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Memorandum M-553

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Project Whirlwind
Servomechanisms Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: BI-WEEKLY REPORT, PART II, JULY 23, 1948

TO: 6345 Engineers

From: Jay W. Forrester

6.0 MATHEMATICS

(P. Franklin)

Studied the two-register method of coding calculations involving a floating decimal point.

(M. Daniloff)

Discussed with Alan J. Perlis the solution of integral equations by the method due to E. J. Nyström. Memorandum, M-524, "The Application of Newton's Method to Functional Equations" issued and distributed to Mathematics group.

Translation of M. Knoll's paper, "Fun Mechanismus der Sekundaer Emission, etc" completed and a memorandum is being edited.

(Alan J. Perlis)

A survey of numerical methods for solving integral equations is being continued with emphasis on iteration and transform procedures.

(C. W. Adams)

Conclusions reached in a survey of decimal-to-binary input conversion have been written up and distributed in M-533. A new application of automatic subprogram procedures has been described in M-549. Present work is on binary-to-decimal output conversion, which should be completed within two weeks.

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6.0 MATHEMATICS (cont.)

(Philip Rabinowitz)

Studying numerical solution of systems of differential equations with emphasis upon the Runge-Kutta method.

(J. W. Carr)

Completion of two-register coding methods accomplished. Commencement of work on coding Reever #73 problems and of coding with complex variables begun.

(A. Orden)

Evaluated interpolation methods of programming sines and cosines.

(Edgar Reich)

Work in writing up the memorandum entitled, "The Solution of Systems of Linear Algebraic Equations by Successive Approximation" is being continued.

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7.0 INPUT AND OUTPUT**7.1 Eastman Kodak Recorders**

(H. R. Boyd)

A conference was held at Rochester on July 13. R. Everett and I represented M.I.T. and the results are written up in M-554. Eastman is making some progress on the film drive and are hopeful of freezing their design by October 1. They are preparing new schedules for next year, and these will be distributed when they arrive.

7.4 Magnetic Recording

(E. S. Rich)

Plans are being made to conduct an investigation of pulse recording on tape where the heads are spaced away from the tape to avoid wear. The design of suitable adjustable head mountings for use with the existing recording apparatus is being worked out. Cooper is working to improve some of the terminal equipment required.

(Gerald Cooper)

Work on the gate generator was continued. It was found that the neon bulb had a tendency to act as a relaxation oscillator. Furthermore, the resulting output was not independent of repetition frequency. Therefore, it was decided to abandon the gas tube coupling circuit.

A direct coupled circuit was next tried. After considerable adjustment of parameters, it appears as though the operation of the circuit is satisfactory.

7.6 Output Printers

(F. A. Foss)

The tape-reading mechanism of the model 19 transmitter distributor has been adapted for use as an input device to the printing registers. Information that has previously been prepared on a perforated tape can now be read into the registers in coded form. The commutator section of the transmitter distributor in conjunction with the teletype printer then extract this same information in printed form.

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8.0 STORAGE TUBES

8.1 Tube Construction and Testing

8.11 Tube Construction and Processing

(F.H. Caswell, T.F. Clough and P. Youtz)

The major effort of the tube construction and processing group was on the evaporation studies. Two more large evaporation tubes were constructed and processed. Each successive attempt produces a better mosaic. But we have not yet produced mosaics satisfactory for a storage tube.

A series of tubes which would isolate the troublesome factors in our evaporation tubes were constructed and processed.

These evaporation studies will continue to be our major objective until we produce a useable mosaic.

We will also continue to produce some beryllium strip tubes which will simulate our beryllium mosaic tube with leads to each conducting area.

(R. Shaw)

The main obstacle to progress in recent weeks has been the difficulty in obtaining a satisfactory beryllium-mosaic surface. During the past two weeks, tubes having the following special features have been or are now being made:

1. A convex target surface to keep the screen in contact with it.
2. A mask with a single sloping wire to determine the maximum tolerable distance between mask and target.
3. A resistance-heated evaporating cup to eliminate the possible effect of high-frequency fields on ionized beryllium atoms.
4. A central support for the screen to reduce sagging.

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8.11 Tube Construction and Processing (Cont'd)

5. A cover having a small aperture placed over the evaporation cup to reduce the effective size of the vapor-source.
6. A radiation shield to reduce heating of the mask and target by the evaporating cup.
7. A support ring which is cupped after having been welded to the screen in order to tighten the screen.

It appears that most of the poor results are due to the fact that the screen reaches its steady-state temperature much sooner than the more massive parts adjacent to it. Temperature differences then cause it to sag. This will be discussed in detail in a memorandum to be issued within the next few days.

Radiation shields have been made for both tube-processing ovens and will be installed as soon as it is practical to interrupt tube production.

(E.S. Prohaska)

The tungsten-molybdenum thermocouple has been calibrated up to 1100° C. Consistent results have been obtained with several thermocouples from different coils of wire. This is, unfortunately, a region between approximately 650° C and 800° C, where the thermocouple output does not vary with temperature and remains constant at 1.7 mv. This characteristic makes it useless for measurements in that range.

A tungsten-kovar thermocouple has been tested and found to give excellent results up to 1100° C. Its output at 1100° C is about 22 mv.

8.12 Tube Testing

(J.S. Rochefort, R.L. Sisson and G.L. Corderman)

Tests on ST 32 have shown the "time effect" dependence of surface switching upon the rate of rise of the signal plate voltage to be due to a shielding effect of the collector. Thus, when the collector is highly positive, few electrons reach the dielectric surface, it follows the changes in

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8.12 Tube Testing (Cont'd)

signal plate voltage and switches to collector potential when a positive change of voltage equal to 1st crossover is reached. For lower collector potentials, more electrons reach the surface and its switching from cathode to collector potential depends upon the rate at which the signal plate voltage is increased. The same general results were obtained when leaving the signal plate voltage fixed and decreasing the cathode voltage although other effects took place in this case since the focusing and accelerating voltages were being changed.

Tests are now being started to determine the surface stability when both positive and negative areas are present.

8.13 Storage Tube Demonstration

(R.L. Sisson and J.S. Rochefort)

After the Demonstrator was moved to a new position in the lab, oscillation developed in the switching unit and troubles occurred in the video amplifier and gate circuit. The oscillation seemed to be parasitic and was removed by movement of circuit elements. Two faulty tubes were found in the gate circuit of the video amplifier; and pickup from the RF Bomber was reduced by putting a 1000 μ f condenser across the +300V supply.

The Demonstrator is now functioning properly with Mod 18 installed. Once a new coil for the television set has been received, this unit will operate with the Demonstrator.

8.2 Storage Tube Research

8.22 Anodizing

(R. Sisson)

The entire anodizing setup, including the d-c power supply and the air compressor, was moved from the storage tube lab to the basement (Room 026).

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8.22 Anodizing (Cont'd)

It is being rewired and installed. It should be tested and ready to operate by July 27.

7 small, 10 hole discs had been anodized before moving the equipment.

8.24 Holding Gun Studies

(H. Klemperer)

Testing of RT 34 was completed with exception of life test, which is still going. Final report on holding gun development was issued in M-547.

8.3 Unclassified

(M.I. Florencourt)

Drafting corrections are still being made where necessary on unsigned tube drawings. Signatures on all sepias must be removed. This work may take as much as two more weeks to clean up. In the meantime, freehand sketches of changed parts are being made for all new tubes in order to keep up to date as much as possible. Formal drawings may be made later.

The plan of keeping all information and data on a tube together in one notebook is working fairly well.

The anodizing equipment has been moved to the basement but has not been reassembled or rewired. This must be finished as soon as possible so that more large discs may be anodized.

(N.S. Zimbel and J.H. McCusker)

RT 32, a storage tube with a 15E Eimac sealed to it, has been calibrated so that the storage tube itself may be used as an ion gauge. RT 32 was tested at pressures of 5×10^{-5} and 3×10^{-7} mm. of Hg.

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9.0 SERVOS AND SIMULATION

9.1 Cockpit

9.11 Structure

(E. S. Prohaska)

Work on the cockpit has been discontinued. The report on it will be submitted in the early part of August.

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10.0 TRAINING

10.1 Seminar Series

(E. Blumenthal)

On Wednesday, July 14, another of a series of informal block diagram seminars was held in the basement lecture room. E. Blumenthal discussed WWI orders.

On Wednesday, July 21, J. W. Forrester spoke to the staff on future plans for Project Whirlwind, and future applications of computers in general.

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11.0 FACILITIES AND CENTRAL SERVICE

11.1 Publications

(J. N. Ulman, Jr.)

The following material has been received in the Library,
 Room 217, and is available to 6345 Personnel:

6345 Reports

<u>No.</u>	<u>Title</u>	<u>No. of Pages</u>	<u>No. of Drws.</u>	<u>Date</u>	<u>Author</u>
E-132	Gate-Tube Investigations	4	3	7-8-48	M. H. Hayes
E-135	Life Data of 7AD7 Tubes of Five-Digit Multiplier	2	-	7-20-48	J. J. O'Brien
M-517	Design of a Holding Gun for Use in Storage Tubes	6	8	7-2-48	H. Klemperer
M-518	Storage Tube Testing	7	-	7-2-48	S. H. Dodd
M-527	Calibration of a 15E EIMAC as an Ionization Gauge	3	6	7-7-48	J. H. McCusker
M-529	Instruction Booklets for Test Equipment	2	-	7-8-48	R. Rathbone
M-530	Bi-Weekly Report, Part I, July 9, 1948	18	-	7-9-48	
M-531	Bi-Weekly Report, Part II, July 9, 1948	17	-	7-9-48	
M-532	Parts List Distribution	1	-	7-12-48	C. W. Watt
M-533	Decimal to Binary Conversion for WWI Input	13	2	7-15-48	C. W. Adams
M-534	Fuse Indication Panel Proto- type Approval	2	-	7-13-48	C. W. Watt
M-535	Symposium on Numerical Methods of Analysis in Engineering - Illinois Institute of Tech- nology, Chicago, May 7	4	-	7-13-48	E. Reich
M-536	Fixed Voltage Switching Panels, Layout Approval	1	-	7-13-48	C. W. Watt
M-537	Operation Matrix Change Approval	1	-	7-13-48	H. Fahnestock
M-538	Frequency Divider Layout Approval	1	-	7-14-48	H. Fahnestock
M-539	Digit Interlock Panel, Lay- out Approval	2	-	7-14-48	C. W. Watt
M-540	Overhead Wireway Drawing Approval	1	-	7-14-48	C. W. Watt

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6345 Reports (Continued)

<u>No.</u>	<u>Title</u>	<u>No. of Pages</u>	<u>No. of Drvgs.</u>	<u>Date</u>	<u>Author</u>
M-541	Standard Test Specifications for WWI	1	-	7-20-48	C. W. Watt
M-542	B-Register/In-Out Register Video Layout Revision Approval	1	-	7-21-48	H. Fahnestock
M-543	Restorer Pulse Generator, Layout Approval	1	-	7-21-48	H. Fahnestock
M-544	Conference on Installation Problems, WWI	2	-	7-21-48	H. S. Lee
M-545	Correspondence; MIT and Sylvania on WWI Design	2	-	7-21-48	H. Fahnestock
M-546	Synchronizer Design Proposal	2	-	7-21-48	J. A. O'Brien
M-550	Check and Comparison Register Layout	1	-	7-22-48	H. Fahnestock
C-57	Project Whirlwind Seminar 31: Runge-Kutta Method, etc.	5	-	5-26-48	P. Franklin

Translation

M-524	The Application of Newton's Method to Functional Equations - by L. V. Kantorovich, Reports of the Academy of Sciences, USSR	9	-	7-7-48	M. Daniloff
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PB Report

74384	Impulsverzerrung durch einen Transformator	33	-	6-10-42	Dr. H. R. Schlegel
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Library Files

-	Proceedings of the IRE, July, 1948				
47	Technical Information Pilot U580-638, U639-701				Library of Congress
47	Technical Information Pilot U518-579				Library of Cong.
73	Pre and Post Analysis, June 24-28, 1948				Reeves Analysis and Computer Grp.
73	Post Analysis, July 6, 1948				Reeves Analysis & Computer Grp.
121	High-Speed Pulse Recording on Magnetic Tape (Master's Thesis), May 20, 1948				E. S. Rich
559	Technical News Bulletin, July, 1948				Nat'l. Bur. of Standards

Book

Vacuum Tubes

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Prof. K. R. Spangenberg
 Stanford Univ.

11.0 FACILITIES AND CENTRAL SERVICE (Continued)

11.2 Standards Committee

(C. W. Watt)

A memorandum, M-541, was issued on standard test specifications for WWI. This sets up a series of numbers to cover test specifications for all units of WWI equipment.

(S. R. Abbott)

The following specifications have been revised and distributed:

7.024D and 6.024D	Capacitors, Bathtub
7.024B and 6.024B	Capacitors, Tubular
7.071C and 6.071C	Cable Clamps
6.024E	Capacitor, Inverted, Rectangular Can
6.024F	Capacitor, Rectangular Can
6.091A	Lamps, Pilot
7.183A	Turret Lugs

The following specifications have been distributed:

S6.503	Wiring Standards
S6.501	Construction Standards
6.115B	Batteries, Dry
7.032	R. F. Chokes
6.032D	R. F. Choke (High Current Rating)
6.195-2	Filament Transformer
6.143D	D. C. Relays, Power
7.143	D. C. Relays
7.144	Time Delay Relays
7.195-2	WWI, Filament Transformer

11.3 Purchasing and Stock

(H. B. Morley)

Bids have been received on WWI prefabricated cables and a requisition for the work will be issued as soon as the contractor is selected.

Outstanding overdue orders for WWI installation material have been expedited and deliveries promised not later than August 10.

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11.3 Purchasing and Stock (Continued)

A sample Hammertone finished panel has been submitted to the vendor doing our silk screening, for experimental processing in an effort to secure more durable markings.

A cut-away sample of the new dry battery with interlocking flat cells developed by Olin Industries has been received. Longer shelf life is claimed for these batteries, a feature of interest to this laboratory.

(R. Fairbrother)

The past week has been spent in inventorying all equipment with "SM" numbers. This problem, and maintaining up-to-date stock records, would be simplified if personnel exchanging equipment would notify the stockroom of the transfer. Also, no numbered equipment should be removed from the stockroom without recording the removal on the sign-out sheets provided.

11.4 Electronic Construction

(F. H. Caswell)

One switching unit with control box and one deflection unit completed, both for storage tube test.

The T. V. unit has also been rewired for use in storage tube tests.

The storage tube group technicians were moved to make room for test equipment. The benches are now set up in Room 219.

Three holding gun power supplies have been received from the Electronics Lab. Also, three a-c circuit breaker boxes and three d-c outlet boxes.

Three technicians are working on tube component construction, two on electronic construction. The work load remains heavy.

(R. H. Murch)

The following jobs and units are in the Electronics Lab for construction:

1. Twenty-five d-c power strips. Eight of these units have been completed.

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11.4 Electronic Construction (Continued)

2. Point-off control WWI. This unit is about 95% complete and will be completed on Monday, July 26.
3. Multiply-shift control WWI. Construction of this unit started today.
4. Wind special pulse transformer.
5. Engrave panels for panel selection rack. This job will be completed by July 30.
6. Register driver panel WWI. This unit is about 95% complete and will be completed on Monday, July 26.
7. Voltage regulator.
8. Divide error and sign control WWI. Construction of this unit is due to start Monday, July 26.
9. Push-button synchronizer breadboard.
10. Experimental check register control.

The work load in the Electronic Laboratory is as follows:

Two WWI prototype technicians have a work load of 5 weeks.

The other four technicians available for general lab work have a work load of 3 weeks.

During the next two weeks Ernest Nickerson will be in charge of the Electronic Laboratory. John Di Giorgio will be responsible for all WWI panels under construction in this laboratory.

(W. S. Rogers)

Among the service circuits being modified are the changes for the Storage Tube Lab, Room 026, and the Photo Lab.

Fifteen lab benches were wired for Room 026 and elsewhere.

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11.5 Drafting

(A. M. Falcione)

Memorandum M-479, Production Drawings for WWI Units Constructed at MIT, has been issued. The production drawings referred to in this memo will be started as soon as drafting time becomes available.

The operation of the Ozalid Streamliner machine has improved considerably since the replacement of the burner. The transformer top was also changed. The speed at which prints can be put through the machine has approximately doubled.

The work load is being handled very well in spite of vacation schedules.

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12.0 GENERAL

(J. W. Forrester)

New Staff Personnel

DIC Staff Members

W. Gordon Welchman taught mathematics at Cambridge University, England, from 1929 to 1939. During the war he administered a project in the field of communications, having contact with many devices and circuits similar to those of the computer field. For the last three years he has been Research Director of the John Lewis & Company department store in London. He is moving his family to the United States to take up American citizenship. His project activity will include mathematics and computer applications.

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