Griffith

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Exchange Memo No. 8

Magnetic Core Crosspoint Switch [redacted]

The Magnetic Core Crosspoint Switch is a configuration of multihole cores. The configuration is of a two dimensional matrix type, with one or more of this type of magnetic core at each intersection. The number of cores at each intersection depends upon the information or signal handling capacity of one core - ie, how many signal holes it is reasonable to place in one core.

The purpose of this invention is two fold. The first action it is necessary to obtain is similar to that of a mechanical cross-bar switch. That is, given N signal channels corresponding to the columns in the Matrix and given M signal channels corresponding to the rows in the matrix, where M is usally greater than N, that any one or more of the N signal channels may be coupled to any M signal channel and that this coupling be a unique coupling with no cross coupling or interference between channels. Also that the number of unique paths that may be set up connecting or coupling the M signal channels to the N signal channels be limited only by the number of M signal channels or N signal channels, whichever is the lesser number and that each of these coupling or connections be unique. Also, any of these couplings can be either initiated or decoupled without interferring with any other couplings.

The second purpose of the invention is to provide a temporary storage or buffering action for the signals that are transmitted

through the channels. Thus the storage property of the multihole ferrite that is used in the intersection fulfills this purpose and effectively takes the place of a storage register or some other component that would be necessary external to the crosspoint switch if the familiar mechanical equivalent of the crosspoint switch were used.

To obtain these properties, ie, that of a device that corresponds to a mechanical cross-bar switch and that of a device that provides a temporary storage of signals for buffering purposes, a matrix composed of multihole ferrites is constructed.

The multihole ferrite has the following properties: It is a toroidal shaped core which has several holes formed through the toroidal structure and which are perpendicular to the plane of the core. One of these holes and the center hole are used to contain windings which are used to select or set the core into the state necessary that the rest of the holes can be switched. Therefore, the center hole and one of the smaller holes in the toroid are used for selection and the rest of the holes in the toroid are signal holes. (See Figure 1) When the core is in a non-selected state the flux in the toroid is saturated in the same direction on both the inner and outer sides of the signal holes.

To select a core a half select current is introduced in the row winding and coincidentially a half select current is introduced in the column winding of which that particular core is the intersection. One of the windings in which the half select current is introduced passes through the select holes of all cores in the row. The other winding in which the

half select current in introduced is passed through all center holes in the columns. Neither of these currents by itself is sufficient to cause a flux reversal in a core. At the intersection the additive mmf's caused by the currents in the two windings which currents are of the proper magnitude and direction, will establish in that core a kidney shaped flux path surrounding all other holes. (See Figure 1) Signals can then be wirtten into or read out of these holes since the flux can be switched around a hole by a current pulse of the proper duration, amplitude, and direction.

Referring to Figure 2, any one of the Msignal channels can connected to one or both of the N signal channels. All of the N channels could be used simultaneously, being connected to the same or to different M channels as desired. Assume that Channel 2 is to be connected to Channel A. Current pulses would be sent into the Half Select 2 and Half Select A lines, thus selecting the core at the intersection of the lines. A kidney shaped flux pattern is established, enabling information to be stored in and passed through the core.

To send information in, the Write 2 lines in Figure 3 would be energized with current pulses in accordance with the information to be sent. Those lines receiving current would switch the flux around their respective signal holes in the selected core, with no effect on the unselected core in Channel B. The changing flux would induce signals on the Output A lines. If direct cross-bar switch action is desired, these signals could be used as outputs. If storage action is desired, the signals,

always having the same polarity, could be discriminated against in an amplifier. The signal is stored in the core by virtue of the switched flux around the signal holes. When reading out is desired, the flux is switched back to the kidney shape by pulsing the Read or Reset line. Voltage would be induced on the output lines, with a polarity opposite that in the case of direct cross-bar switch action. When using the array as a cross-bar switch without storage, it is still necessary to pulse the Read or Reset line of the selected core after each signal, to prepare it for receiving the next signal. If desired, the reset can be accomplished on the write lines. Each input signal would then consist of two sequential current pulses, the first in one direction, the second in the other.

The read winding is common to all signal holes in a column. This is because only one core in any column is selected and holds information at any one time. Thus the writing in to a selected intersection is done by the write windings each of which is common to one signal hole per core per row. Reading out is done by column read windings. Thus when several channels are set up, ie, several columns are uniquely coupled to several rows, writing in by row is independent of reading out by column. Thus the information can be temporarily stored in an intersection while the other columns are individually scanned and read out.

If the output sensing device is sensitive to the signal induced by writing rather than that induced by resetting, these two signals being opposite in polarity, then cross-bar switch action without storage

is obtained. However, the signal holes must be reset prior to the next write pulse in this case.

When it is desired to disconnect an input channel from an output channel, full deselect current is applied to the column in use. (See Figure 2) This is a large current which saturates the core with flux in one direction, destroying the kidney flux pattern. The current is opposite in direction to that of half select.

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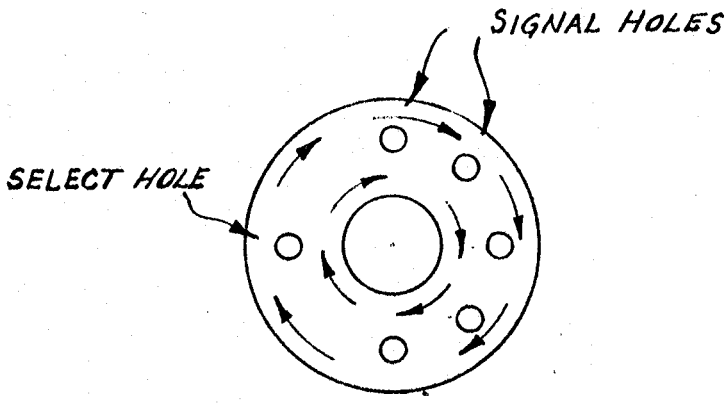
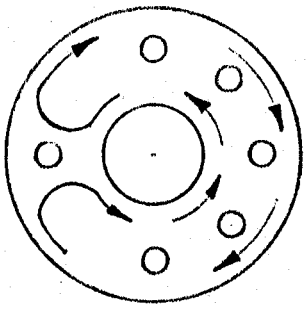
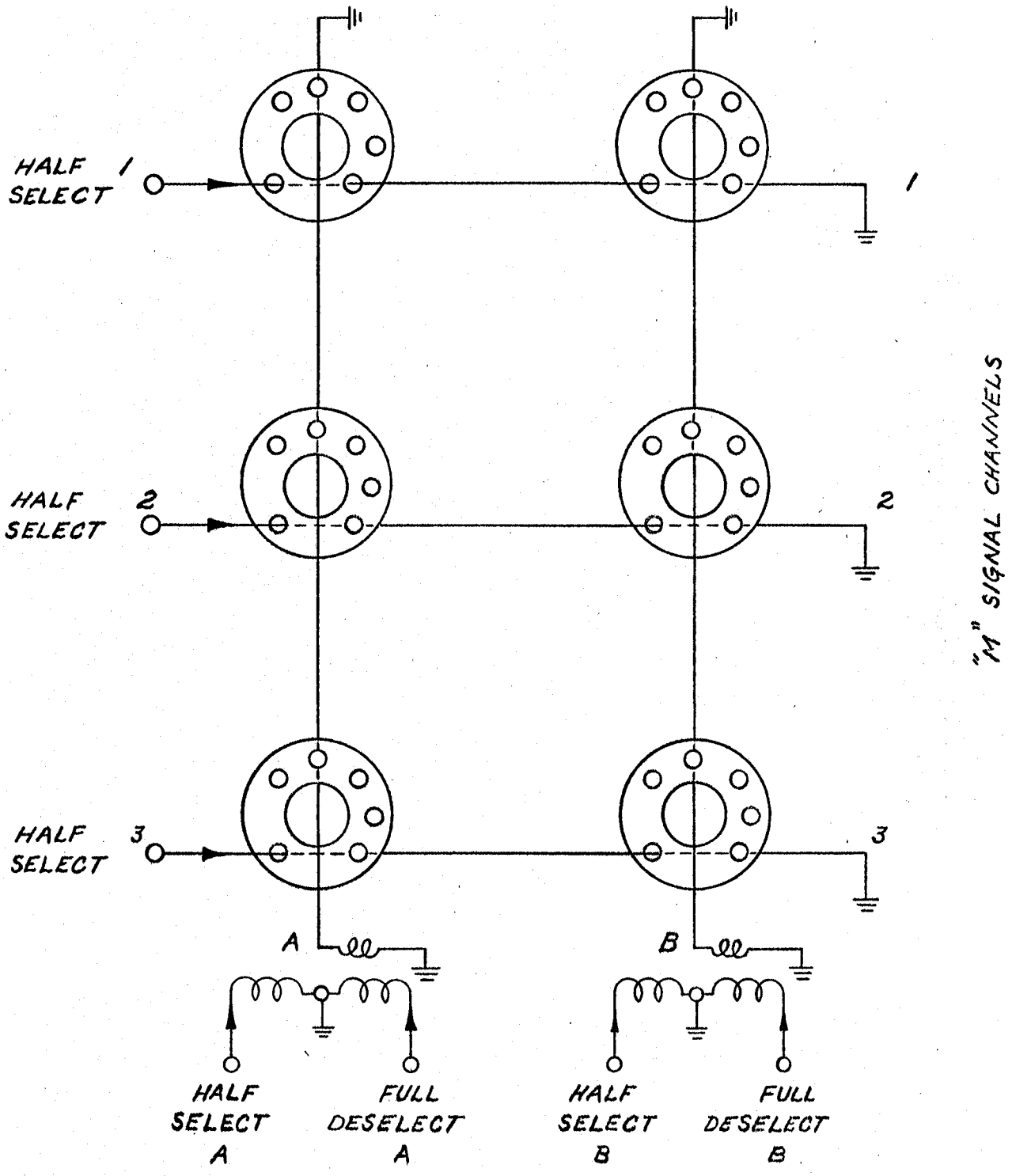


CORE DESELECTED, WITH FLUX SATURATED IN ONE DIRECTION



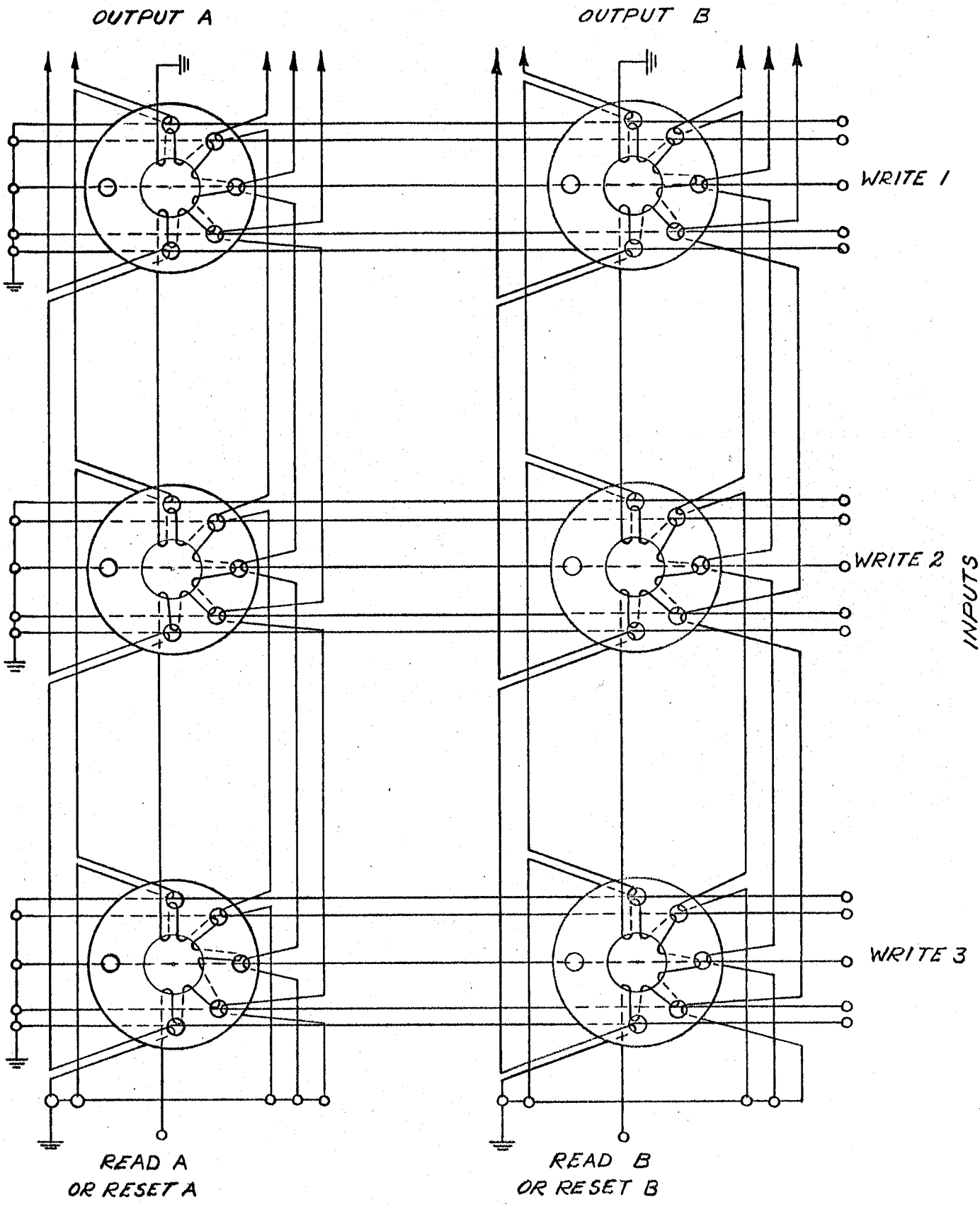
CORE SELECTED, WITH FLUX IN A KIDNEY SHAPED PATTERN

FIG. 1



A 2x3 CROSSPOINT SWITCH ARRAY SHOWING SELECTION WINDINGS ONLY. ONE OR TWO OF THE "N" SIGNAL CHANNELS CAN BE COUPLED TO ANY ON OR TWO OF THE "M" SIGNAL CHANNELS.

FIG. 2



A 2×3 CROSSPOINT SWITCH ARRAY SHOWING SIGNAL WINDINGS ONLY.

FIG. 3