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MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

Report No. 2

Prepared by D. A. Buck

PROGRESS REPORT TO THE DEPARTMENT COMMITTEE ON GRADUATE STUDY AND RESEARCH

SUBJECT OF RESEARCH: S. M. Thesis: Ferroelectrics for Digital Information Storage and Switching

Period Covered by this Report: January 15, 1952, to April 7, 1952

Student Working on Research: D. A. Buck

Building: Whittemore

Expected Date of Completion: May 16, 1952

Supervisor: Professor A. R. von Hippel

Details of Work Currently Active: Pulse-testing of barium titanate ceramics to determine their suitability for digital information storage and switching; evaluation of the ferroelectric switch; construction of a prototype 8 x 8 ferroelectric memory; evaluation of a new scheme for sensing; preparation of drawings, diagrams, graphs and text.

Expected Date for Completion of this Detail: May 16, 1952

Progress

The pulse-test equipment has been improved to remove transients associated with extinguishing the thyatron switch. Trouble with transients when switching between the read-write voltage and the disturb voltage (mentioned in the preceding progress report) has been cleared up. Removal of these transients has allowed photographs to be taken as a routine part of the data-taking on various materials. Because of the low pulse-repetition frequency, two-minute exposures are required using a Dumont Land Scope Camera. Eighty-four photographs have thus far been taken of switching waveforms.

A new material, body "X-48", has been received from the Glenco Corporation and additional quantities of body "X-18" in thinner (.010") sheets have been received. Both of these materials are promising for matrix-memory operation.

The pulse studies have been divided into two groups, called mode A and mode B. Mode A tests subject a dielectric to alternating polarity pulses of adjustable amplitude for switching-time studies. Mode B tests are designed to evaluate the material for use in a matrix memory where the material must retain a residual displacement after a large number of lesser-amplitude disturbing pulses.

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A multi-position ferroelectric switch has been developed (Fig. 1) which can accomplish many of the switching tasks in an information handling system; in particular, it can select among the rows and columns of a ferroelectric memory. The logical circuitry of the ferroelectric switch can be painted directly onto the two sides of a thin ferroelectric sheet. When compared with existing methods of switching; this new method shows great promise wherever size, weight, and cost are important factors.

As mentioned, body "X-18" has been found to be on the borderline of suitability for matrix-memory operation. An 8 x 8 prototype memory is under construction which uses a one-inch square of "X-18". A method of detecting switching currents into an array has been devised. It consists of running all of the row (or column) leads through a magnetic-core ring transformer. Since, during selection, only one condenser in the array switches, a signal on the output winding of the transformer can be sensed to indicate the current to that condenser.

One-third of my time is at present devoted to thesis writing. On April 25 this will be increased to two-thirds and on May 5 to full time. Sixteen drawings, photographs, and graphs have thus far been completed by the drafting room and photo lab.

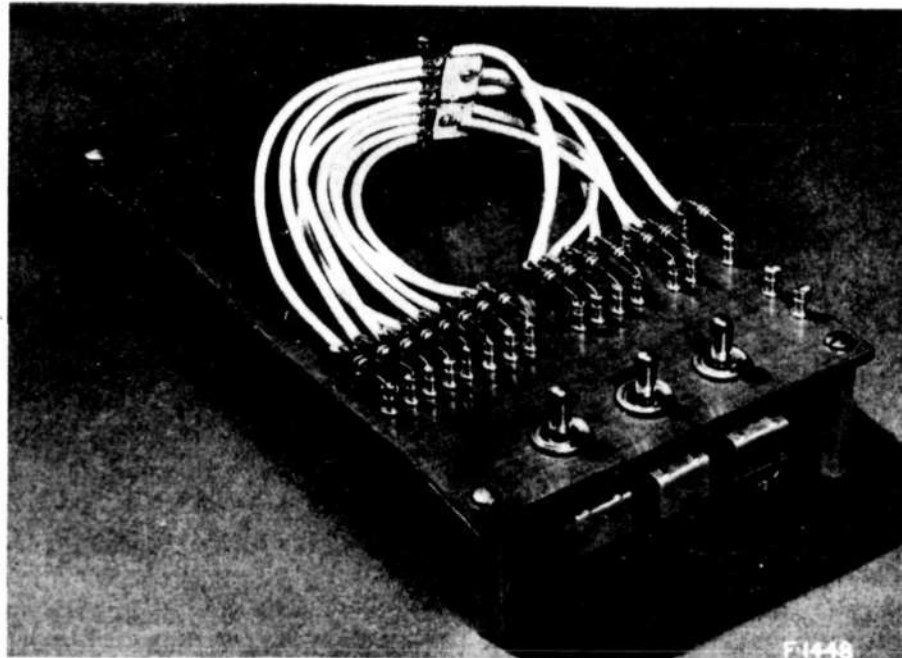
Signed Dudley A. Buck
Dudley A. Buck

Approved William N. Papian
William N. Papian

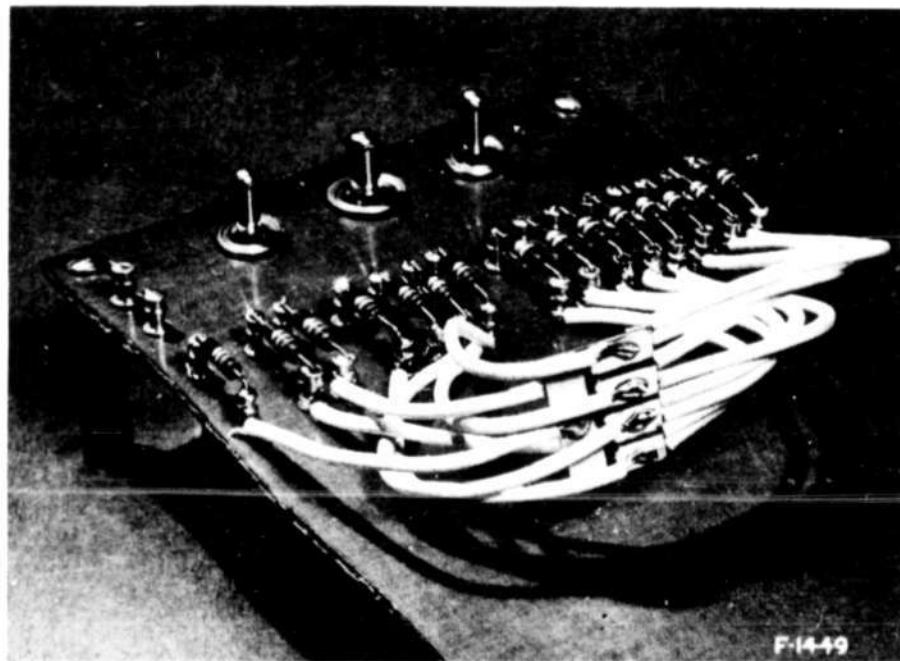
DAB/jk

Drawings attached:

A-50906 Figure 1



(FRONT VIEW)



(BACK VIEW)

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FERROELECTRIC MULTI-POSITION SWITCH