Pennsylvania Lines west of Pittsburgh, with office at Columbus, Ohio. Mr. Durrell goes to this important position after a ripe experience gained in varied fields of work. His first work, we believe, connected with railways, was in the drawing room of the Brooks Locomotive Works. He held this connection for several years and represented the Brooks works at the Centennial Exposition at Philadelphia. He went from the Brooks works to the Illinois Central Railway as mechanical engineer. This position he held for several years, when he left to become master mechanic of the Michigan & Ohio Railway. He was later assistant master mechanic of the Union Pacific Railway, in charge of the Cløyenne shops of that road. Then he was called back to the Illinois Central, to his old-time post as mechanical engineer. He was later with the Illinois Steel Works at South Chicago, as mechanical engineer, and still later master mechanic and assistant superintendent for Swift & Co. at Kansas City. For the last two years he has been mechanical superintendent of the Universal Car Bearing Co., with office at Chicago. Mr. Durrell's many friends will be pleased to learn of his return to direct railway work.

Mr. F. C. Cleaver, master mechanic of the Louisville, Evansville & St. Louis Con-

solidated, has resigned to become superintendent of motive power and cars of the Wisconsin Central, vice Angus Brown, resigned.

Mr. R. A. Moore has been appointed master mechanic of the Wrightsville & Tennille, with headquarters at Tennille, Ga., vice J. H. Green, resigned.

Mr. Oscar Antz, heretofore general foreman car department on the Lake Shore & Michigan Southern, has been appointed general foreman of the locomotive department on the same road at Elkhart, Ind.

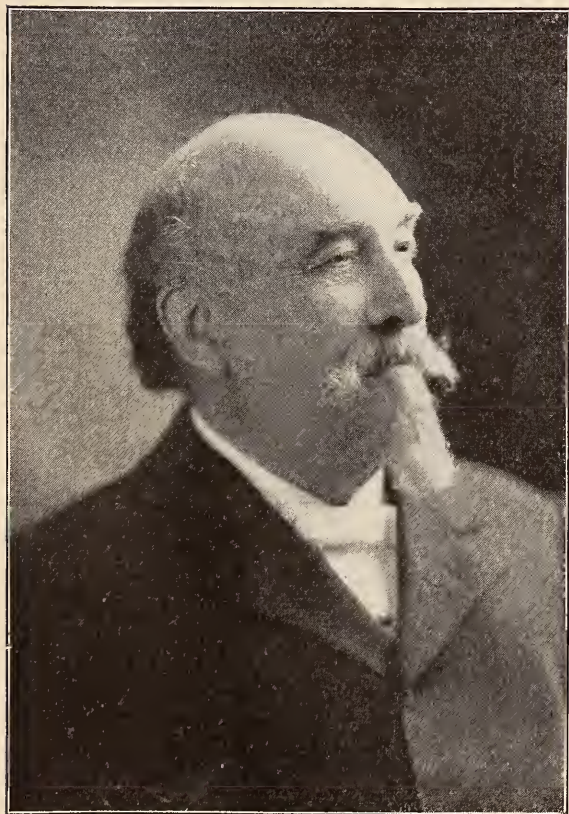
Mr. R. C. Esson, master mechanic of the Southern Pacific at Newark, Cal., has resigned.

Mr. M. Kirby, heretofore master mechanic of the Mobile & Ohio, at Tuscaloosa, Ala., has been appointed master mechanic at Whistler, Ala., vice D. O. Smith, resigned. T. E. Harwell, heretofore foreman at Okolona, Miss., has been appointed general foreman at Tuscaloosa.

Mr. W. A. George, general foreman on the Colorado Midland at Colorado Springs, Colo., has been appointed master mechanic of the Colorado & Southern, at Denver, Colo.

Col. Thomas W. Yardley, widely known in iron and steel circles, and who, for the past ten years has been connected with Robt. W. Hunt & Co., of Chicago, died at his home in

Chicago November 21, from Bright's disease. Colonel Yardley was born in 1826, in Bucks county, Pennsylvania. His ancestors were Quakers who had come over with William Penn and settled in that state. He was principal partner in the firm of John Burnish & Co., proprietors of the Pottsville Rolling Mills, and later he built the rolling mills of the Elmira Mill Company at Elmira, N. Y. During the war he was connected with the department of military railroads under General Callum, with the rank of colonel. Under his direction a rolling mill was built for the government at Chattanooga, Tenn., for the purpose of rolling rails to repair the destroyed railway property of the South for the furtherance of military operations. After the close of the war Colonel Yardley was engaged with Gen. W. W. Wright on the survey of the Kansas Pacific Railroad, which later became part of the Union Pacific system. He was then connected with the Gaylord Cast Iron Pipe Company of Cincinnati and Newport, Ky. In 1884 he was made purchasing agent of the Troy Steel and Iron Company of Troy, N. Y., and from



COL. THOMAS W. YARDLEY.

there came to Chicago. Colonel Yardley was never married. For the past sixteen years he had resided with his cousin, Robert W. Hunt. Colonel Yardley commanded the respect and admiration of all those who came in contact with him during his long and busy career. This, not only because of his sterling business integrity and technical attainments, but because of his notably courteous manner. It is rarely, indeed, that one meets a man who could even approach Colonel Yardley in the way of courtly grace and genial dignity of manner. He was truly "a gentleman of the old school."

Mr. D. Witherspoon has been appointed master mechanic and master car builder of the Washburn, Bayfield & Iron River, with headquarters at Washburn, Wis.

Mr. John Burke has been appointed master mechanic of the Louisville, Evansville & St. Louis Consolidated, with headquarters at Princeton, Ind., vice F. C. Cleaver, resigned. He is succeeded as storekeeper by W. S. Taylor.

On the Cleveland, Cincinnati, Chicago & St. Louis the following changes in the mechanical department have been made: F. P. Zerbee, division master mechanic at Wabash, Ind., has been transferred to Bellefontaine, Ohio; G. Wirt, division master mechanic at Mattoon, Ill., succeeds Mr. Zerbee; Walter Thomas, general foreman of the shops at Wabash, becomes general foreman of the Louisville shop and roundhouse; W. P. Orland, general foreman of the Louisville shop, goes to Wabash to take a similar position.

Mr. W. S. Hancock has been engaged by the Waters-Peirce Oil Co. to supervise its railroad interests on lines out of St. Louis. Mr. Hancock was formerly, for many years, master mechanic at the Needles and Winslow, Cal., on the Santa Fe Pacific.

Mr. John J. Monahan has been appointed division master mechanic of the Louisville & Nashville at Memphis, vice the late J. V. Slusser.

Mr. Francis J. Cole, for quite a number of years mechanical engineer of the Rogers Locomotive Works, has left that post to become assistant mechanical engineer of the Schenectady Locomotive Works, with office at Schenectady, N. Y. Mr. Cole has had a valuable training, fitting him for his present duties. From 1877 to 1881 he was first apprentice in the machine shop and later draftsman on the Northern Central division of the Pennsylvania Railroad. In 1881 he went to the trans-Ohio division of the Baltimore & Ohio as chief draftsman, retaining that position until 1883. For the next two years he was with the New York, West Shore & Buffalo Railway, under superintendent of motive power R. H. Soule. In 1885 he went to the Baltimore & Ohio as chief draftsman of the car and locomotive departments of that road, and in 1890 he was made mechanical engineer of the Baltimore & Ohio system. He remained in this important position until 1895, when he went to the Rogers Locomotive Works as mechanical engineer, retaining that position continuously until his present change. The Schenectady Locomotive Works are to be congratulated upon the addition of such a valuable man to their staff.

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## SUPPLY TRADE NOTES.

The Richmond Locomotive Works have just received an order from the Chesapeake & Ohio Railway Company for twenty-five 22 x 28 inch Class G-6 consolidation locomotives. These engines are exact duplicates of the 25 machines the Richmond works now have under construction for the Chesapeake & Ohio Railway, making 50 engines in all of the same type and design. The principal dimensions are: Cylinders, 22 x 28 inches; drivers, 56 inches; driving wheel base, 17 inches; total wheel base, 25 feet 3 inches; diameter of boiler, 70 inches; steam pressure, 200 pounds; weight on drivers, 165,000 pounds; total weight, 184,000 pounds; total weight of tender, loaded, 103,000 pounds; tender, 6,000 gallons capacity.

Mr. James L. Taylor has been elected third vice president of the Consolidated Railway Electric Lighting & Equipment Company. He was until recently the general European agent of the Pennsylvania Railroad in London, and previously had a railroad experience in this country, having served in prominent positions on the lines forming the Plant and Southern Railway systems, before entering the service of the Pennsylvania. He is well and favorably known in this country as a railroad man, and during his residence abroad attained an enviable position in the social and railway world. He was president of the American

Society in London, and delegate to the International Railway Congresses in London and Paris. He was connected with the American Commissions at both the Brussels and Paris Expositions, and for his services at the first named he has the decoration of the Order of Leopold. Mr. Taylor's election promises to be a valuable addition to the organization of the Consolidated Company.

Mr. Jos. H. Williamson, who for nearly eighteen years has been the business manager of the Manufacturers' Advertising Agency, New York City, desires to announce that he has severed his relationship with that company to connect himself with the old established Viennot Advertising Agency, 524 Walnut street, Philadelphia, as its business manager, in the place of Mr. Thompson, resigned. Mr. Williamson also desires to express his appreciation of the uniform courtesy extended to him by his many friends in the trade paper and general advertising field in the past, and will be glad to welcome them at any time at his new address, either at the office in Philadelphia or at the New York office of the Viennot Agency, 127 Duane street; Graham Building.

At the annual meeting of the Westinghouse Air Brake Company, held in Wilmerding, Pa., the report of W. W. Card showed that the income for the past fiscal year was \$8,530,905.21, and the disbursements of all kinds, \$5,011,706.46, thus leaving the net profits for the year \$3,519,198.75. The disbursements include \$3,534,710.03 for material and wages, and the remainder, which is \$476,996.43, covered the purchase of valuable patents relating to electric braking and heating apparatus for street cars, alterations of buildings, installation of new power plants, and general expense. The electro-magnetic braking and heating apparatus, covered by the patents referred to, has been tested thoroughly, and arrangements have been made to begin its manufacture on a large scale, as there is believed to be a good demand in store for this new invention, based on the greater safety to the public and the comfortable heating of cars, obtained without the use of any of the current from the power circuits. The friction draft gear, the right to manufacture which has been acquired by the company, has been applied to nearly 3,000 steel cars, as well as to many locomotives. The rapid deterioration of the ordinary type of brake, due to the heavy steel and other cars, has caused the advantages of the friction draft gear to be appreciated by railroads, and there is said to be an increasing inquiry for this apparatus that is indicative of much larger business from this source. Practically all of the unimproved property available has been utilized by the company for the erection of dwellings of a suitable class that have been readily rented at a rate that provides a satisfactory return for the investment. The foreign business of the company is said to be in a very satisfactory condition and growing rapidly.

The Richmond Locomotive Works have just received an order from the Rio Grande Western Railway for five 23½ and 30 x 28 inch compound consolidation locomotives, the principal dimensions of which are as follows: Drivers, 56 inches in diameter; total weight, 187,000 pounds; weight on drivers, 170,000 pounds; fire box, 122 x 41 inches; total wheel base, 24 feet 6 inches; driving wheel base, 16 feet 3 inches; tires, 3½ inches thick; driving axle journals, 9 x 12 inches; steam pressure, 185,000 pounds; 6,000 gallon tender.

Mr. E. G. Acheson, president of the Carborundum Company, Niagara Falls, N. Y., has recently received from Paris the award of "Grand Prix," accorded to his individual exhibit of the Carborundum products by the jury of award at the Paris Exposition. It is an unusual thing for an individual exhibit to receive the highest prize, and both the Carborundum Company and Mr. Acheson have reason to feel proud of their success at the big show. A letter from Paris, in the *Railway and Engineering Review*, in referring to the award says: "The jury must have been deeply impressed by the value of Carborundum. Usually the 'Grand Prix' is only given for exhibits which, in addition to possessing great merit, are large and showy or impressive. This can hardly be said of that of E. G. Acheson, of Niagara Falls, who has been awarded the highest prize. Novelty combined with genuine

scientific and economic importance were evidently attributed to 'Carborundum,' as this remarkable abrasive material is called. As the other grand prizes in the machinery department all went to the large corporations of already international fame, this one to an individual is all the more remarkable."

The Chinese Minister to the United States and Minister Plenipotentiary Wu Ting Fang, visited Cincinnati, Ohio, Friday, November 23, 1900. Mr. Minister (his addressed title) is quite practical, having large mill interests in Canton and Tien Tsin, and as he specially wished to see the latest up-to-date outfit for making cars and making car repairs, he visited the great woodworking machinery establishment of J. A. Fay & Egan Co., where President Thomas P. Egan explained the different machines to him. The Fay & Egan Works are so extensive that Mr. Minister had an opportunity of seeing almost an entire outfit in operation, and he expressed himself as being highly pleased; he showed a wonderful amount of skill in questioning Mr. Egan regarding the various machines and their operations. Mr. Wu laid great stress on the fact that he was born in the same city, "Canton," as President McKinley.

Mr. Asa M. Mattice has been appointed chief engineer of the Westinghouse Electric & Manufacturing Company, and will enter upon his duties in December. Mr. Mattice was for ten years (up to a year ago) principal assistant to E. D. Leavitt, of Cambridgeport, Mass., and has been actively connected with the design of all the large machinery coming from Leavitt's office during that time. During the past year he has been remodeling the Coheco Cotton Mills at Dover, N. H. Mr. Mattice is an engineer graduate of the Naval Academy of the class of '74, of which class Mr. B. H. Warren, vice president of the Westinghouse Electric & Manufacturing Company, is also a member. He was assistant to Admiral Melville at the beginning of the new navy; and had an important part in the design of the machinery of the "Maine," "San Francisco," and others of the important early ships. The Westinghouse Company is to be congratulated on the additional strength which he will give to their already strong engineering staff.

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MASTER CAR BUILDER WANTED—One who can design, build and maintain all classes of cars, and attend to all matters pertaining to car department on a Canadian railroad. Address M. C. B., care Railway Master Mechanic, for full particulars.

WANTED—Situation as foreman locomotive repairs, by practical man. Have had several years' experience in this kind of work. Good references furnished. Address S. E., care Railway Master Mechanic.

WANTED—Position as chief clerk in motive power department of a railway. Thoroughly competent and best of references. Address Q., care of Railway Master Mechanic.

SITUATION WANTED—By a capable general foreman of locomotive repairs. Address G. F., care of Railway Master Mechanic.

WANTED—Position as mechanical engineer or master mechanic by experienced mechanical engineer, now employed. Address P. R., care of Railway Master Mechanic.

POSITION WANTED—By a thoroughly competent mechanical man, who is experienced in directing work in a railway shop and in manufacturing establishments. Particularly well up in car work. Now employed, but wishes to make a change. Address the editor of the Railway Master Mechanic.

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FOR SALE—One set of Pratt & Whitney wheel center and tire gauges, standard American railway master mechanic gauges, perfect condition, with cases.

F. M. HICKS,

620-225 Dearborn street, Chicago.







