United States Patent

Witcher

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[45] **Oct. 17, 1972**

[54] **SWITCHING MATRIX**

[72] Inventor: **Thomas Howard Witcher,** Silver Spring, Md.

[73] Assignee: **The United States of America as represented by the Secretary of the Army**

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[52] **U.S. Cl.** .....**339/18 R,** 200/46

[51] **Int. Cl.** **H01r 25/00**

[58] **Field of Search**.....339/17 LM, 17 M, 18, 18 R; 200/46

[56] **References Cited**

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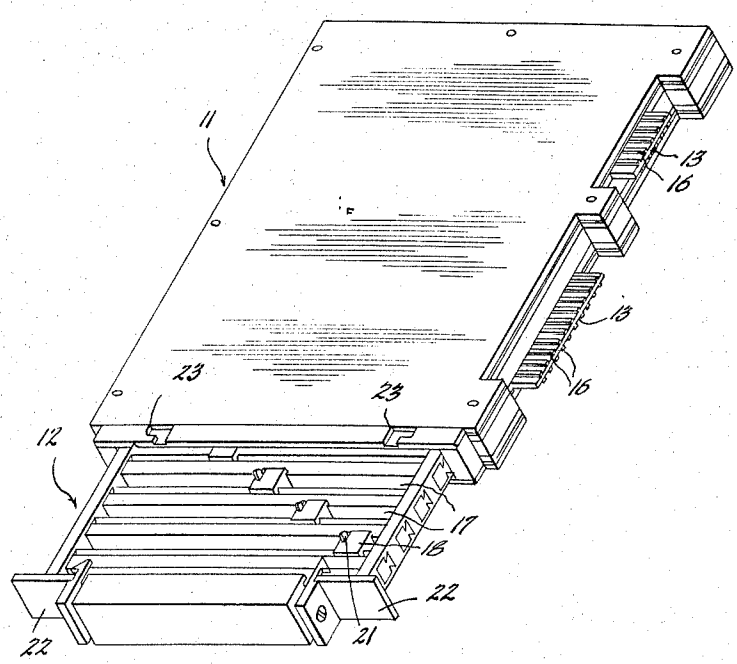
Primary Examiner—Robert F. Stahl

Attorney—John R. Utermohle

[57] **ABSTRACT**

A switching matrix includes a settable matrix adapted for insertion between input and output contact boards. Sliders of insulative material, carrying knife-edged cross contacts, are secured to separate guides in the settable matrix. The cross contacts are adapted to provide an electrical connection between two conductive paths, one associated with the input contact board and one associated with the output contact board.

9 Claims, 5 Drawing Figures



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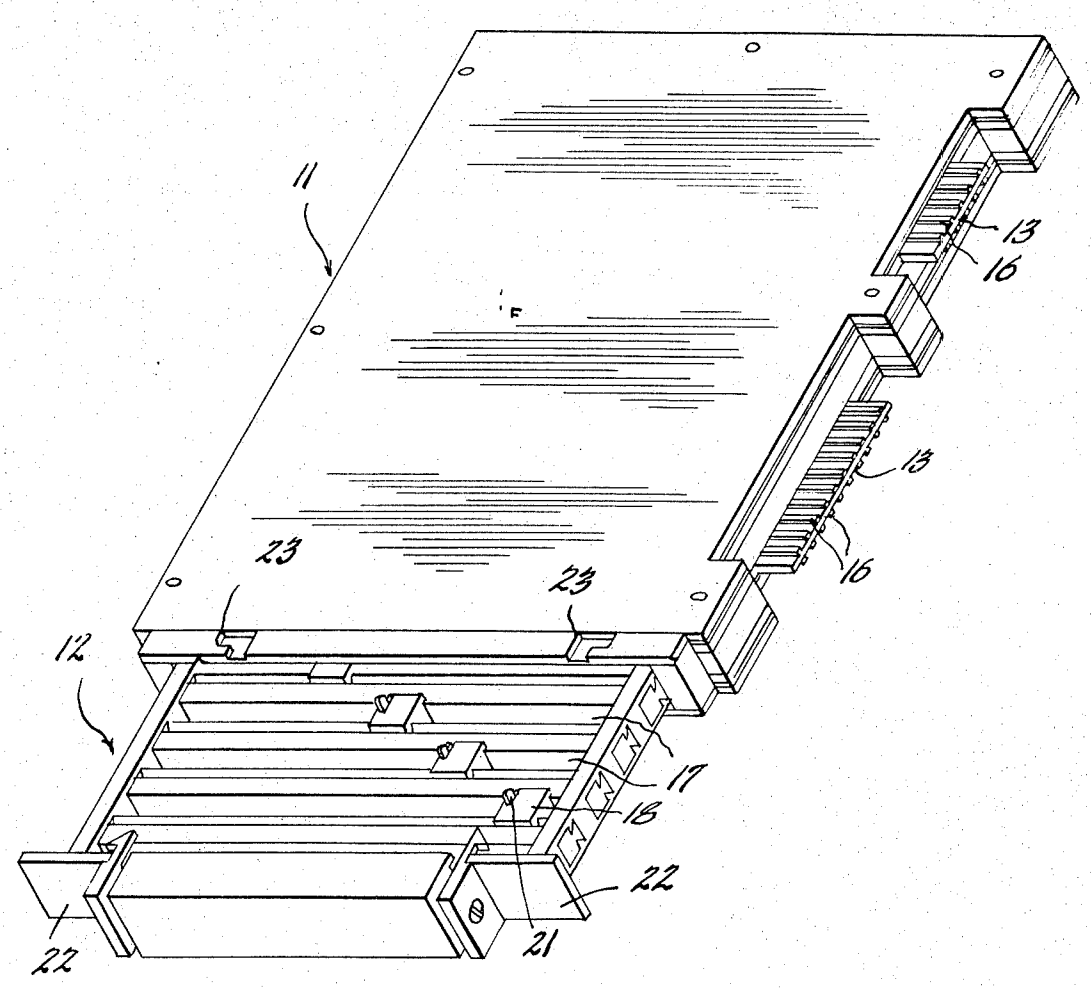


FIG. 1

Inventor
Thomas H. Witcher.

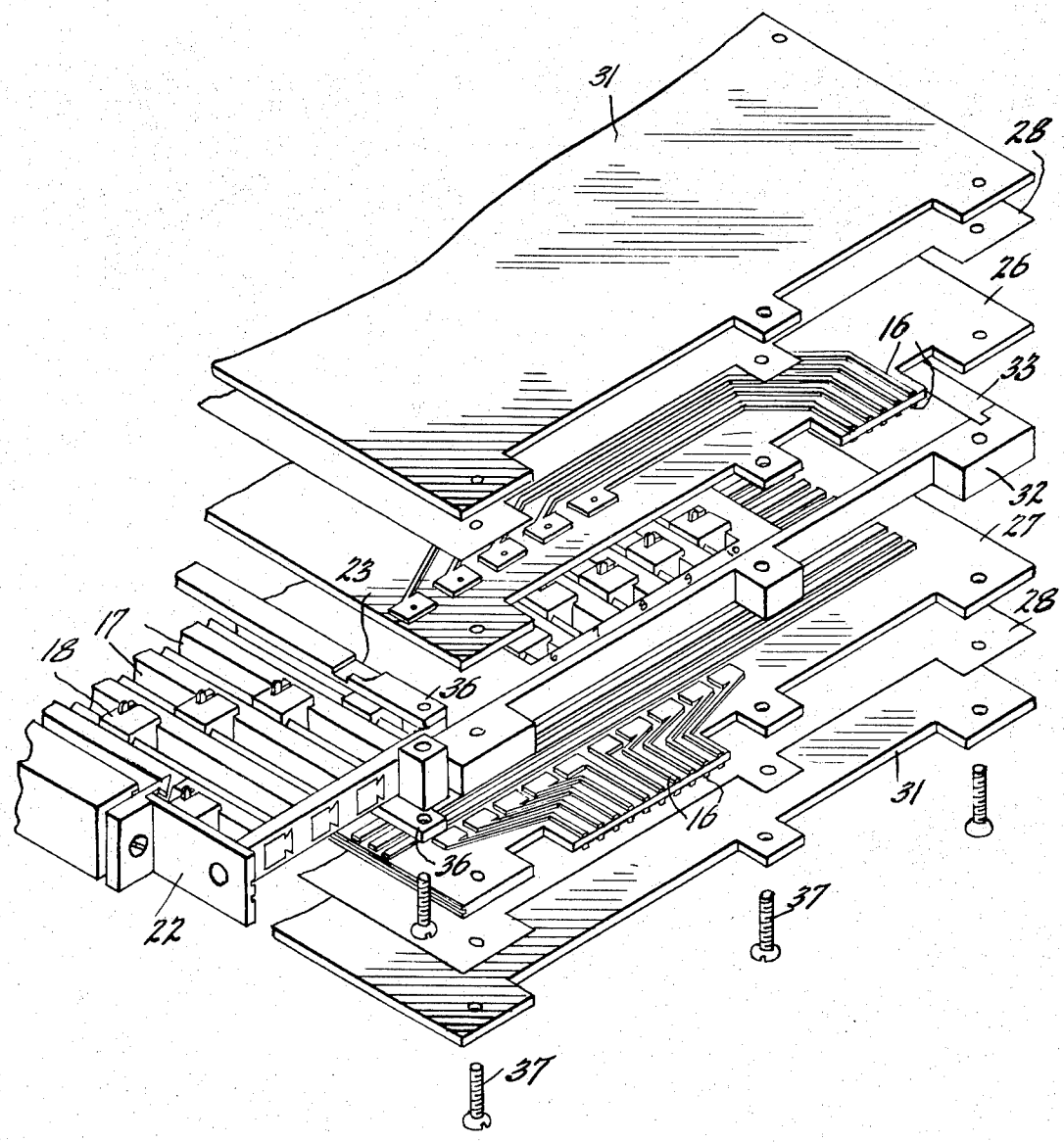


FIG. 2.

INVENTOR
Thomas H. Witcher

BY

ATTORNEY

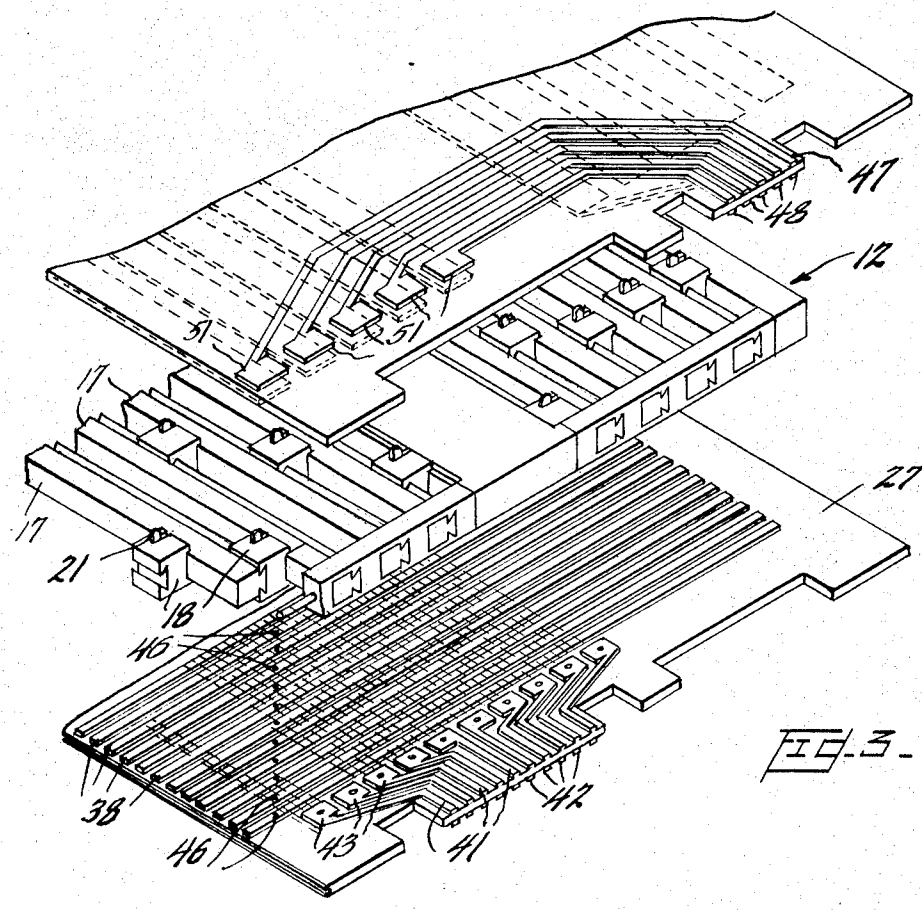


FIG. 3.

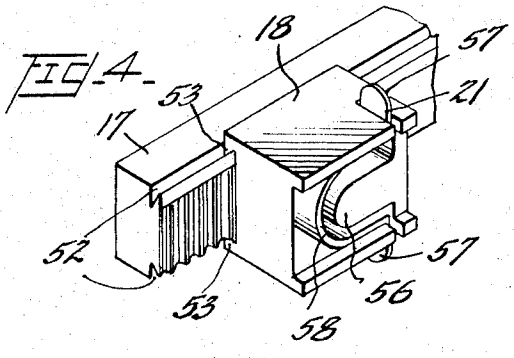


FIG. 4.

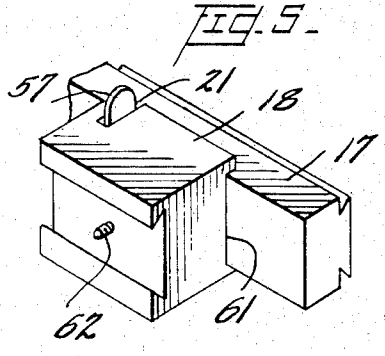


FIG. 5.

INVENTOR

Thomas H. Witcher.

BY

ATTORNEY

SWITCHING MATRIX

BACKGROUND OF INVENTION

1. Field of Invention

Many systems require the provision of a permuting board, that is, a switching matrix. Typically, these systems which are often used in secure communications are required to handle wide ranges in voltage and current. It is not unusual for the same switching matrix to be required to handle currents that vary from the milliampere range to the ampere range, with corresponding voltages that range from millivolts to hundreds of volts. Other typical uses for a settable matrix of this type are found in the computer technologies. Here, as in the communications field, ease in setting the desired matrix pattern is of extreme importance. Moreover, it is extremely desirable to be able to preset the matrix and insert the matrix into the system desired as a separate unit.

2. Description of Prior Art

In prior art switching matrices, no provision has been made to insure that contact resistance does not build up and eventually cause the system to be less sensitive. Typical of the prior art is the patent to Frank et al., U. S. Pat. No. 3,205,469, which issued on Sept. 7, 1965. In that system, as in other similar systems, a cross-contact member (shown in FIG. 4) is inserted through the entire switching matrix and joins two conductive paths, as shown in FIG. 2. It should be realized, in systems such as these, that contact resistance may occur with a corresponding decrease in the sensitivity of the switching matrix. Moreover, if a setting on the matrix shown in the Frank et al. patent is to be changed, the time-consuming process of removing the cross-contact members and relocating them is required. In the alternative, the entire switching matrix may be removed from the system in which it is operating and replaced by a second switching matrix which has been preset.

SUMMARY OF INVENTION

An object of the present invention is to provide a new and improved switching matrix.

Another object of the present invention is to provide a new and improved switching matrix wherein provision is made to keep contact resistance to a minimum.

Still another object of the present invention is to provide a switching matrix that is small in size and simple in construction.

Yet another object of the present invention is to provide a new and improved switching matrix wherein the cross-contact members are permanently attached to a settable matrix.

A further object of the present invention is to provide a switching matrix wherein separate settable matrices may be inserted into the switching matrix to permit rapid changeover in the permutation set in the switching matrix.

Still another object of the present invention is to provide a settable matrix which may be easily withdrawn from the switching matrix.

A further object of the present invention is to provide a switching matrix which may handle very wide ranges in current and voltage.

With these and other objects in view, a switching matrix embodying the present invention may include: an input contact board and an output contact board,

the boards each having a plurality of conductive paths formed therein, means for securing the boards in spaced relation, and a settable matrix adapted for insertion between the input and the output boards.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a perspective view of the switching matrix with the settable matrix partially withdrawn;

FIG. 2 is a partial, exploded view of the apparatus shown in FIG. 1;

FIG. 3 is a partial exploded view of portions of the switching matrix;

FIG. 4 is a partial perspective view of one guide of the settable matrix with an attached slide; and

FIG. 5 is a partial perspective view of one guide of the switching matrix and associated slide.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring now to FIG. 1, the switching matrix is composed of two major units, a pluggable receptacle 11 and a settable matrix 12. The receptacle 11 is adapted to be plugged into any system by means of plugs 13—13 and to receive the settable matrix 12. The switching matrix is electrically connected to the desired system by means of conductive paths 16—16 which form a part of the plugs 13—13.

The settable matrix 12 has a series of guides 17—17 to which slides 18—18 are secured. The slides 18—18 carry cross-contact members 21—21, only a portion of which is visible in FIG. 1. The slides 18—18 are positionable on the guides 17—17, and four of the slides 18—18, set at different positions, are visible in FIG. 1. The construction of the slides and the guides is shown in greater detail in FIGS. 4 and 5 and will be explained more fully herein below. For our present purposes, it is sufficient to say that a latching means, designated by the numerals 22—22 and 23—23, is provided to secure the settable matrix 12 in its seated position within the pluggable receptacle 11.

Referring now to FIG. 2 the several layers of the switching matrix are clearly shown. The settable matrix 12, when it is seated in the receptacle 11, is positioned between an input contact board 27 and an output contact board 26. The contact boards have conductive paths 16—16 secured to both their top and bottom sides. The relationship of the conductive paths to the input and output contact boards will be described in greater detail below. Two insulative shields 28—28 are provided to prevent a shorting of the conductive paths by metallic dust covers 31—31.

A support structure, part of which is shown in this view, includes a support rail 32 which is attached to a cross-support member 33. Further cross-support bars 36—36 are secured to support rail 32. These cross-support bars 36—36 carry a portion of the latching means 23—23, and are beveled so as to compress the cross-contact members 21—21 when inserting the settable matrix 12 into the pluggable receptacle 11. As can readily be seen in FIG. 2, the support rail 32, the cross-support member 33 and the cross-support bars 36—36 provide the basic support for the components of the pluggable receptacle when they are brought into registration and secured by means of screws 37—37. Although not shown in FIG. 2, a second support rail, for the is parallel to the support rail 32, is provided.

This further support rail is secured to both cross-support member 33 and cross-support bars 36—36. In this manner, the pluggable receptacle has a structure which is adapted to receive, at its open end, the settable matrix 12.

Referring now to FIG. 3, only the input contact board 27 and the output contact board 26 of the pluggable receptacle 11, with a portion of the settable matrix 12, are shown. The input contact board 27 has conductive paths running on its top and bottom surfaces. The conductive paths 38—38 are secured to the top portion of the input contact board 27 in a substantially horizontal position. On the same face of the input contact board 27 are substantially perpendicular conductive paths 41—41. On the under side of the input contact board 27 are further perpendicular conductive paths 42—42. Each of the perpendicular conductive paths 41—41 is electrically connected to an associated perpendicular conductive path 42 by means of an electrical connection 43. The electrical connections 43—43 pass from the top to the bottom of the input contact board 27.

A further electrical connection 46 is provided to interconnect each of the perpendicular conductive paths 42—42 with one of the horizontal conductive paths 38—38. In this manner, by applying a particular potential to any of the conductive paths 41—41, a continuous electrical path is provided for any flow of current caused by that voltage through the conductive path 41 involved, to a conductive path 42 by means of one of the electrical connections 43—43, up conductive path 42 to a connection 46 and to a horizontal conductive path 38. Consequently, by applying different potentials to the various conductive paths 41—41, these potentials will appear at the corresponding interconnected horizontal conductive path 38.

The output contact board 26, in a like manner, has conductive paths on its top and bottom surfaces. Each of several conductive paths 47—47, secured to the top of the output contact board 26, is adapted to carry a potential over its path to one of several perpendicular conductive paths 48—48, secured to the bottom of the board 26. Electrical connection is made at a point 51 to interconnect each conductive path 47 with a particular perpendicular conductive path 48. In this manner, by applying a potential to any one of the several conductive paths 47—47, the potential will appear on the specific perpendicular conductive path 48 to which the conductive path 47 is electrically connected. It should be noted that the conductive paths on both the output contact board 26 and the input contact board 27 are secured to insulative material to prevent shorting. Techniques used in fabricating standard printed circuit boards are quite satisfactory for the fabrication of the input and the output contact boards.

The settable matrix 12 is shown in its general spatial relation to the input contact board 27 and the output contact board 26 in FIG. 3. In this view, ten slides 18—18 are visible. The slides are shown in different settings on their respective guides 17—17. The cross-contact members 21—21, described in greater detail herein below, extend from the top and the bottom of the slides. By putting the desired setting on the settable matrix, an electrical interconnection is established between horizontal conductive paths 38—38 attached to the top of the input contact board 27 and perpendicular conductive paths 48—48 attached to the bottom of the output contact board 26. Consequently, if an input potential is applied to the input contact board 27 along one of the various conductive paths 42—42, and a slide 18 is positioned along its guide 17 at a desired location, the input potential would appear at the desired horizontal conductive path 38, and, through the various interconnections, the potential applied to the horizontal conductive path will appear at a desired one of the perpendicular conductive paths 48—48 associated with the output contact board 26.

Referring now to FIG. 4, each guide 17 has a surface 51 which has a series of lands and grooves thereon. On the same surface 51 as the lands and grooves are two V slots 52—52 which are adapted to receive extensions 53—53 on each slide 18 and which secure the slide 18 to the guide 17. Both the slide and the guide are made of an insulative material to prevent any shorting of the cross-contact member 21. The cross-contact member 21 is secured in the slide 18 by being positioned in a slot 56 adapted to receive the cross-contact member 21. The cross-contact member itself has two knife edges 57—57 which are adapted to make contact with the respective conductive paths associated with the input contact board 27 and the output contact board 26. Each cross-contact member 21 has a bend 58 which gives a spring action to the knife edges 57—57. To insure that there is a spring action, the slot 56 must be of suitable width to accommodate the cross-contact member 21 in its compressed position.

Referring now to FIG. 5, one of the slides 18—18 is shown resting on a guide 17. A channel 61 is provided in the slide so that the slide may be securely supported by the guide. A spring-biased detent 62 is adapted to engage the land-and-groove surface 51 of the next adjoining guide when the slide is secured in the settable matrix so that the slide will be held securely at any of a large number of positions along the guide. Also, in this view, the knife edge 57 of cross-contact member 21 is visible. When the settable matrix 12 is inserted into the pluggable receptacle 11, the knife edges 57—57 have a wiping action across the various contact paths with which they come into contact. This is due to two factors, the knife edges associated with each cross-contact member 21 and the spring action due to the bend 58. The wiping action tends to clean the surfaces which are in contact and to prevent any contact resistance from developing.

Should it be desired, several settable matrices can be utilized for one pluggable receptacle. In this mode of operation, those settable matrices not in use could be preset for later use with the receptacle. Naturally, this would be dependent upon the specific needs of the user. Also, the voltage and current any specific switching matrix can carry, is determined in large measure by the thickness and the composition of the conductive paths and the cross-contact members. For many uses, the noble metals are extremely desirable for use as the conductive materials. This is so because of their good conductive properties and the small voltages in currents that a switching matrix may be required to handle.

The above description is of a preferred embodiment of the switching matrix, and numerous modifications

can be made thereto without departing from the spirit and scope of the invention which is limited only by the appended claims. For example, one modification that may be made is that the various conductive paths could be rearranged, there being no need for them to be in the horizontal and vertical position. Or, as another example, the spring action in the cross-contact members could be achieved by using coiled springs.

What is claimed is:

1. A switching matrix comprising an input contact board and an output contact board, said boards each having a plurality of conductive paths, means for securing said boards in spaced relation, and a settable matrix having means for infinitely varying the setting between said contact boards.

2. A switching matrix comprising an input contact board and an output contact board, said boards each having a plurality of conductive paths, means for securing said boards in spaced relation, and a settable matrix adapted for insertion between said input and output boards, said settable matrix comprising a plurality of guides and a plurality of slides, each of which is secured to a separate guide.

3. The combination set forth in claim 2 in which each of said slides comprises an insulative block and a cross-contact secured to said insulative block.

4. The combination set forth in claim 3 in which said input contact board and said output contact board are printed circuit boards.

5. The combination set forth in claim 3 in which said conductive paths are in a straight line, and said plurality of conductive paths associated with said input contact boards are substantially perpendicular with respect to said plurality of conductive paths associated with said output contact board.

6. The combination set forth in claim 3 in which each of said cross-contacts is adapted to engage simultaneously one conductive path associated with said input contact board and one conductive path associated with said output contact board.

7. The combination set forth in claim 6 in which each cross-contact comprises two knife edges, one knife edge being engaged with one input conductive path and the other knife edge being engaged with one output conductive path.

8. The combination set forth in claim 6 in which each of said cross-contact comprises conductive material bent so as to give spring action to those parts of said cross-contact adapted to engage said conductive paths.

9. The combination set forth in claim 6 in which each of said cross-contacts comprises conductive material bent so as to give spring action to those parts of said cross-contact adapted to engage said conductive paths and two knife edges on said conductive material, one knife edge being engaged with one input conductive path and the other knife edge being engaged with one output conductive path.

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