6345
Memorandum M-305

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

Report No. 2
Prepared by E. I. Blumenthal

PROGRESS REPORT TO THE DEPARTMENT COMMITTEE ON GRADUATE STUDY AND RESEARCH

SUBJECT OF RESEARCH: A Trouble-Location Scheme for a Digital Electronic Computer

PERIOD COVERED BY THIS REPORT: March 2, 1948, to March 18, 1948

Students Working on Research:

Edwin I. Blumenthal
George G. Hoberg

Room Number: Barta Building - 255
Expected date of Completion: May 1, 1948
Supervisor: R. R. Everett

Noted by:
Res. Lab. Office _____
Grad. Comm. _____
Supervisor _____

DETAIL OF WORK CURRENTLY ACTIVE: The investigation of problems suitable for the step-by-step isolation of a trouble to a particular digit column in a binary register assuming the trouble is known to exist in a specific tube-type in the register.

Expected date of completion of this detail: May 1, 1948.

STATEMENT OF PROGRESS SINCE LAST REPORT. Include REFERENCES, with statements of their usefulness.

Since March 2, I have extended the number of problems to 31 which are designed to localize a trouble to a specific tube-type in a specific digit column of the A-Register. These 31 problems accomplish this task in the five-digit multiplier, one-digit column of whose A-Register is drawn in block diagram form in Fig. 1.

The types of failures considered total 13 (so that 65 independent failures are handled by the 31 problems).

The failure-types are:

1. A Flip-flop permanently "1" (such as would be caused by a burned out tube in the flip-flop).

2. A Flip-flop permanently "0" (caused by the second tube in the flip-flop burning out).

3. A Flip-flop unable to be complemented by triggers applied to its cathode, but able to respond to inputs at either grid (such as would be caused by a circuit parameter failure in the "complement" input line to the flip-flop).

6345
Memorandum M-305

4. A Flip-flop unable to be reset to "0" by triggers applied to one grid, but capable of switching under any other input (again - a circuit parameter failure).

5. The same type failure as 4, but where the initial flip-flop condition (before the first of the 31 problems) differs from that of 4.

6. A Flip-flop unable to be set to "1" by triggers applied to that grid - or a burned-out read-in gate tube (these failures cannot be isolated).

7. A burned-out read-out gate tube.

8. A burned-out complement gate tube.

9. An internal control grid short in the complement gate tube.

10. An internal suppressor grid short in the complement gate tube

11. An internal control grid short in the read-out gate tube.

12. An internal suppressor grid short in the read-out gate tube.

13. A control grid internal short in the read-in gate tube.

For these failures, the 31 problems give definite patterns of correct and incorrect solutions, an average pattern of which consists of roughly an equal number of right and wrong answers. G. Hoberg will now evaluate this particular sequence of problems in terms of the equipment necessary for application to the five-digit multiplier, and also in terms of the amount of storage facilities an extended sequence of problems of the same type would require in a large scale computer. (The sequence of 31 problems can easily be extended to a sixteen-digit machine, for example, by an addition of 55 problems. The patterns for 86 problems would roughly contain the same ratio of correct to incorrect solutions).

The A-Register of Fig. 1 is considered representative of a digit column in a register of a parallel machine; and therefore any series of problems such as that just developed can be easily extended to handle any specific register in any similar machine. For this reason, we have decided to modify our aims to the development of an optimum series of problems for such a register. This explains the change in the indicated "expected date of completion" above.

While G. Hoberg evaluates these 31 problems, I will attempt to devise a different set aiming at the minimization of total incorrect solutions, regardless of the total number of problems employed. It is hoped that evaluation of this scheme by Hoberg will show relative merits and disadvantages of the two schemes.
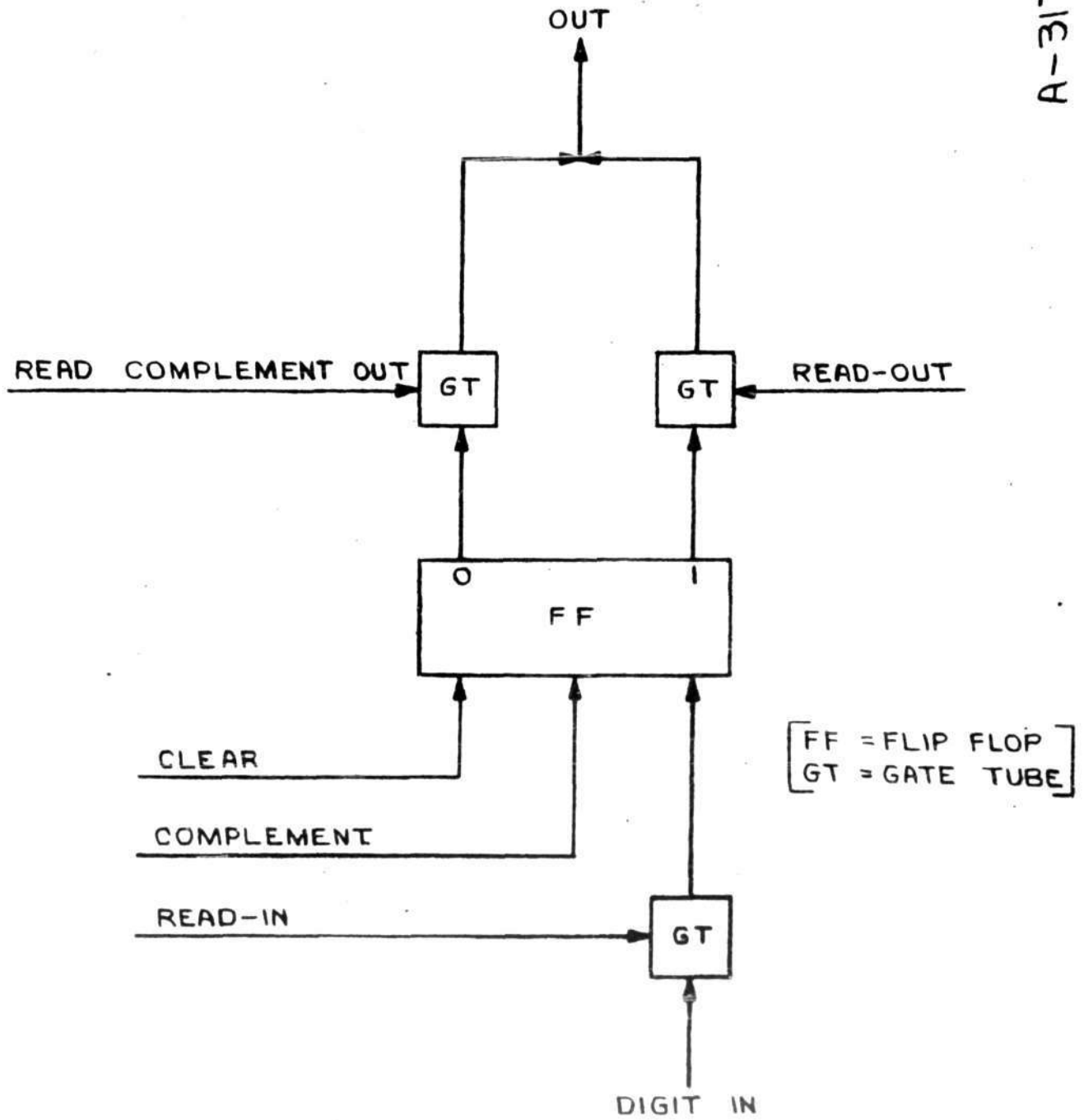
Signed: *Edwin A. Blumenthal*
Edwin I. Blumenthal

Drawing A-31728

EIB/lj

OUT

READ COMPLEMENT OUT → GT   GT ← READ-OUT

O   FF   I

CLEAR

COMPLEMENT

READ-IN → GT

DIGIT IN

$$\left[\begin{array}{l} FF = FLIP\ FLOP \\ GT = GATE\ TUBE \end{array}\right]$$

FIGURE 1
DIGIT COLUMN OF A-REGISTER