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Memorandum M-1417

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Page 1 of 2

Digital Computer Laboratory  
Massachusetts Institute of Technology  
Cambridge, Massachusetts

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Auth: DD 254  
By: R. L. Everett  
Date: 2-1-60

SUBJECT: WHIRLWIND II MEETING OF FEBRUARY 29, 1952

To: Whirlwind II Planning Group

From: N. H. Taylor and R. P. Mayer

Date: March 3, 1952

Members

Present:	R. Everett	W. Linvill	W. Papiant
	W. Hosier	R. Mayer	C. Shultz
	J. Hughes	J. McCusker	N. Taylor
	J. Jacobs	W. Ogden	J. Woolf
	R. Jeffrey	R. Pacl	

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The meeting was opened with a discussion of a new flip-flop and gate combination. At a previous meeting, a circuit was discussed which involved a transistor and a magnetic core operating as a re-circulating type of memory in which the core was used as a memory device, and the transistor acted only as an amplifier. In the present circuit the transistor acts like a flip-flop, and magnetic cores are used as gates. The output of the transistor simply drives a gating core to saturation so that an input pulse will not pass through. In order to prevent the input pulse to the core from interfering with the proper operation of the transistor, two cores should be used; wound so that this undesirable feedback is cancelled out. This same pair of cores allows two output windings to be used -- one on each core. If these output windings are wound so that the desired output from each core of the pair is added together, then, due to the cancelling windings mentioned above, the flipping of the flip-flop will produce output pulses which will cancel. Thus, the use of two cores allows isolation both ways between the flip-flop action and the gating action. Any number of pairs of cores can be connected to any one transistor, and will act as individual isolated gates.

The cores should have a hysteresis loop which is as small as possible and it should have a sharp knee. The transistor output simply has to shift the core from one side of the knee to the other so that in the unsaturated position some flux change can occur while in the saturated position none will occur.

There is some question as to whether the impedance and current characteristics of the transistor and magnetic core combination will work as desired in this application. At first this circuit will probably operate more slowly than we would like. It is also possible that we may have to use vacuum tubes in the circuit until we gain more experience with it. A more careful quantitative investigation will be made by W. Linvill in cooperation with the transistor and magnetic groups.

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Pacl suggested that it might be possible and desirable to build transistors in series (like batteries) in order to provide more desirable voltage characteristics.

So far we have been using brute force techniques for making Electronic circuits behave. It would be advantageous to find a neat solution to the problem of designing computing circuits and it appears that eliminating vacuum tubes would help us to do this. The vacuum tubes, of course, would have to be replaced by some other Electronic components such as transistors or magnetic cores. One problem, then, is: what combinations of magnetic cores and/or transistors should be used as flip-flops and gates. Discussions such as the above bring to everyone's attention different combinations of such components and indicate the direction that further research should take in developing more desirable characteristics of transistors and cores for use in various applications.

The remainder of the meeting dealt with the Arithmetic Element for Whirlwind I 1/2. The block diagram department is attempting to find the minimum number of channels required for operating a single digit of the Arithmetic Element. Suggested channels included: add in, read out, carry to next digit, complement, shift (probably a one way cyclic shift), and possibly a subtract in.

Shifting can be accomplished without using gate tubes by clearing the flip-flop and passing the transient on to the next flip-flop. It might be difficult to use such a register for other purposes, and Taylor mentioned that it might be desirable to have separate registers for shifting, adding, etc. The problem is to determine whether it is better to build a single register with gates or several registers without gates.

*Rollin P. Mayer*

(Rollin P. Mayer)

N. H. Taylor

(Norman H. Taylor)

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