Project Whirlwind
Servomechanisms Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: BI-WEEKLY REPORT, June 24, 1949

To: 6345 Engineers

From: Jay W. Forrester

1.0 SYSTEMS TESTS

1.1 Whirlwind I System Test

(G. C. Sumner)

Enough experience has been gained on the arithmetic element so that it can be relied upon as a basis of systems-testing of central control and test storage. The arithmetic element and that part of control already installed have been subjected to test conditions considerably more strenuous than encountered in normal computation. Correct operation was maintained even under these conditions, but the eccentricities and weaknesses of the system were uncovered and studied. There remains the problem of developing marginal checking techniques to establish reliability.

Activity of the past two weeks has mainly been confined to collecting marginal checking data. These data will form the basis of setting variation limits when automatic sequences are attempted. It is interesting to note that the investigation of a low margin from these tests led to the discovery of a previously unsuspected crystal rectifier with high forward resistance in the accumulator. A clamping crystal with low back resistance was also located by marginal checking.

The check register has been installed and has had restorer pulses applied. The time pulse distributor was modified as stated in the last report. However, tests showed that a slight additional modification was necessary to further delay the pulses received by the counter with respect to the output pulses.

Testing will be discontinued for a few days beginning June 27 to allow further installation of power wiring.

1.1 Whirlwind I System Test (continued)
(H. F. Mercer)

Component Failures in Whirlwind I - The following failures of electrical components have been found since June 10, 1949:

Tubes	Quantity	Comments
7AK7	1	G.T. in digit 13 of accumulator. Intermittent high resistance short after 700 hours.
6L6	1	Phase Inverter in Operation Matrix Driver. Control grid failed to cut-off after 120 hours.
Crystal Rectifiers		
D-357	1	Accumulator - Digit 3. Between secondary of the 1 from left input transformer and the common point of the mixing circuit. Crystal showed high forward resistance after 783 hours.
D-358	2	One crystal was between grid and cathode of 7AD7 CF tube in Digit 13 of Accumulator. Low (decreasing) back resistance was noticed with application of voltage after 739 hours. The other was a clamping crystal in Divide Control panel. Crystal showed unstable back resistance and F.F. had tendency to stall even with 16 μ sec restorer pulses after 748 hours. Failure caught by marginal checking.
Pulse Transformer		
6.193-6 (1.1)	1	7AK7 Output Transformer of TPDC panel. Open secondary found after 327 hours.

1.2 Storage Tube Reliability Tester

(R. Sisson)

A pattern will cycle at a 20 Kc shifting rate for several hours before making an error. ST96-2 is being used for all these tests. The errors appear to be random, and therefore it is hard to detect the source of the errors. Tests of various types are being devised to detect marginal operation in either the equipment or the storage tube.

TV observation of the 16 x 16 array of positive spots on a negative background shows that the spots are clearly defined and well separated. The whole surface is usable.

This setup was shut down for approximately one week during which time considerable progress was made in switching over to a five tube setup.

(L. J. Nardone)

Expansion of the storage tube reliability tester is proceeding at the expected rate. Power cabling to the control racks is near completion. A sufficient amount of video cables have been received so that the video cabling of the control racks can now start. It is hoped that one tube operation in the new rack location can be obtained in the next two weeks.

2.0 Circuits and Components

2.1 Circuits by System Number

100 Central Control

(J. A. O'Brien)

The central control of the computer has been installed and tested. The results were as expected. A few modifications were made on the operation matrix drivers and the control pulse output units will be modified some time in the future to make them act as standardizers.

One of the effects of mixing matrix switch output signals was overlooked in the design of control and as a result there are some conditions under which essentially d-c signals are applied to a-c coupling circuits.

To overcome this difficulty in the storage and control switches a gating signal will be applied to the output of the switching matrix during restoration to insure that all output signals are zero at this time; thus effectively chopping any output signals from a succeeding mixer.

102 Program Counter

(R. H. Gould)

The video testing of the first five panels of the program counter has been completed and the panels delivered to the computer room. Testing of the remaining panels has started today.

103 Program Register

(S. H. Dodd)

The program register is to be used as an output register from electrostatic storage as well as for its normal function as a program register. This requires modification of the panel. A spare PR panel has been modified and assembly drawings etc. are being changed. As soon as the PR can be released from its temporary use as a check register, the shop will make the change on all panels.

106 Time Pulse Distributor

(R. H. Gould)

The modification of the TPD counter panel consisting of the addition of .05 microsecond delay in the trigger circuit of the flip-flops has been completed and tested. McVicar is now working on the problem of reducing the delay in the pulse inputs to the gate tubes of the TPD output panel. Since this will involve further modification of the panel, work on the drawings of the TPD will be stopped until the design of the panel has jelled.

410 In-Out Control

(A. K. Susskind)

The design of in-out control has been completed. The modifications of two A-registers and two check registers have been decided upon and drawings prepared which indicated these changes. The modifications are quite extensive and require considerable work by the shop and the drafting room. It is suggested that the shop modify these four panels on the basis of marked prints now available, rather than from the new drawings. In this way the shop will not have to trace through all the circuits but will know exactly what has to be modified.

A single block schematic of input-output incorporating in-out control, COR check, COR, IOR, bus drivers, standardizer amplifiers, and register drivers has been prepared.

601 Check Register

(R. H. Gould)

Video testing of all the check register panels has been completed and the panels have been delivered to the computer room. The test set-up used will now be used for video testing of program counter panels.

602 Alarm Indication

(A. K. Susskind)

The alarm-indicator control has been tested and turned over to R. Lurch for use in the computer. The tests revealed several shortcomings in the design which have been overcome by several minor modifications. With these modifications there is assurance of reliable operation. Test specifications for the alarm-indicator control are now being written up.

810 ES Control

(R. Read)

Following completion of the block schematic sketch for ES control two weeks ago, the circuit and block schematics for all the units which make up control have been revised and circuit modifications are under way. Testing should get under way next week, with a temporary power set-up in ES row.

820 ES Deflection

(S. H. Dodd)

ESD Gate Panels - Two panels are complete and have passed shop test and inspection. Video testing of these panels will probably be done during the next two weeks.

ESD Decoder Panels - These panels are slightly behind schedule in the shop. The aluminum panels are complete and the phenolic panels are approximately 50% assembled.

ESD Output Panel - The aluminum panel for this unit is now complete. The phenolic assembly has just been started in the shop.

ESD Transmission Line - Drawings and parts list are being put into final shape and construction of the final unit will begin soon.

(G. G. Hoberg)

Storage-Selection Mixer - Preliminary design, breadboard construction, and final circuit design have been completed. This unit contains only 2 tubes and closely resembles one channel of a standardizer-amplifier.

831 Storage Tube Mount

(S.H. Dodd)

The prototype storage tube mount with the aluminum box is complete and video and R-F testing is being done. These tests have not as yet indicated that any substantial layout changes are required.

The mu-metal box has been received and inspected. The sheet metal shop is mounting the shelves inside this box and the box will then be painted.

832 ES Output

(S.H. Dodd)

Prototype now being constructed. Aluminum panel complete. Phenolic is being wired. One RF amplifier is complete and tested and ESO prototype should be completed by end of next week.

833 Signal-Plate Driver

(C. G. Hoberg)

Testing of the prototype has been started.

Test equipment has been set up in Room 226 for operating prototypes of WWI storage-tube circuits with WWI power and under simulated WWI operating conditions.

834 Gun Driver

(S. H. Dodd)

Sheet metal and phenolic panels have been made. Wiring is expected to begin in the shop on July 17.

835 RF Pulser

(C.H.R. Campling)

Tests on the breadboard for this unit have been completed, and it appears to be satisfactory in all respects.

The phase reference output is adjustable up to a maximum of about 75-volts peak across a pair of twinax lines, each terminated in 100 ohms. With maximum output the dissipation ratings for the 3E29 are exceeded, but normal operation will not require maximum output and the tube will operate within its rating.

(S. H. Dodd)

Drawings have been completed for the aluminum panel construction and phenolic assembly for this unit. The sheet metal shop will construct the panel and cut out the phenolic board and Mach will wire and assemble this unit.

Holding Gate Generator and Read Gate Generator - Circuit schematics for these units have been completed and graded. Aluminum panel and assembly drawings are being checked.

2.2 WWI Drawing List	Block Diagram	Block Schematic	Circuit Schematic
System	B-37071-5		
Control	B-37098-4		
Master Clock	B-37159-3		
101 Pulse Generator	B-37155-3	B-32385	E-32333-4
102 Program Counter	B-37062-4	B-32213-1	D-31516-7
103 Program Register	B-37067-4	B-39289-2	D-33836
104 Control Switch			
Input Panel	B-37066-3	B-34321	
Matrix Panel	B-37066-3	C-33843-1	R-32722-3
Switch Panel	B-37066-3	B-34100	Z60CS00-2-E
Output Panel	B-37066-3	B-34101	Z60CS00-B
105 Operation-Matrix Driver Panel		S60OM00	Z60OM00-1-E
105 Control-Pulse Output		R60CP00	S60CP00-1-B
106 Time-Pulse Distributor	B-37068-5	T60PD00-3-C T60PD00-4-C	
106 Time-Pulse-Distributor Counter		T60PD00-3-C	Y60PD00-D
106 Time-Pulse-Distributor Output		T60PD00-4-C	Z60PD00-1-F
109 Clock-Pulse Control	B-39817-4	C-32642-5	E-31916-8
110 Frequency Divider	B-37154-4	B-32264-1	R-31729-2
111 Synchronizer	B-37172-1	C-33485	R-33486-2
112 Restorer-Pulse Generator	B-37160-2	B-32209-4	D-31909-8
200 Test Storage	B-37156-2		
201 Test-Storage Amplifiers	B-37121-2	C-32855-3 C-33768	D-33706-2
201 Storage Switch			
Input Panel	B-37121-2	B-34322	
Matrix Panel	B-37121-2	C-32855-3	R-32722-3 D-33706-2
Switch Panel	B-37121-2	B-34102	Z60CS00-2-E
Output Panel	B-37121-2	B-34103	Z60CS00-B

2.2 WWI Drawing List (continued)	Block Diagram	Block Schematic	Circuit Schematic
202 Toggle Switch Storage			
Switch Panel	B-37122-3	C-33768	D-33706-2 C-33707
Output Panel	B-37122-3		E-32721-4
203 Flip-Flop Storage			
Output Panel	B-37060-5	B-32269-1	E-31635-6
Register Panel	B-37057-4	B-32268-1	E-31621-6
Control	B-37061-7	D-32106-3	
301 A-Register, Digit 0	B-37056-3 B-37072-8	B-31574-1	D-31573-8
301 A-Register, Digits 1-15	B-37056-3	B-31211-3	D-31276-12
302 Accumulator			
Digit 0	B-37173-1	D-32851	R-32850-3
Digit 0, Auxiliary Panel	B-37173-1	B-32492-2	D-32602-1
Digits 1-14	B-37173-1	D-31213-4	R-31275-10
Digit 15		D-33964	
303 B-Register	B-37097-5	B-31212-5	D-31277-8
304 Sign Control &	B-37072-8		
308 Divide-Error Control		C-31576-3	E-31619-2
305 Step Counter	B-37074-7	D-31828-2	D-39764-4
305 Step-Counter Output		A-32723-1	D-32735-2
306 Multiply &		C-31532-3	E-31588-5
307 Shift Control	B-37072-8		
308 Divide Control	B-37072-8	C-31552-3	R-31718-5
309 Special Add Memory & Overflow	B-37072-8	C-31575-5	E-31632-5
310 Point-Off Control	B-37072-8	C-31600-6	E-31717-6
400 Input-Output	B-37178		
403 In-Out Register	B-37178	B-32434-2	D-31277-8
404 Comparison Register	B-37178	B-32578-3	E-32576-7
404 Comparison-Register Check	B-37178	B-33488-1	E-33515-2
601 Check Register	B-39816-3	B-32577-1	E-32576-7
601 Check-Register Check	B-39816-3	B-32018-1	E-32023-3

2.2 WWI Drawing List (Continued)	Block Diagram	Block Schematic	Circuit Schematic
602 Alarm-Indicator Control	B-37175	B-33603	E-33651-2
820 ES Deflection			
ESD Gate Panel	B-37220	A-34036	B-33876-1
ESD Decoder	B-37220		E-33908-2
ESD Output	B-37220		C-34182-1
831 ST Mount	B-37220		SC-34040-2
833 Signal Plate Driver	B-37220		SD-34029-2
834 Gun Driver	B-37220		SD-34181
835 Holding-Gate Generator	B-37220	A-34354	C-34060
835 Read-Gate Generator	B-37220	A-34355	C-34324
Standardizer Amplifier		A-33881-1	C-33880-1
Bus Driver, Arithmetic Element		A-32297-1	D-31727-7
Bus Driver, Flip-Flop Storage		A-32296-1	D-31726-7
Register Driver, Type I		B-32207-1	E-32261-8
Register Driver, Type II		B-32691-2	D-32690-2
Bus Connections	B-37124-3	C-37123-3	
Fuse-Indication Panel			W60PP00-7-D
Voltage-Variation Panel			W60PP00-6-C
WWI Power-Connector Pin Connections			B-31955-6
Digit-Interlock Panel			W60PP00-8-B
Fixed-Voltage Switching Panel			T60PP00-11-B
Power-Interlock & Indication Panel			Z60PP00-12-B
Power-Supply Control		D-32017-3	D-33184-2 (cabling diagram)

2.5 Tubes & Components

(John Olivieri)

The tube complement for the ESD gate panel, 820, WWI has been filled and delivered. The circuit numbers on BR 35 have been changed to conform to its use as ES bank selector. V-11, a 7AK7 was replaced by a 7AD7.

Twelve 6AG7's from the prototype deflection voltage generator have been retested. Seven of these were replaced since the plate currents dropped from between 55 to 68% after 3155 hours.

Seven characteristic curves for W. J. Nolan have been completed. Thirteen more curves remain to be drawn. The data has been taken on these, however.

An adaptor for 715-B tubes was constructed.

Twenty-five 715-B tubes have been tested for S. Dodd. Several of these are gassy.

Forty-five 7AD7's and 45 7AK7's have been preburned: 45 7AK7's are now burning.

A graph representing plate, screen distribution of 7AK7's is being worked on. This will give the distribution before and after preburning.

2.6 Test Equipment

(D. Hageman)

Gate Delay Unit - A gate and delay unit (latest model) has been modified and tested with the expectation of obtaining the results described in the bi-weekly report of May 13. It was decided that the modified unit required too large an input pulse for satisfactory switching of the one-shot multivibrator. Efforts to find a feasible modification continued.

3.0 STORAGE TUBES

3.1 Construction

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

A new research tube to study the secondary emission of beryllium under bombardment of low-velocity electrons was under construction this bi-weekly period. This tube is described in E-231. This tube will be processed 27, 28 June, 1949. The construction of this tube has not interfered with the construction work on regular storage and evaporation tubes.

As we reported in the last bi-weekly report we have begun the operation to produce three or four tubes similar to ST96-2, which had very satisfactory operation. Several minor mechanical changes were made in the storage assembly to give us an assembly which could be reproduced. We have carefully recorded each detail of the construction procedures. These procedures will be checked and recorded for each tube. Later these records will be edited and issued as procedure specifications. The three evaporation tubes constructed and processed during this period behaved similarly during processing. One target was put in storage tube ST101. See section 3.2 for results on this tube. The other two targets will be put in storage tubes the early part of next week.

We will continue with an intense effort to make tubes which reproduce the desired characteristics of ST96-2.

(R. Shaw)

Drawings for holding-beam analyzer tube, RT55, have been completed and most of the metal parts have been made.

Consideration has been given to the possibility of designing a beam-analyzer target that will be easier to construct than the present one. Several proposals have been sketched and one of these is being built in order that the leakage resistance may be measured.

Extensive revisions have been made to the evaporation tube assembly, chiefly to facilitate the use of assembly jigs.

Plans have been made for extending the tube-assembly facilities, and a considerable part of the remodelling has been completed.

3.1 Construction (Continued)

(W. E. Pickett)

Glass Components - During this last period, the glasswork for the portable vacuum-firing system was completed. Parts for three Be boilers have been fired in the system and the results of two of these Be boilers in processing ET tubes show that the system works exceptionally well. In evaporation tube processing, the two boilers showed little gas and were exceptionally clean.

A new envelope for evaporation tubes was tried out this last period. The glass envelope is made from a standard hard glass transmitting tube envelope and cuts down the time necessary to construct an evaporation tube envelope compared with the old method. This envelope seems to work well and will be used from now on in evaporation tube construction.

The inventory of glass components for tube construction remains good. No difficulties or delays are expected due to glass components.

Pictures of the polariscope have been taken and if time permits, the memo on the construction and use of the polariscope will be started.

The long series of articles on glass construction of the storage tube still remains in progress.

The glass shop has started sealing RT51, the research tube to study secondary emission of Be. This will be completed this period.

Envelopes were also prepared for further studies in which the beam-analyzer tube type is used.

No unusual difficulties were encountered except those encountered due to the unseasonal hot, humid weather.

(J. S. Palermo)

Mechanical Components - During the past two weeks, we have endeavored to standardize the various techniques employed in the construction of storage and evaporation tube target assemblies, beryllium boiler assemblies, and guns. Our cleaning methods are now completely standardized, and a series of cleaning notes will be available before the next report.

3.1 Construction (Continued)

Revisions have been discussed and are planned for the beryllium boiler assembly. The purpose is to produce a more uniform and practical boiler from an assembly viewpoint.

Our present inventory of mechanical components for evaporation and storage tube target assemblies is exceptionally good.

3.2 Test

(C. L. Corderman and A. H. Ballard)

ST101-1 was received from the construction group and given initial tests. Processing of this tube was patterned closely after that of ST96, which has shown superior performance.

Results on ST101-1 show that, for the most part, its surface is capable of storing spots of small size in a uniform and stable manner. However, a defective area, roughly 5/8" in actual diameter, is present on the surface. Its behavior seems to indicate a region of low capacitive coupling between mosaic and signal plate.

Another difficulty observed, although not arising from the storage surface, is a transient deflection of the holding beam, as though from an asymmetric buildup of charge somewhere inside the tube. The effect is to uncover, momentarily, as much as one third of the surface. Disturbance of the stored pattern depends largely on whether or not a scanning readout beam is being used.

Tests were run on ST77 and ST94 to investigate the effects of a high holding-beam current density upon ST operation. The current density was increased roughly 7 times, by magnetically focusing the holding beam.

It was found that in the case of the strong holding beam:

(a) The degree of formation of after-storage was greater.
(b) The spot size obtained when writing positive without cutting off the holding beam was essentially unchanged.
(c) Negative spots on a positive background were stable up to a V_{HG} 60 volts higher than in the case of the normal holding beam.

3.2 Test (Continued)

(N. S. Zimbel and J. S. Rochefort)

High Speed Write-Read Unit - Testing of ST73 was interrupted in order that holding-gun stability curves might be run on ST96-2. Higher voltages used with the latter tube caused a potentiometer to break down and tests had to be discontinued while the trouble was removed and the equipment given a complete overhaul. After a 3-day period the unit checked-out satisfactorily and its operation was checked with a number of tubes.

Testing of ST96-2 has re-commenced but sufficient data has not yet been obtained.

(J. H. McCusker)

RT54-1, a beam analyzer tube, is being tested. An RCA 5UP high-velocity electron gun is mounted on the center line of the tube so that the beam will not enter the target hole at an angle. A 5 x 5 mil hole in the target is being used in place of the 20 mil diameter hole so that better resolution of the beam can be obtained.

The current-density distribution in the beam was found to be a critical function of the target potential, the d-c level of the deflection plates, and especially of the third anode potential. If the potentials of these electrodes were adjusted to their critical values, the maximum current density at 1500 volts accelerating potential and zero volts bias was 4.5 ma/sq. cm; the spot size at the 0.2 diameter point was 60 mil. If the voltages were not adjusted to the critical values, the current density was 1.4 ma/sq. cm and the spot diameter was 120 mil. Approximately 80% of the current in the beam was within the 0.2 diameter point. A large amount of current was striking the third anode, however.

At the critical voltages, the maximum current density decreased as the control grid was made more negative. Away from these critical voltages, the maximum current density at first increased, reached a maximum, and then decreased as the control grid was made more negative. The maximum and decreasing section of the latter curve was found approximately to be a section of the former curve. RT50-1, a beam analyzer tube with a 5RP Dumont electron gun, had approximately the same general characteristics with respect to the critical potentials. The decrease in spot size was visually observed on ST18, a storage tube with a calcium tungstate storage surface, at these critical potentials.

The velocity distribution in the high-velocity beam of RT54-1 was uniform to within a few volts of cathode potential.

3.2 Test (Continued)

Electron leakage on RT50-1 prevented the measurement of the velocity distribution in that tube.

3.3 Research and Development

(H. Rowe)

A sketch has been made of a research tube to be used to investigate the secondary emission ratio of a pure beryllium surface. After measurements on the surface have been made it will be exposed to oxygen and heat to determine the effects of the processing techniques presently used on mosaics. An engineering note has been written describing the tube.

An electrolytic tank to be used in designing the new holding gun is being constructed.

5.0 INSTALLATION AND POWER

5.1 Power Cabling and Distribution

(H. S. Lee)

During the past two weeks the installation group has accomplished the following:

a. Terminal strips and transformers have been installed in Racks EX3, EX4 and EX5.

b. Reset Switch Panels and Master Switch Panel in console were wired and installed.

c. Relays in panel selection system were adjusted.

d. Filament voltages in "C" Row were adjusted.

The drafting of power cables for Racks EX3, EX4, and EX5 is approximately 30% completed.

Effective June 27 the computer will be inactive for a minimum period of four days to allow the installation group sufficient time in which to install the permanent distribution wiring for the repetitive elements. When this installation has been completed the following circuits in the repetitive elements will be variable:

+250 BA and BD Plates and Screens
+150 BA, CF and TT Plates and Screens
+120 FF Screens (0)
+120 FF Screens (1)
+ 90 GT Screens
- 15 GT Suppressor
Gnd GT Suppressor

Construction requisitions have been forwarded to the shop for the following:

10 DC Filter Panels
10 Voltage Variation Panels
10 Fixed Voltage Switching Panels

5.2 Power Supplies and Control

(J.J.Gano)

WW Power Supplies - During the WWI shutdown period, the permanent panels for the filament alternator regulator and power supply will be installed. There will then remain only the work of rearranging some of the cabling for this supply and the d-c supplies. This will be completed as time permits.

115 Volt A-C Laboratory Supply Regulator - The permanent regulator and power supply will be mounted sometime after the WWI shutdown period when there will be no interference with the reliability testing of storage tubes.

5.3 Video Cabling

(R. H. Murch)

The video cable timing busses for central control have been measured and are being constructed. These cables and approximately 800 more will be installed during the first part of next week.

6.0 BLOCK DIAGRAMS

(J. M. Salzer)

Elimination of selective pushbutton operation (according to M-809) suddenly reduced the operator's manual omnipotence to a mere trickle of pulses he could order from his seat at the console. A recapitulation of these manual controls is desirable:

RESTART	- changes to automatic operation
CLEAR	- clears all FF's (ac and dc) except those intimately connected with the clock pulse supply, such as the Pulse Generator and Frequency Divider.
SINGLE PULSES	- for manual step-by-step operation
COMPUTER COMPLEMENT	- complements all FF's which are restored and in addition re-complements the Clock Pulse Control to preserve the type of operation of the computer.
CHANGE TO PUSHBUTTON	- changes to manual operation.

The Synchronizer converts the pushbutton signals to properly-timed pulses.

Obviously with such a small variety of manual actions testing of particular components and the insertion of check problems becomes difficult. Since the spare Synchronizer circuits are limited, additional manual controls should be installed only after careful consideration of their utility. There was no doubt in the mind of the checking group that the incorporation of the following pushbutton was necessary:

RESET	- sends a "reset" (preset, test reset whichever the case) pulse to FF Storage, Step Counter, Control Switch, Time Pulse Distributor, Test Storage Switch, Program Counter, Check Register, Comparison Register.

The main advantage of this pushbutton action is that after the setting of the reset toggle switches (one for each digit), it will be possible to insert chosen numbers into the registers enumerated. For testing, however, it would also be desirable to insert numbers in selected registers only without disturbing the contents of the unselected registers. An additional toggle-switch panel has been installed in Test Control for this purpose. Each toggle switch on this panel controls the resetting of one register. Depending on the position of the proper toggle switch a "reset" pushbutton will or will not reset the register in question.

The block diagram of the Central Control has been entirely revised.

6.0 BLOCK DIAGRAMS (continued)

(R. P. Mayer)

Work on the coordinated block diagram for Electrostatic Storage is continuing in the drafting room. It has been decided to omit 108, Storage Selection Control and 103, Program Register from this drawing since they belong to Central Control and will be shown on other drawings. The reset connections for the ESC Delay Counter (811) have been determined (tentatively), and revisions are still occurring in the numbering and titling of many of the units shown. The title and drawing number for this diagram will be: Block Diagram, 800, Electrostatic Storage, WWI, D-37220. A B-reduction will also be made.

7.0 CHECKING METHODS

(C. W. Adams)

Recent discussions of an automatic check procedure for testing the storage switch and program counter independent of the arithmetic element have resulted in an apparently satisfactory method which involves simply removing two cables to form a special operation. The method is described in M-863.

An engineering note (E-250) has been written in an attempt to clarify the status of temporary operations (the so-called "q" orders) which may be wired temporarily into the operation matrix. In essence, it is essential that the convenience with which such operations can be installed should not cause people to install temporary operations at the drop of a hat. Only confusion will result from building test procedures around operations that may be changed next week.

(G. Cooper)

The list of variable voltage lines drawn up by C. W. Adams has been checked. A few corrections have been found, but the revised list will not be issued until the design changes on the TPD have been settled. Anyone interested in these corrections may obtain them from G. Cooper.

The development of test checking sequences to be used with marginal checking is continuing. As reported previously, the attack used has been quite successful with several of the lines to the SC. Rather than work out the details for the remaining lines in the SC, it is felt that a study of this particular method applied to other parts of the computer is in order at this time. Should this prove to be fruitful, it is planned to write a Master's Thesis on the topic. It is believed that such will be the case.

9.0 FACILITIES AND CENTRAL SERVICE

9.1 Publications

(J. N. Ulman, Jr.)

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

6345 Reports

No.	Title	Classified	No. of Pages	Date	Author
R-146	Test Equipment Series - Coder	-	11	5-25-49	R.R. Rathbone
R-166	Digital Computers as Information-Processing Systems	-	15	6-1-49	J.W. Forrester
R-168	A Dual-Triode Capacitively-Coupled Flip-Flop (SM Thesis, 5-20-49, Abstract in E-251)	-	89	6-15-49	M.H. Hayes
E-246	Calculation of Correlation Functions by WWI	-	8	6-1-49	C.W. Adams
E-248	A Low-Speed Analogue for Analysis of Flip-Flops (Abstract of R-167, SM Thesis)	-	2	6-22-49	J.M. Hunt
E-249	Deposit of Film in the Glass Necks of Storage Tubes	-	3	6-10-49	W.E. Pickett
E-250	Temporary Operations for Whirlwind I	-	3	6-17-49	C.W. Adams
E-252	Proposed Test-Control Circuit for Whirlwind I with Test Storage	-	3	6-20-49	G.C. Sumner
M-860	Bi-Weekly Report, 6-10-49	Restr.	25	6-10-49	
M-861	Summary of Flip-Flop Storage Test Results	-	1	6-13-49	G.C. Sumner
M-862	Data on Secondary Emission from Beryllium and Beryllium Oxide	-	2	6-13-49	H. Klemperer
M-863	"Switch Check": Automatic Testing of the Program Counter and Storage Switch	-	5	6-16-49	C.W. Adams
M-864	A Pursuit Problem	-	2	6-21-49	P. Franklin
A-89	Time Cards	-	3	6-20-49	R.A. Osborne

Library Files

47	Technical Information Pilots Nos. U3276-3470-3535	Lib. of Congress
73	Pre- and Post-Analyses by Reeves Analysis and Computer Group; May 24 -27, June 1-3, 1949	(Reeves Instrument Corp.

Library Files (Continued)

No.	Title	Author
180	Document Office Bulletins, June 7 and 21, 1949	RLE, MIT
198	Interim Engineering Report on Radio Control Transmitter AN/ARW-55 and Radio Control Receiver Model AN/ARW-56; June 1, 1949	(Collins Radio (Company
291	A Study of the Prediction of the Position of a Flying Aircraft; Eugene F. Grant	(Cambridge (Field Station
292	The Characteristics of a Multi-Orifice Journal Air Bearing; M. D. Vance, 2-23-49	(Curtiss- (Wright Corp.
293	Some Properties of the Ba_2SiO_4 Oxide Cathode Interface; A. Eisenstein, 8-19-48	RLE, MIT
294	The Brain as a Computing Machine; W. S. McCulloch	Elec. Eng. Reprint
295	Measurement Techniques: Wide Range Oscilloscope; C. E. Ingalls; 2-21-49	(School of E.E., (Cornell Univ.
296	Tube Circuit Design Using the "G" Curve Technique; Keats A. Pullen, Jr.	(Ballistic (Research Labs.
559	Technical News Bulletin, June 1949	Nat. Bur. Stand.

Books

Electrical Circuits Magnetic Circuits and Transformers Applied Electronics	Principles of Electrical Engr. Series	Electrical Engineering Staff, MIT

9.2 Standards, Purchasing and Stock

(H. B. Morley)

Procurement - Final design specifications have been approved for the WWI Storage Tube Filament Transformer, spec. S6.193-3, and a purchase order initiated for procurement of one sample for test and approval. A purchase order has also been placed for 4 special 26 volt transformers for Storage Tube Lab.

Sampled of the IPC high voltage connector were tested and suggested modifications accepted by the vendor. The order has been placed and delivery scheduled for July 15.

New Products - Sprague Electric Company has announced several new items of miniature components. Technical data is on file in the Procurement Office.

9.3 Construction

(R. A. Osborne)

Production Report - The following units have been complted here since June 10:

23 Video Cables
2 E.S.D. Gate Panels
13 Program Counters
1 E.S.C. Counter
4 E.S.T.D. Selector
16 Check/Comparison Register
6 Standardizer Amplifiers
2 Voltage Variation Panels

(L.Prentice)

Sheet Metal Shop - WWI Metal work is on or ahead of schedule. More dies must be made for replacement and for closer tolerence needed to punch stainless steel for storage tube parts.

Machine Shop - We have about 2 week's work scheduled ahead. Most of the work in progress is on storage tube components.

(A. Taylor)

WW construction is now about one week behind schedule. It is expected that we can be back on schedule within three weeks.

(A. R. Curtiss)

The largest single items in the work load have been the drawings for the R-F Pulser and construction work on the E.S. output panel which have taken about 40% of the time.

A Storage Selector Mixer breadboard and numerous small parts for testing the storage tube mount prototype have been built, work has been done on a control panel for the portable vacuum firing system, and the r-f amplifier prototype has been tuned.

10.0 GENERAL

Staff Terminations

C. H. R. Campling

Replacement Non-Staff:

Miss Phyllis Quinn is working with the Print Room during the summer months. She replaces Lorraine Graham who is going to Secretarial School.