May 21, 1957 K. N. HEIMBACH 2,793,354

PLUG-IN CONNECTOR TYPE TERMINAL BOARD

Filed March 2, 1954 3 Sheets-Sheet 1

FIG. 1.

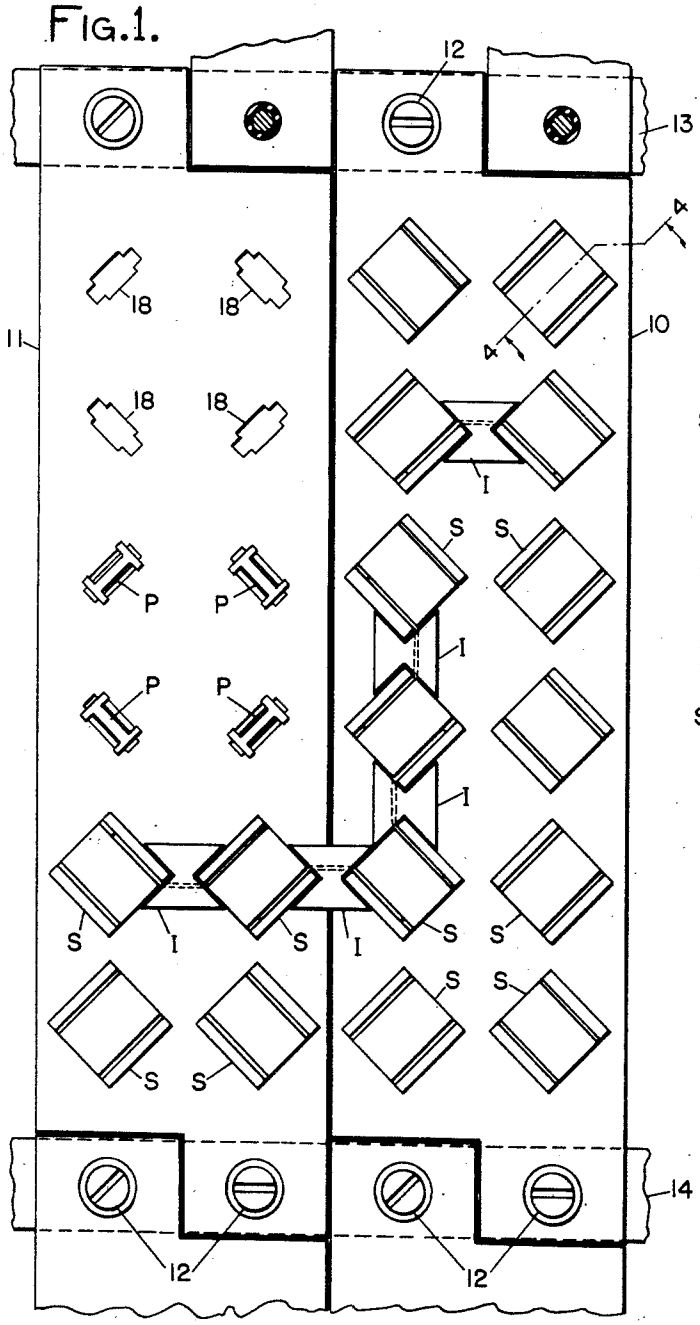
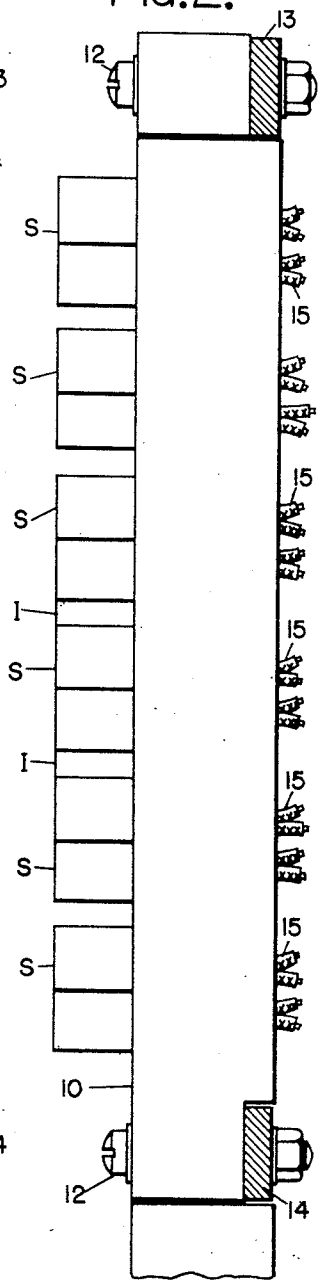


FIG. 2.



INVENTOR.
K.N.HEIMBACH

BY Forest B. Hitchcock

HIS ATTORNEY

May 21, 1957 K. N. HEIMBACH 2,793,354

PLUG-IN CONNECTOR TYPE TERMINAL BOARD

Filed March 2, 1954 3 Sheets-Sheet 2

FIG. 3.

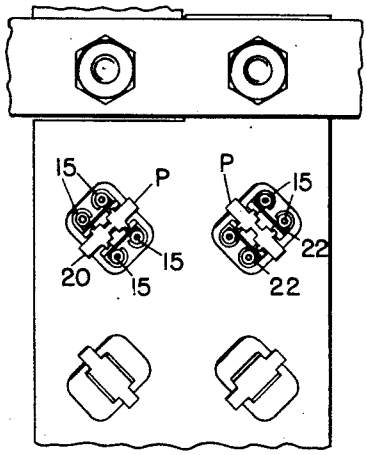


FIG. 8.

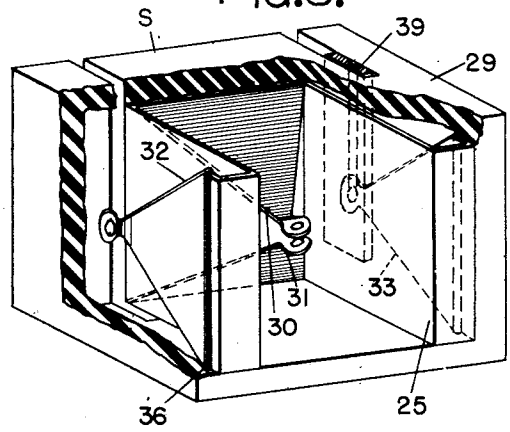


FIG. 4.

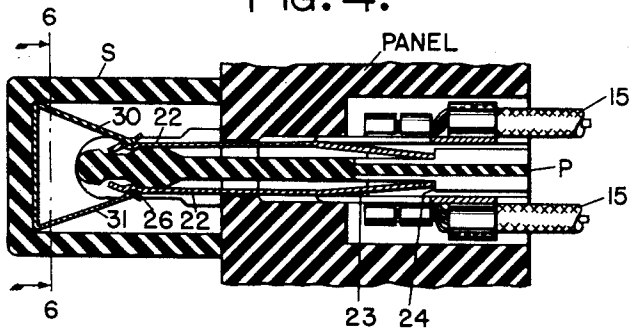


FIG. 6.

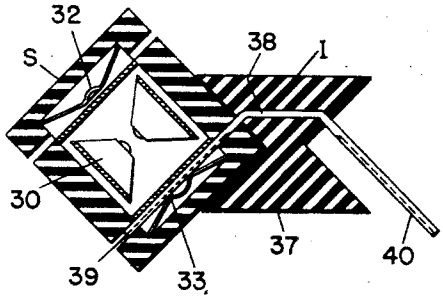
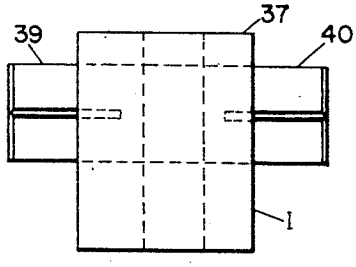


FIG. 7.



INVENTOR.

K.N.HEIMBACH

BY

Forest B. Hitchcock

HIS ATTORNEY

May 21, 1957 K. N. HEIMBACH 2,793,354

PLUG-IN CONNECTOR TYPE TERMINAL BOARD

Filed March 2, 1954 3 Sheets-Sheet 3

FIG. 5.

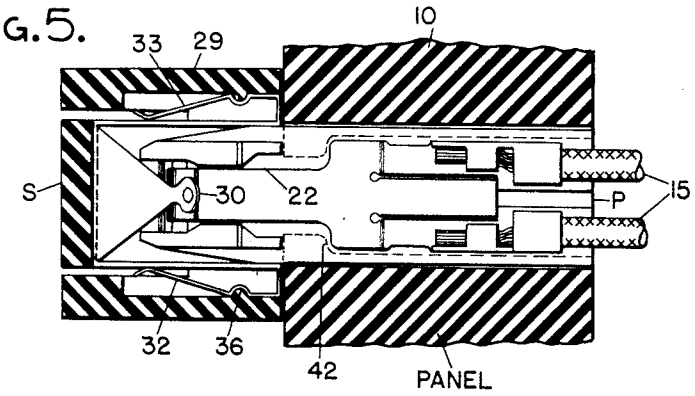


FIG. 9.

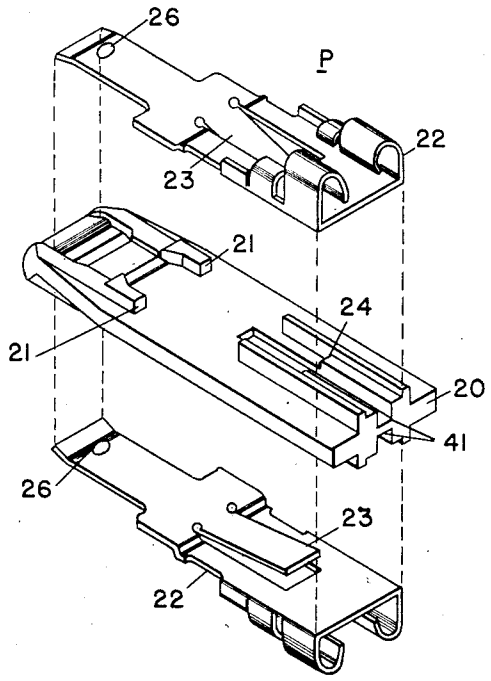


FIG. 10.

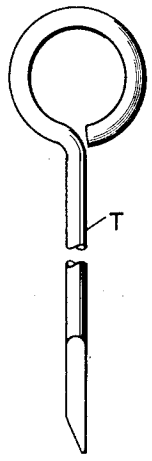
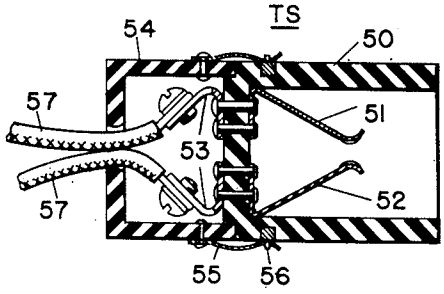


FIG. 11.



INVENTOR.
K.N.HEIMBACH
BY Forest B. Hitchcock
HIS ATTORNEY

United States Patent Office 2,793,354 Patented May 21, 1957

2,793,354

PLUG-IN CONNECTOR TYPE TERMINAL BOARD

Karl N. Heimbach, Mexico City, Mexico, assignor to General Railway Signal Company, Rochester, N. Y.

Application March 2, 1954, Serial No. 413,690

7 Claims. (Cl. 339—198)

This invention relates to terminal boards for interconnecting electrical circuits.

In the provision of various types of electrical control systems, it is desirable to provide terminal boards to which certain of the circuits are brought so that these circuits may be normally interconnected by electrical jumpers between terminals; but may at times be disconnected by the removal of the jumpers so that testing operations for the various circuits may be accomplished. This is particular true in a railway signalling system where a high degree of safe performance is required.

In accordance with the present invention, it is proposed to provide a terminal board for the above mentioned purposes which is of the plug-in type. More specifically, it is proposed to bring the various wire connections to the back of the terminal board and have them electrically connected to the conductive contact springs or fingers of the plug members which extend outside of the terminal board or panel on its other side or face. It is then proposed to provide socket connections which may be placed over the extending plugs to provide the normal electrical interconnection between any pair of plug contact fingers.

In some instances, it is not only desired to have electrical connections between the two contact fingers of a plug for a particular circuit but it is also desired to have several different circuits interconnected. In accordance with the present invention, this is accomplished by having additional members or interconnectors for providing connections between the different socket connectors. These interconnectors snap into slots provided in the various socket connectors. In this way, the interconnection of the circuits is accomplished wholly on the face of the terminal board and may be readily removed for testing and the like as well as being readily replaceable after such testing operation has been completed.

The provision of this type of a terminal board not only facilitates testing operations during the maintenance of the associated apparatus but also provides greater versatility in the use of the terminal board for various circuit combinations.

Another object of the invention may be said to provide an organization of the above described character which is economical to manufacture and install in connection with electrical systems.

Other objects, purposes and characteristic features of the present invention will become apparent as the description of the invention progresses.

In describing the invention in detail, reference will be made to the accompanying drawings, in which:

Fig. 1 is a front view of a plug terminal board panel constructed in accordance with the present invention;

Fig. 2 is a side view of a terminal board panel as shown in Fig. 1;

Fig. 3 is a fragmentary view of the back of one terminal board panel;

Fig. 4 is a cross-sectional view showing one of the plug members with its socket connector member in place;

Fig. 5 is a top sectional view of one of the plug members with its socket connector member in place;

Fig. 6 is a bottom sectional view of a socket connector and an associated socket interconnector;

Fig. 7 is a side view of a socket interconnector;

Fig. 8 is an isometric sectional view of a socket connector which is shown slightly enlarged;

Fig. 9 illustrates the construction of the plug members and their conductive contact springs;

Fig. 10 illustrates the special tool employed for removing the contact springs of a plug connector; and

Fig. 11 shows a test socket member for use in connection with the testing of the circuits.

With reference to Figs. 1 and 2 of the drawings, the terminal board panels **10**, **11**, etc. are mounted in a row on supporting bars **13** and **14** by suitable bolts **12**. It is readily apparent that there can be any desired number of these panels **10**, **11**, etc. mounted in a row. It is assumed that other panels may be mounted above and below those shown by the use of additional support bars or brackets (not shown). It will be observed that the panels **10** and **11** have protruding ends which are suitably fastened to the supporting bars, and these ends are offset in such a way as to match with the panels mounted above and below the panels shown. In this way, the same supporting brackets **13** and **14** may be used for the adjacent rows of terminal panels.

In Fig. 2, the edge of the panel **10** is shown so that it can be readily seen that the wires **15** may be brought into the plug members P from the back of the panel; while on the face of the panel the various socket connectors S are shown in their respective positions. In connection with the panel **11**, four of the plug members P have been shown removed to illustrate how the holes **18** are provided in the panel for mounting the plug members with their respective contact springs. In addition, four plug members P have been shown in position on this panel **11** but with their respective socket connectors S removed, while there are also four plug members with their socket connectors in place. All of the plug units for panel **10** have been shown with their respective socket connectors S in position and certain of these are shown with associated interconnectors I. These interconnectors I are so positioned to illustrate how circuit connections may be carried from one panel to an adjacent panel as well as between socket connectors on the same panel.

Each of these panels, such as **10** and **11**, is provided with a plurality of rectangular holes **18** formed therein and these holes are at 45° angles with respect to the vertical. It should also be noted that alternate holes of any row are 45° from the vertical in opposite directions. This is to permit the use of the interconnectors I, as later described. Each of these holes **18** receives a plug member P from the face of the panel. This plug member P is placed in position during manufacture under proper press fit conditions so that its plug member **20** is firmly held in its position. This member **20** can be inserted only until its abutments **21** touch the outer surface of the face of the panel **10**. Associated with each plug member **20** is two identical contact springs **22**, each of which has prongs at one end for connecting one or more wires suitably held by soldering and/or crimping of the contact spring. Thus, springs **22** are inserted into opposite sides of each plug member **20** from the back of the panel after the wires have been connected. They snap into position so that they are prevented from being withdrawn by reason of the centrally extending spring portion **23** which snaps into position against the abutments **24** of the plug member **20**. This structure of the plug P with its contact springs has been generally shown and described in the Patent No. 2,457,703, to Merkel; but more particularly the plug members P for the present

invention have their contact springs 22 provided with suitable "dimples" or ridges 26 over which the contact springs of a socket connector S may snap so as to be held in position.

Referring to Fig. 8, it can be seen that each socket connector S is formed of insulating material to make a box-like structure including within it a metal insert 25 which has two extending fingers 30 and 31 for connecting the two contact springs 22 of any plug pair. These contact fingers 30 and 31 are formed by a single sheet of metal, which also has portions doubled back to form fingers 32 and 33. This organization may be suitably stamped from a flat strip of suitable metal such as phosphorus bronze or the like, and then formed on a suitable press before being inserted into the molded box-like shell of the socket. This metal contact insert 25 is held within the socket outer portion 29 by reason of a crimped groove in the fingers 32 and 33 snapping over respective ridges 36 within the opposite sides of the shell 29 as shown in Fig. 5.

Referring to Fig. 4, a socket connector S is shown in section as being mounted in position to cooperate with a plug P. This shows the contact fingers 30 and 31 of the socket connector S completing a circuit between the fingers 22 of the plug P and also being received in the small dimples 26 near the ends of the contact springs 22.

With reference to Fig. 5, the socket connector S is shown in the same position as shown in Fig. 4 but viewed from the top. This Fig. 5 illustrates how the contact finger 30 connects with the upper spring 22 and is an integral part with the fingers 32 and 33 which are adapted to receive the extending prongs of interconnectors I as shown in Fig. 6.

The interconnectors I are formed of suitable molded insulating material to make a block-like member 37 which has molded into it a metal strip 38. This conducting strip 38 has extending prongs 39 and 40. The block 37 has its ends indented so as to fit two socket connectors S, while the prongs 39 and 40 are inserted in the slots of such socket connectors. Each of the prongs 39 and 40 has a groove to allow the dimple of a contact such as 33 to snap into it. This groove can be slightly seen at the cross sectional point of prong 39 as viewed in Fig. 8. The interconnector I is shown in Fig. 7 viewed from the bottom as seen in Fig. 6. This shows that each of the prongs 39 and 40 has a groove extending longitudinally along it.

The interconnectors I can then be inserted at any one of four corners of a socket connector S. This has been illustrated in Fig. 1 where the interconnectors I are shown at different angles. However, it will be observed that only two interconnectors I can be attached to one socket connector S at a time. This is because the prongs of an interconnector I occupy substantially the entire slot on one side of a socket connector S.

Referring to Fig. 10, it will be seen that a tool T has a pointed end with an inclined plane. This tool T is made of sufficient thickness so that it can be inserted in the groove 41 of the plug member 20 to force upwardly the spring 23 of a finger 22 to release it from locking with abutments 24. This allows a maintainer to remove such finger 22 at any time to make changes in wiring connections. The Fig. 3 shows the back of the panel where there are two wires 15 fastened to each of the two contact springs 22 with respect to two of the plug members P. It should also be observed that when the contact fingers 22 are inserted, and the spring portions 23 are locking against abutments 24, they cannot be withdrawn, and since the springs 22 are enlarged to have shoulders for abutting against the inner portions 42 of the rectangular holes in the panel, neither the springs nor the plug members P can be moved. This is because the members 20 are placed into the panel 10 from its face while the springs 22 are placed into the panel from its back.

Referring to Fig. 11, a test socket TS is shown as having an outer shell 50 which is made of suitable molded material and within which is located two contact springs 51 and 52. These contact springs are independent and are held by rivets which extend through the shell to the opposite side for supporting terminal pieces 53. This permits the attachment of wires 57, as illustrated, and permits a molded cap 54 to be snapped into position to cover the terminals 53. This cap 54 is suitably held in position by springs 55 having holes for receiving prongs of inserts 56. Whenever a maintainer desires to make a test, he can remove a regular socket connector S and snap the test socket TS into position. The wires 57 may be connected to any suitable test instruments.

Having described one form of a plug-in connector type terminal board as one specific embodiment of the present invention, it is desired to be understood that this form is selected to facilitate in the disclosure of the invention rather than to limit the number of forms which it may assume; and it is to be further understood that various modifications, adaptations and alterations may be applied to the specific form shown to meet the requirements of practice, without in any manner departing from the spirit or scope of the present invention.

What I claim is:

1. In a terminal board structure, a panel member having a plurality of equally spaced recesses, a plug member inserted in each of said recesses, each plug member having at least a pair of contact springs for wire connections on one side of said panel and said contact springs extending outside the surface of said panel on its other side, a plurality of insulated quickly detachable socket members each having an electrically conductive metal insert formed to connect any pair of said contact springs when said socket member is positioned over the corresponding pair, and each of said socket members having a slot for receiving one prong of an interconnector for making contact with the metal insert of that socket member, and a plurality of quickly detachable interconnectors each having a metal strip forming two extending prongs with an insulated central portion, each of said interconnectors being of the proper length to connect adjoining socket members when its prongs are inserted in slots of such socket members respectively.

2. In a terminal board structure, a panel having a plurality of equally spaced recesses, said recesses being rectangular and located to have their longitudinal axis at 45° away from the vertical, alternate ones of said recesses being away from the vertical on opposite sides thereof, a plug member inserted in each of said recesses, each plug member having a pair of contact fingers for wire connections on one side of said panel and said contact fingers extending outside the surface of said panel on its other side, a plurality of quickly detachable socket members each having a pair of electrically joined contact springs adapted to make contact with a pair of plug member fingers when positioned over the corresponding plug member, said socket members also being constructed to receive the prongs of two quickly detachable interconnector members, a plurality of quickly detachable interconnectors each having two extending metal prongs electrically connected and shaped to fit any socket member.

3. In a terminal board structure, a plurality of panels located adjacent each other, each panel having a plurality of spaced recesses, a plug member inserted in each of said recesses and having a pair of contact fingers for wire connections on one side of its panel and said contact fingers extending outside the surface of its panel on its other side, a plurality of quickly detachable insulated socket members each having a conducting metal insert formed to connect any pair of said contact fingers of said plugs when said socket member is positioned over the corresponding pair, a plurality of quickly detachable in-

terconnectors each having two extending prongs adapted to be received by any adjacent pair of socket members, whereby the plug member contact fingers may be interconnected in different rows by the positioning of a plurality of socket members and interconnectors for those rows either in the same or adjoining panels.

4. In a terminal board, a panel having a plurality of pairs of spaced contact fingers protruding from the surface of the panel at equally spaced points, quickly detachable sockets for the respective pairs of contact fingers, said sockets having two laterally spaced slots formed therein extending in a plane parallel to the surface of the panel, said slots being formed in each of the sockets at right angles to those of the next laterally and elevationally adjoining sockets, contact strips extending from said slots to make quickly detachable electrical connection with said fingers, and a plurality of quickly detachable connectors, each of said connectors having a contact strip extending through the connector and protruding from opposite sides thereof so that the protruding ends extend at angles to each other of substantially 90°, said protruding ends being receivable in certain of said slots in adjoining sockets so as to make electrical connections between fingers of different pairs.

5. In a terminal board, a panel having a plurality of pairs of spaced contact fingers protruding from the surface of the panel at equally spaced points, a quickly detachable socket for each of the pairs of contacts, said sockets having two laterally spaced slots formed therein extending in a plane substantially parallel to the surface of the panel, said slots being disposed in each of the sockets at right angles to those of the next laterally and elevationally adjoining sockets, a contact strip in each of the sockets for making a quickly detachable electrical connection between a pair of contact fingers, said contact strip extending into both of said slots in the associated sockets, and a plurality of connectors having quickly detachable contact strips receivable in the slots of adjoining sockets, the contact strips of two connectors being respectively receivable one in one slot and the other in the other slot contemporaneously in the two laterally spaced slots of a single socket.

6. In a terminal board, a panel having a plurality of pairs of spaced contact fingers protruding from the surface of the panel at equally spaced points, each of the

pairs of contact fingers being disposed at right angles to the next adjoining pair horizontally or vertically, a quickly detachable socket for connecting the contact fingers of any pair with which it may be associated, said socket having at least one slot formed therein in a plane parallel to the surface of the panel, a contact strip in said socket extending into said slot and adapted for electrical connection with at least one of said contact fingers of a pair, and an interconnector having a protruding contact strip detachably receivable in said slot of said socket for extending the connection from said socket to a similar adjoining socket, said interconnector being effective to extend the connection horizontally or vertically dependent upon which side up it is disposed when inserted in a slot of the socket.

7. In a terminal board, a panel having a plurality of pairs of spaced contact fingers protruding from the surface of the panel at equally spaced points in horizontal and vertical rows, quickly detachable sockets for the respective pairs of contact fingers, said sockets having two laterally spaced slots formed therein extending in a plane parallel to the surface of the panel, said slots being formed in each of the sockets at right angles to those of the next horizontal and vertical adjoining sockets, contact strips extending from said slots to make quickly detachable electrical connection with said fingers, and a plurality of quickly detachable connectors, each of said connectors having a contact strip extending through the connector and protruding from opposite sides thereof so that the protruding ends extend at substantially right angles to each other, said protruding ends being receivable in certain of said slots in adjoining sockets so as to make electrical connections between fingers of different pairs, whereby said connector when used one side up is adapted for connection of horizontal adjoining sockets and when used the other side up is adapted for connection of vertically disposed sockets.

References Cited in the file of this patent

UNITED STATES PATENTS

2,380,151 David ---------- July 10, 1945

FOREIGN PATENTS

20,486 Great Britain ---------- of 1899