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Printed Cards for the Card Capacitor Memory

Foglia, McDermid and Petersen have described the card capacitor memory, a semipermanent, read-only storage device utilizing replaceable metallized IBM punched cards as the information storage medium.[1] Although this device has a theoretically high signal-to-noise ratio, attempts to implement the scheme in a memory of useful size have been only partially successful because of the small coupling capacity available. This letter describes a revision of the original scheme which provides coupling capacity 10 to 30 times greater while maintaining a signal-to-noise ratio adequate for many purposes.

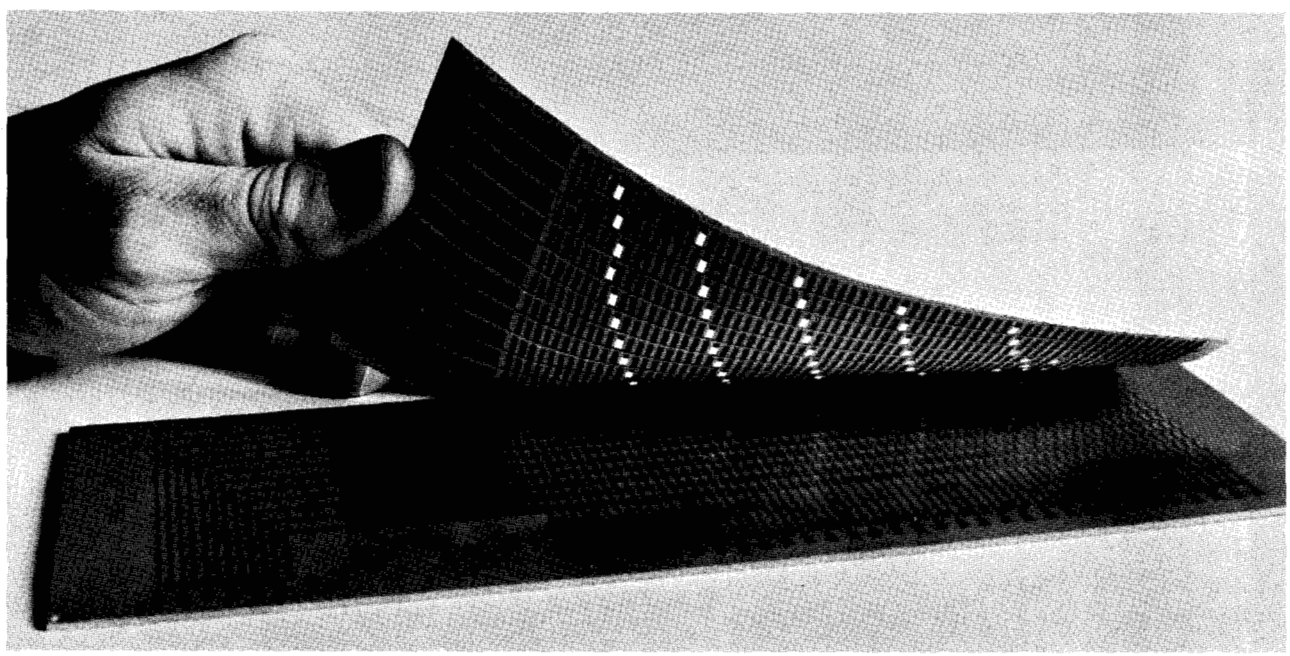
The change in the original design consists essentially of 1) replacing one of the two etched circuit boards with a paper card printed with a conductive ink pattern which also serves as the information storage medium and 2) sandwiching this card between a grounded electrostatic shield and the etched circuit board rather than using the grounded electrostatic shield as the center element.

There are several variations possible with the revised scheme. For example, the printed card and the etched circuit board are shown in a relatively simple arrangement in Figure 1. Only 64 out of the 80 columns are used for information storage, the remaining 16 columns being used to connect the card to the external circuitry. The entire surface of the etched circuit board is covered with a thin insulating film, e.g., Mylar* film or silicone varnish. Alternatively the end-connection pads may be gold-plated and left bare to make direct ohmic contact with the paper card.

A single card read-only storage device is formed by placing the paper card in proper registration over the insulated etched circuit board and applying uniform pressure to the card with a resilient ground plane consisting of a sheet of copper-clad Mylar film backed with sponge rubber and mounted on a rigid plate. Thus, a capacitive coupling is produced between the conducting pads on the

*Registered trademark, E. I. du Pont de Nemours & Co., Wilmington, Delaware.

Figure 1. **Photograph shows arrangement between card and etched circuit.** *Electrostatic shield, normally placed over card, is not shown. The system can be energized from row conductors and the sensing made at column conductors or vice versa.*



card and etched circuit. Individual pads on the card can be removed by a standard key-punch machine, thus eliminating capacitive coupling. Stray coupling at punched-out locations is prevented with the electrostatic ground shield. With adhesive-backed 0.001-in. Mylar film as the insulation, the coupling capacity ranges typically from 2.2 picofarads at unpunched locations to 0.25 picofarad at punched-hole locations for an 1/0 coupling ratio of 8.8. A multi-card storage device can be formed by assembling the required number of circuit boards, printed cards, and resilient ground planes into a sandwich structure.

A 4-card experimental read-only memory has been built and operated at frequencies up to one Mc, using this simple arrangement. More complex arrangements utilizing plated-through hole techniques have also been devised which use the entire 80 column area of the card for information storage and which yield 1/0 coupling ratios greater than 20.

Reference

1. H. F. Foglia, W. L. McDermid and H. E. Petersen "Card Capacitor—A Semipermanent Read-Only Memory." *IBM Journal* **5**, 67 (January, 1961).

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