July 8, 1969 M. M. ROUZIER ETAL 3,454,911

REED RELAY MATRICES OF CROSSPOINTS

Filed Dec. 14, 1967 Sheet 1 of 2

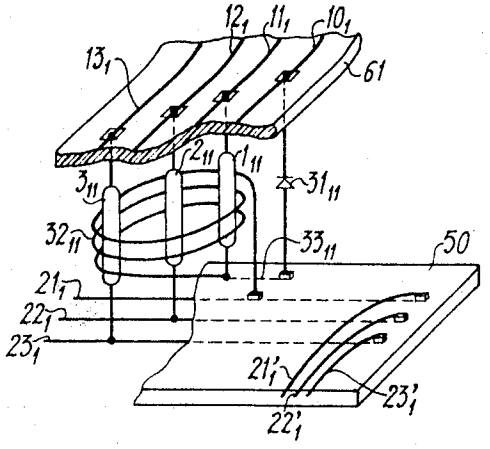
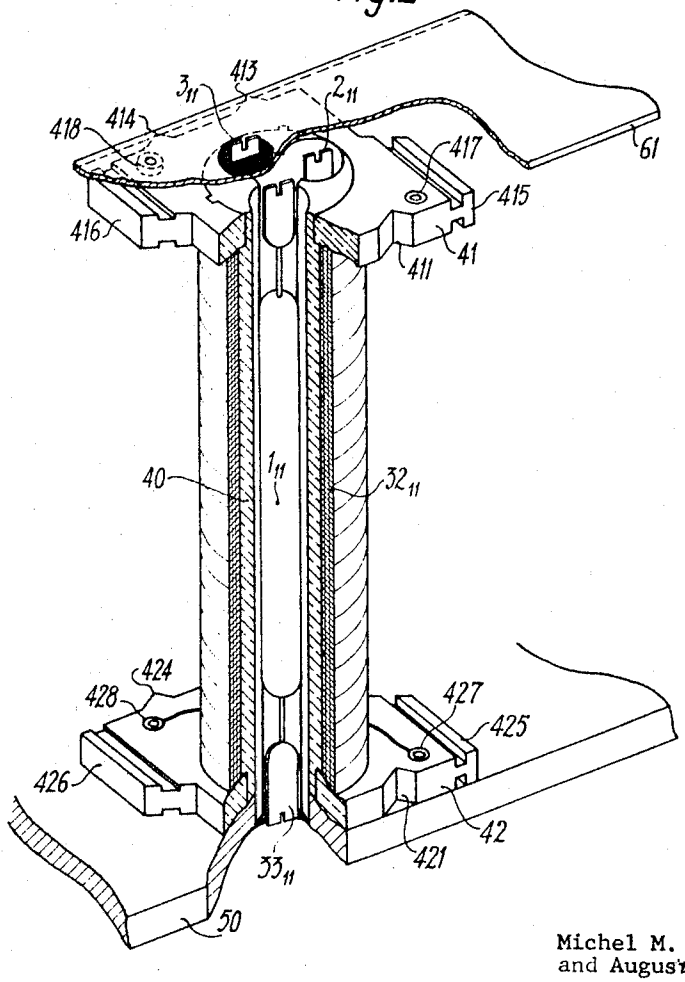


Fig.1

Fig.2



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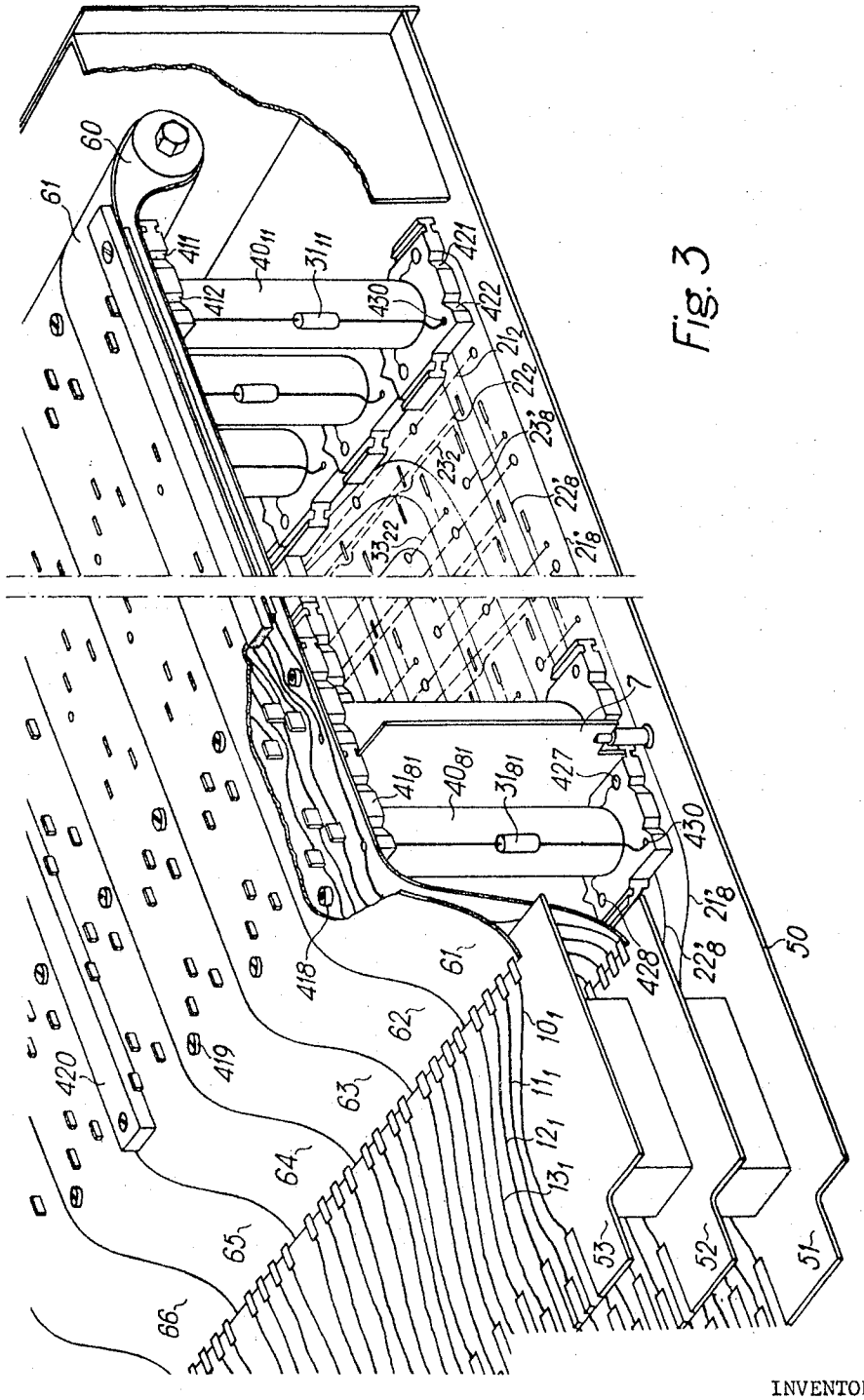

Fig. 3

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REED RELAY MATRICES OF CROSSPOINTS

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Int. Cl. H01h 67/14, 1/66
U.S. Cl. 335—112 4 Claims

ABSTRACT OF THE DISCLOSURE

A sealed contact type connection matrix comprising a support board, a plurality of crosspoints, each comprising at least three reed relays contained in a moulding which serves as a former for a common energizing winding, disposed perpendicularly to the support board and supporting a system of flexible tapes, all the external connexions of said matrix being made through printed circuits on both faces of said support card and one face of said system of tapes, terminating in three stages of a tiered connector rigidly connected to the support board.

This invention relates to the printed wiring matrices used in the construction of electronically operated electromechanical switching networks, more particularly of the kind wherein the crosspoints are embodied by a number of reed relays having a common energizing winding.

Switching matrices are known wherein the rows and columns are printed on two parallel surfaces of an insulating support and each crosspoint takes the form of a number of reed relays disposed in a former on which a winding common to all the relays is wound and which is plugged into the insulating support parallel or perpendicularly thereto by means of pins making contacts with the printed circuits of the insulating support. The steps required to ensure satisfactory contacting in such conditions greatly complicate manufacture of printed circuits of this kind, nor can the same be connected to external circuits by printed parallel tiered connectors, so that the advantages of printed circuit techniques are not used satisfactorily. Also, it is difficult in this system to devise magnetic screens between the rows or columns of crosspoints.

It is an object of this invention to facilitate and improve the construction of reed relay matrices of crosspoints.

It is more particularly an aim of this invention to embody reed relay matrices of crosspoints which do not limit or complicate the use of printed circuit technology.

A crosspoint matrix according to the invention comprises three parallel planes of printed circuits, two of which are embodied by the two surfaces of a circuit board rigidly secured to a tiered connector, while the third is embodied by one surface of a system of juxtaposed flexible tapes connected at at least one of their ends to the tiered connector.

Another feature of the crosspoint matrices according to the invention is that the reed relays of each crosspoint are disposed in a moulding on which the common energizing winding for such relays is wound and which secures the lead-outs from such winding, locates the various crosspoints relatively to one another and on the circuit board, retains the flexible tape system and locates magnetic screens between the crosspoint lines.

Another feature of the crosspoint matrices according to the invention is that all connections between the crosspoints and the printed circuits are by way of local soldering on the outer surfaces of the circuit board and the system of flexible tapes.

Another feature of the crosspoint matrices according to the invention is that the flexible tapes can be connected at both their ends to parallel connectors disposed one above another, so that a complete matrix of m rows and n columns can be converted into an incomplete matrix of m rows and 2 n columns, each of which serves only every other crosspoint, just by replacement of the flexible tapes.

Other aims and advantages of the invention will be disclosed by the following description of an embodiment of a switching network in accordance with U.S. Patent 3,356,973 issued Dec. 5, 1967 to the first-named of the applicants of this invention and Henri Marnat, such network being taken by way of non-limitative example, reference being made to the accompanying drawings in which:

FIG. 1 is a perspective diagram showing the basic arrangement according to the invention of the rows and columns and of a crosspoint of a matrix of the connection network of the U.S. patent specification hereinbefore referred to;

FIG. 2 shows a mechanical embodiment of a crosspoint of the kind shown in FIG. 1, and

FIG. 3 is a partial view, with some parts cut away, of a matrix according to the invention having e.g. 64 crosspoints, only some of which are shown.

The switching matrices described in the abovementioned U.S. patent specification 3,356,973 are triple matrices comprising triple rows, as $\mathbf{21}_1$, $\mathbf{22}_1$, $\mathbf{23}_1$ and triple columns, as $\mathbf{11}_1$, $\mathbf{12}_1$, $\mathbf{13}_1$, whose crosspoints are formed by groups of three reed relays, as $\mathbf{1}_{11}$, $\mathbf{2}_{11}$, $\mathbf{3}_{11}$, having a common energizing winding $\mathbf{32}_{11}$ and, for each triple column, a drive column, as $\mathbf{10}_1$, which is connected to one end of the energizing winding of each crosspoint of the column via a diode, as $\mathbf{31}_{11}$.

Two of the reed relays of each crosspoint, e.g. the relays $\mathbf{2}_{11}$, $\mathbf{3}_{11}$, connect the columns $\mathbf{12}_1$, $\mathbf{13}_1$ respectively to the rows $\mathbf{22}_1$, $\mathbf{23}_1$ respectively allotted to the two wires of a telephone line, while the third reed relay $\mathbf{1}_{11}$, which forms the holding contact of the crosspoint, connects the column $\mathbf{11}_1$ to a conductor $\mathbf{33}_{11}$ connecting the diode $\mathbf{31}_{11}$ to the energizing winding $\mathbf{32}_{11}$, whose other end is connected to the row $\mathbf{21}_1$.

According to the invention, the reed relays, as $\mathbf{1}_{11}$, $\mathbf{2}_{11}$, $\mathbf{3}_{11}$, of the various crosspoints of such a matrix are arranged vertically between, on the one hand, a printed card **50** having the rows, $\mathbf{21}_1$, $\mathbf{22}_1$, $\mathbf{23}_1$, printed on its bottom surface and, on the other hand, a flexible tape **61** having printed on its top surface the columns $\mathbf{11}_1$, $\mathbf{12}_1$, $\mathbf{13}_1$ and the auxiliary drive column $\mathbf{10}_1$. Board **50** is pierced so that at each crosspoint the bottom connections of the three reed relays and of the diode $\mathbf{31}_{11}$ and the two ends of the energizing winding $\mathbf{32}_{11}$ and each row, $\mathbf{21}_1$, $\mathbf{22}_1$, $\mathbf{23}_1$, near one of its ends can extend through the board so as each to be prolonged on the top surface thereof by a printed conductor, as $\mathbf{21'}_1$, $\mathbf{22'}_1$, $\mathbf{23'}_1$, which has a curvilinear shape and which finishes in a direction perpendicular to the rows $\mathbf{21}_1$–$\mathbf{23}_1$—e.g., parallel to the columns $\mathbf{10}_1$–$\mathbf{13}_1$—so that they can all be connected to tiered parallel plug-in connectors, as will be seen in greater detail in the description of FIG. 3. The tape **61** is also pierced so that the top connections of the three reed relays and associated diode can extend through the tape **61** at each crosspoint. Since any tape, as **61**, is independent of the tapes of the adjacent columns, demounting of the matrix can be limited to just a single column. Also, placing the matrix rows and columns on the outer surfaces of the board **50** and tapes, as **61**, makes it possible to use automatic bath or flood soldering to solder the crosspoints to these printed circuits.

FIG. 2 shows the mechanical layout of a crosspoint. The three reed relays 1_{11}–3_{11} are received in the former which bears their common energizing winding 32_{11} and which is formed by three mouldings engaging with one another—a body **40** and two identical end members **41, 42** disposed parallel to the two ends of the body **40**. The same is a cylindrical tube formed internally with three longitudinal parallel zones for receiving the three reed relays whose terminals extend beyond the ends of the body **40** and outside the end members **41, 42**. The members **41, 42** are secured to the flexible tape **61** and board **50** by screw-threaded metal members **418, 428** respectively, which are moulded in with the respective end members **41, 42**, and by screws as **419** (FIG. 3). The member **418** also serves for the electrical connection of the winding 32_{11}, the second end thereof being connected to a metal member **427** which also extends through the end member **42**. The connections for the diodes, as 31_{11}, are led through similar metal members, as **430** (FIG. 3), in the end members **41, 42**.

The end members **41, 42** are formed on two opposite sides with two triangular recesses **411, 412** and **421, 422**, and two matching projections **413, 414** and **423, 424**, the triangular projections of the connection points of any column engaging in the matching recesses in the adjacent column. The end members **41, 42** are also formed, along one half of the sides perpendicular to the sides formed with the matching grooves and projections, with grooved edges **415, 416** and **425, 426**, so that such edges engage between the connection points of two adjacent rows whose grooves are therefore aligned.

FIG. 3 shows a matrix consisting of crosspoints of the kind described; so that the characteristic features of the circuit arrangement may be visible, most of the crosspoints are not shown.

The matrix can comprise, e.g., 64 crosspoints of the kind shown in FIG. 2, and some reference numbers have indices, the first of which indicates the row number and the second the column number of the particular crosspoint concerned. As will be apparent, the board **50** has on its bottom surface triple rows 21_2, 22_2, 23_2, which are shown in broken lines, and connections, as 33_{22}, for forming the common point between one end of the energizing winding of the crosspoint, the bottom terminal of the holding relay thereof, and the anode of the associated diode. The board **50** has printed on its top surface the curvilinear connections, $21'_8$, $22'_8$, $23'_8$, which connect the lines of the bottom surface to the bottom tier **51** of the contactor printed on the top surface of the board **50** at the end thereof. Also visible are the perforations in the board **50** enabling all the bottom connections of the crosspoints to be effected by welding on its bottom surface. The supports of the crosspoints interlock at their top end members in just the same way as at their bottom end members. The oppositely disposed grooves in the top end members **41** and bottom end members **42** of the crosspoints of two contiguous rows receive a plane magnetic screen, as **7**, which is shown between the 7th and 8th rows of the matrix. The screens **7** lock the rows of crosspoints in pairs so that their whole forms a non-deformable unit.

With the part hereinbefora described of the matrix shown in FIG. 3, 64 crosspoints can be used as required to provide either a complete 8-row 8-column matrix or an incomplete 8-row 16-column matrix. The embodiment shown, comprising printed tapes, as **61**, and two tiers **52, 53** of connectors at their ends, is of an incomplete matrix. The matrix column number can be doubled by printing on each tape, as **61**, two sets of columns, 10_1 to 13_1, each

of which serves every other crosspoint and extends to a different connector **52** or **53** at one or the other end of the tape. To this end, one set of columns of each of the 8 tapes, as **61**, which all have different printed circuits and identical perforations, is soldered to the connector **52**, whereafter the tapes are spread out one beside another on the plane surface formed by the top end members **41** of the crosspoints whose terminals extend through their perforations for soldering to the circuits printed on their top surface in accordance with the wiring diagram, whereafter the tapes are folded around a roller **60** so that their second set of columns can be welded to the connector **53**.

The tapes thus folded are secured to the top end members of the connection points by screws, as **419**, and bars, as **420**. The bent part of each tape can be formed with perforations symmetrical of the perforations in the tape part in contact with the crosspoints so that the ends of the reed relay terminals engage in the tapes without being soldered so as to prevent any relative sliding between the two layers of the tape.

What we claim is:

1. A sealed contact type connection matrix comprising a circuit board, a tiered connector rigidly connected thereto, a number of juxtaposed flexible tapes which are disposed parallel to such board and which are connected at least one of their ends to the tiered connector, a number of crosspoints each comprising a number of reed relays disposed perpendicularly to the board between the same and the system of flexible tapes, and three printed circuit planes, two of which are disposed on the two surfaces of said circuit board and the third of which is disposed on one surface of said system of flexible tapes.

2. A matrix according to claim **1** wherein each of the crosspoints comprises an energizing winding common to the reed relays forming the crosspoint concerned, and a moulding which receives the relays and which serves as a former for the winding and secures the connection thereof, locates the various crosspoints relatively to one another and on the circuit board, retains the flexible tape bearing in printed circuit form the columns associated with the crosspoint concerned, and locates magnetic screens between the crosspoint lines.

3. A matrix according to claim **1** wherein the circuit board and the flexible tapes are pierced with perforations through which the terminals of the crosspoints extend, so that all connections between the crosspoints and the printed circuits are effected by local soldering on the outer surfaces of the board and tapes.

4. A matrix according to claim **1** wherein the flexible tapes are connected at both their ends to parallel connectors disposed one above another, so that a complete matrix of m rows and n columns can be converted into an incomplete matrix of m rows and $2n$ columns, each of which serves only every other crosspoint, just by replacement of the flexible tapes.

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