

[54] **APPARATUS FOR CONNECTING CONDUCTORS TO TERMINALS IN CONNECTORS INTERMEDIATE THE ENDS OF THE CONDUCTORS**

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[52] **U.S. Cl.** ..... **29/203 MW**

[51] **Int. Cl.** ..... **H01r 43/04**

[58] **Field of Search** ..... 29/203 MW, 203 P, 203 J, 29/203 HT, 203 DT, 203 DS

[56] **References Cited**  
**UNITED STATES PATENTS**

3,758,935 9/1973 Long et al. .... 29/203 MW  
 3,766,622 10/1973 Brehm et al. .... 29/203 MW

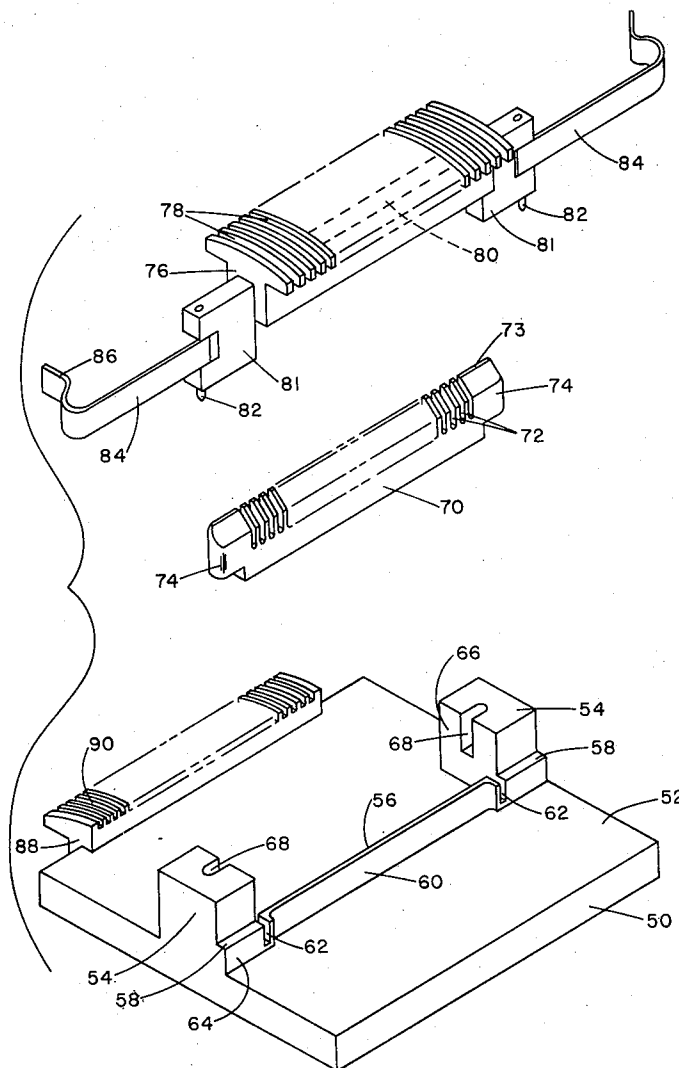
3,803,695 4/1974 Tucci ..... 29/203 H  
 3,816,897 6/1974 Long ..... 29/203 MW

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*Attorney, Agent, or Firm*—Frederick W. Raring; Jay L. Seitchik; William J. Keating

[57] **ABSTRACT**

Apparatus for connecting intermediate portions of conductors to terminals arranged in two parallel rows in an electrical connector has a jig plate for supporting the connector above its surface, means for locating conductors in alignment with the terminals in the upper row with reference to the jig plate, and an inserter which is movable towards the jig plate to insert the wires into the terminals. After the wires have been inserted, the connector is removed from the jig plate and reversed so that the remaining row of terminals is the upper row and wires can be inserted into the terminals in this remaining row.

**5 Claims, 10 Drawing Figures**



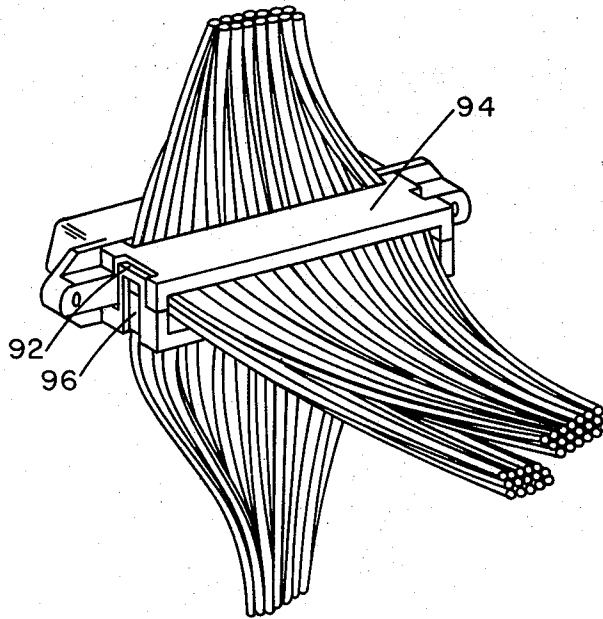


FIG. 1

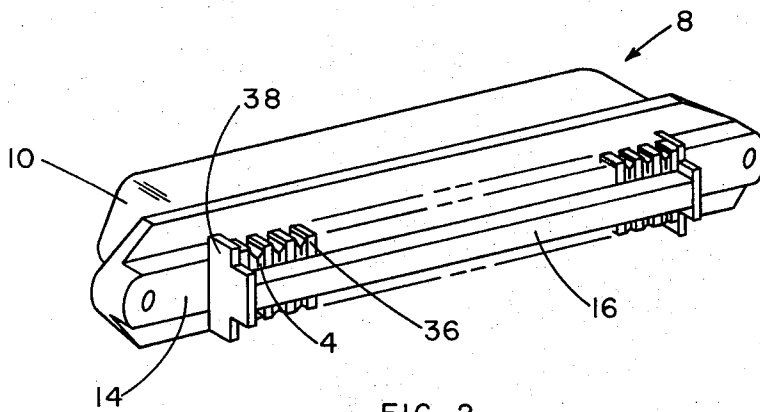


FIG. 2

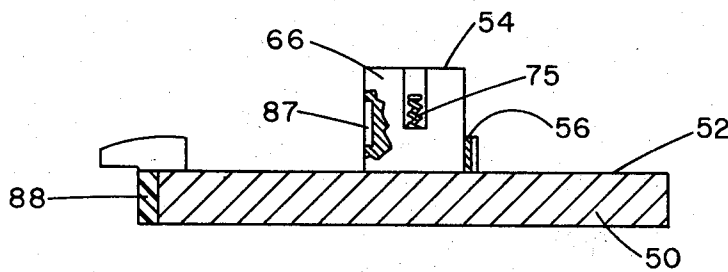
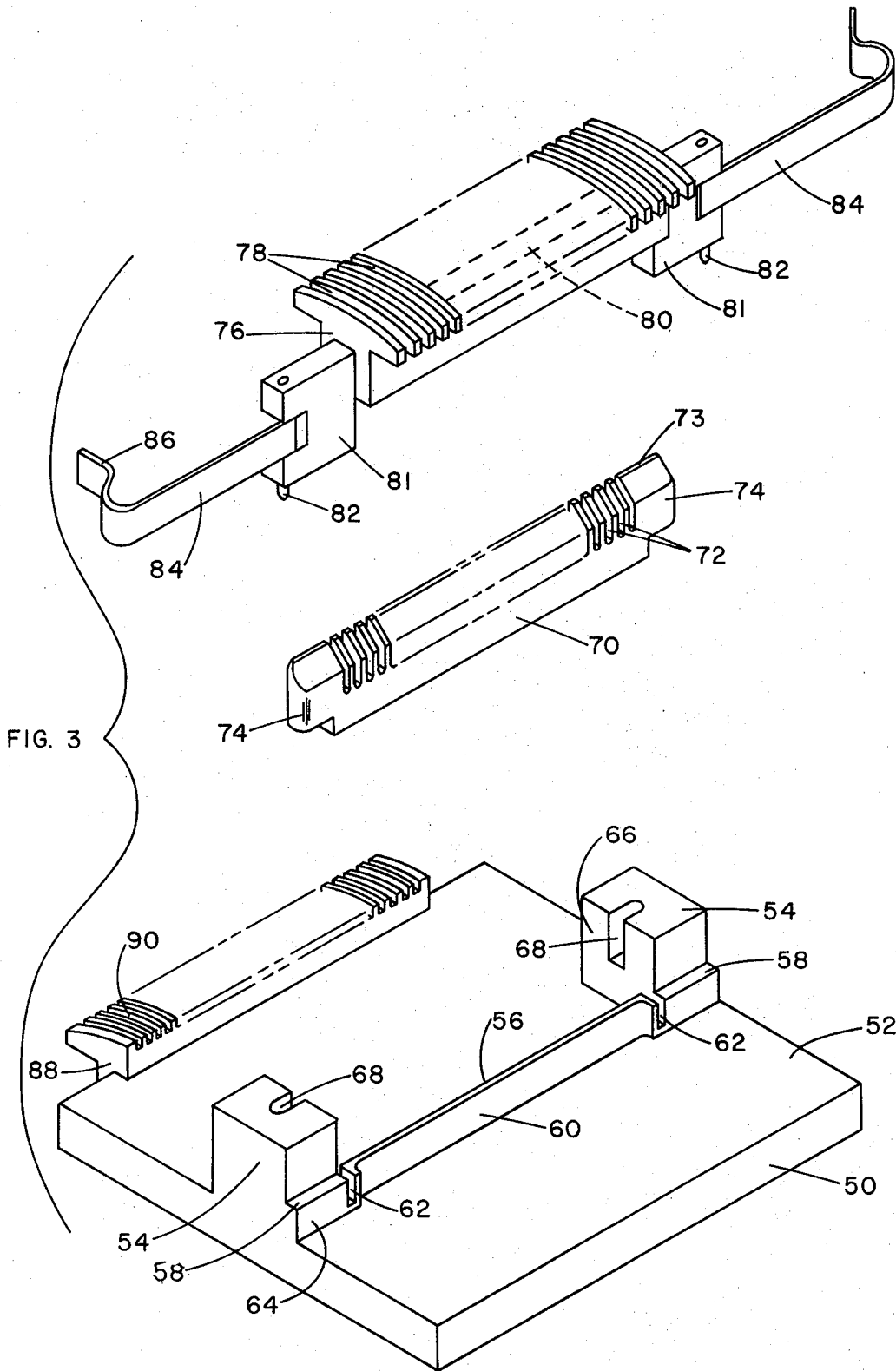
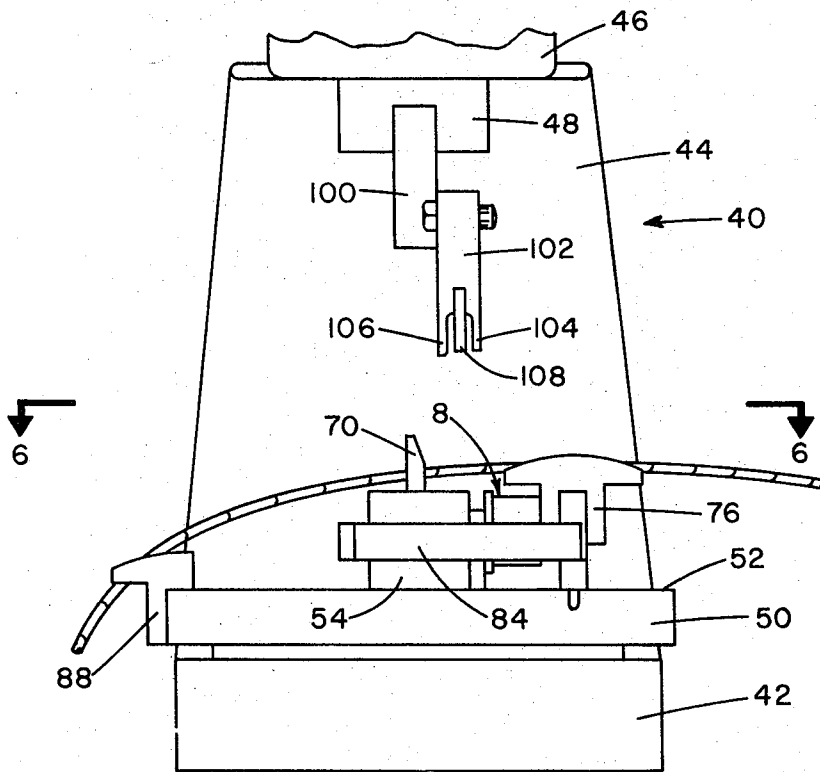
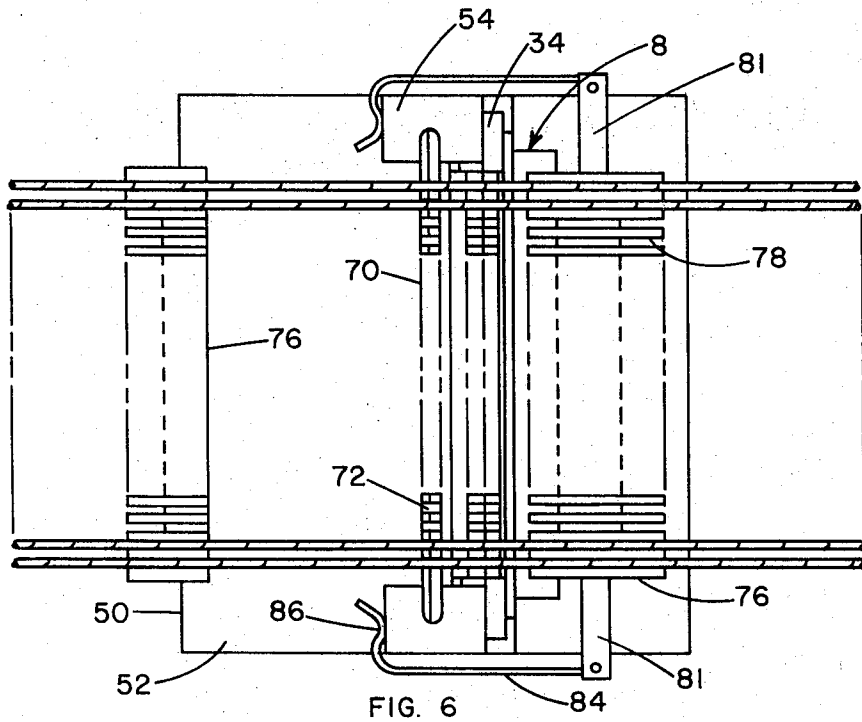
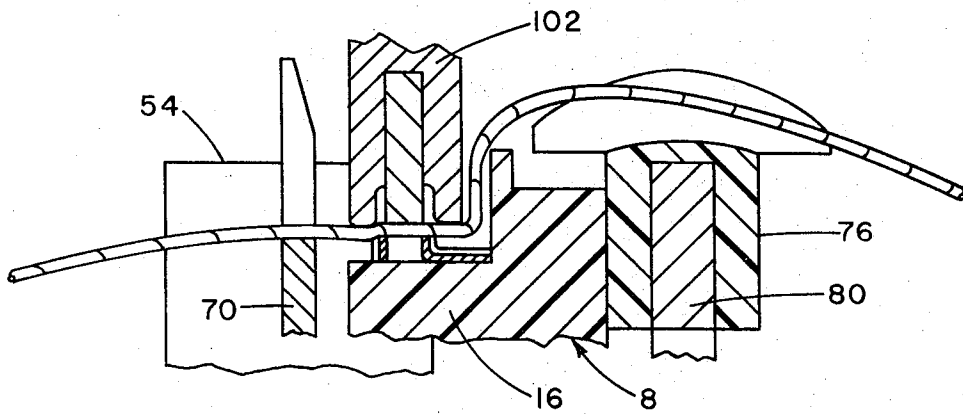
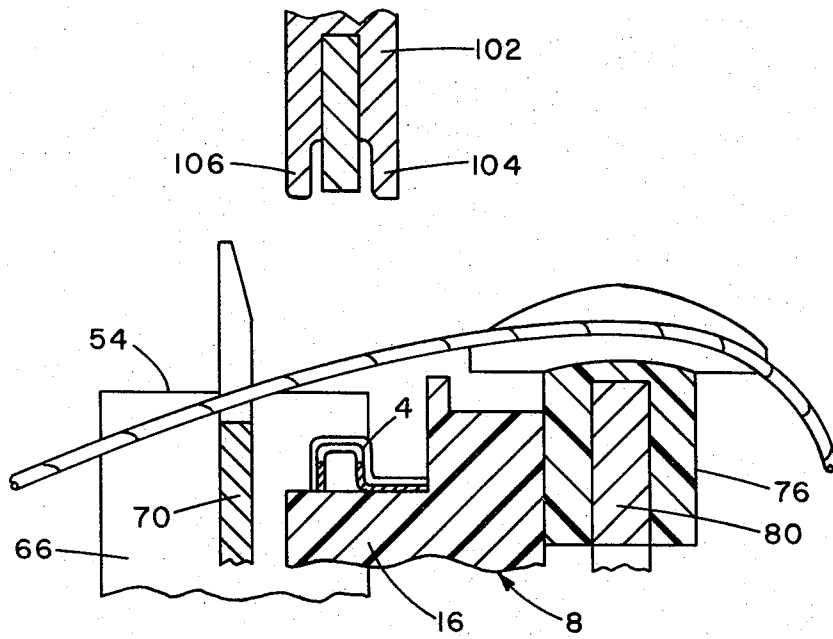


FIG. 4







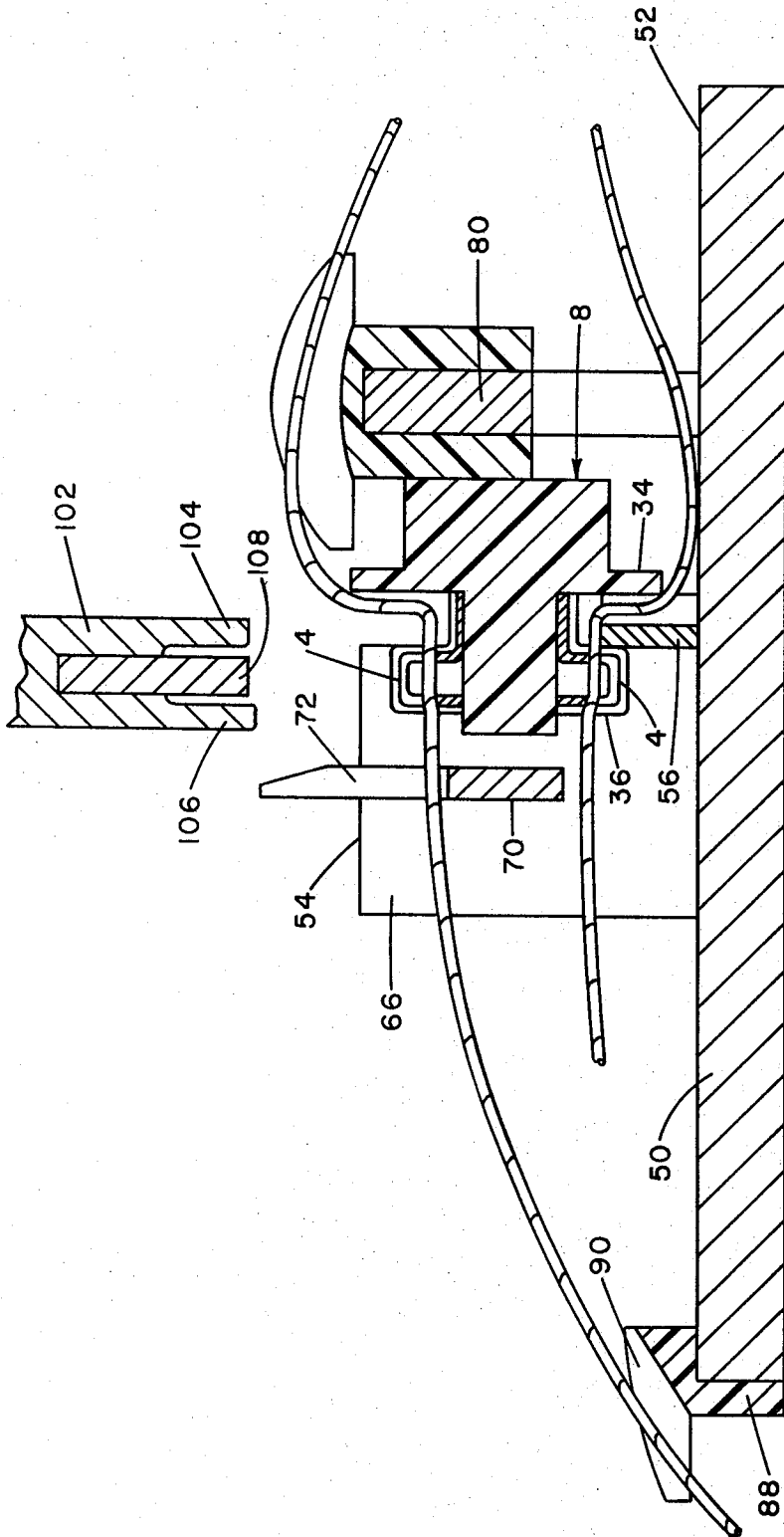


FIG. 9

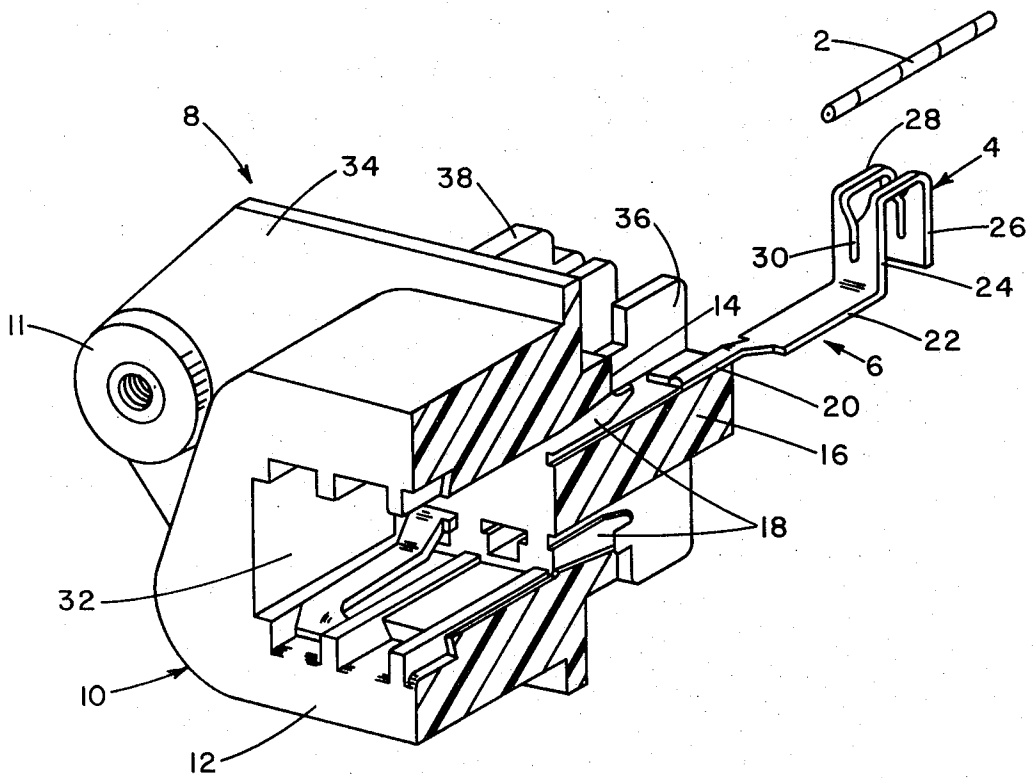


FIG. 10

# APPARATUS FOR CONNECTING CONDUCTORS TO TERMINALS IN CONNECTORS INTERMEDIATE THE ENDS OF THE CONDUCTORS

## BACKGROUND OF THE INVENTION

This invention relates to an improved apparatus for inserting intermediate portions of wires into electrical contact terminals arranged in two parallel rows in an electrical connector housing. The instant invention is related to the apparatus which I show in application Ser. No. 312,394, now U.S. Pat. No. 3,803,695 which shows an earlier form of apparatus for inserting intermediate portions of wires into terminals. The instant invention is also related to the conductor inserting apparatus shown in applications Ser. Nos. 442,958, 442,959, 442,941, which are being filed of even date herewith, in that the several types of apparatus shown in these applications have several common structural parts.

U.S. Pat. No. 3,760,335 discloses and claims a multi-contact electrical connector having two parallel rows of contact terminals therein. Connectors of this type are widely used in the telephone industry and in other industries. In ordinary use, the ends of wires are directly connected to the wire-receiving portions of the electrical contact terminals by means of a suitable apparatus of the type shown, for example, in U.S. Pat. Nos. 3,758,935 or 3,766,622. Under some circumstances, however, it is desirable to connect wires to terminals in such connectors at an intermediate location on the wire so that each wire will extend continuously to a terminal in the connector and then from the terminal to another circuit or circuits. The apparatus disclosed and claimed in application Ser. No. 312,394, now U.S. Pat. No. 3,803,695, was developed specifically for this type of wire connecting operation.

While this prior apparatus was well received and has been successfully used, there is a need for a relatively more simple wire inserting apparatus capable of connecting intermediate portions of wires to terminals in a connector and it is to this need that the present invention is addressed.

It is accordingly an object of the invention to provide an improved apparatus for connecting intermediate portions of wires to contact terminals in a multi-contact electrical connector. A further object is to provide a relatively simple apparatus which can be operated without the requirement of a high level of training or skill on the part of the technician. A further object is to provide an apparatus having a limited number of parts, some of which are interchangeable with other types of wire inserting apparatus adapted to perform other types of wire connecting operations such as the connection of the ends of wires to terminals in a connector. A further object is to provide a relatively simple and robust wire inserting apparatus which can be designed for use with different sizes of connectors and which can be readily adapted for use with different sizes of connectors.

These and other objects of the invention are achieved in a preferred embodiment thereof, which is briefly described in the foregoing abstract, which is described in detail below, and which is shown in the accompanying drawing in which:

FIG. 1 is a perspective view of an electrical connector having intermediate portions of wires connected to

its terminals therein in accordance with the invention.

FIG. 2 is a perspective view of the rearward side of the connector prior to the insertion of wires into the wire-receiving portions of the terminals therein.

FIG. 3 is a perspective exploded view of the fixed or lower tooling of an apparatus in accordance with the invention.

FIG. 4 is a side view, partially in section of a jig plate which forms part of the lower tooling shown in FIG. 3.

FIG. 5 is a frontal view of the apparatus showing the positions of the parts prior to insertion of wires into the wire-receiving portions of the terminals.

FIG. 6 is a view taken along the lines 6—6 of FIG. 5.

FIG. 7 is a fragmentary sectional side view showing portions of the fixed tooling and of the movable insertion tooling, this view showing the positions of the part prior to insertion of the wires into the terminals in the connector.

FIG. 8 is a view similar to FIG. 7 but showing the positions of the parts at the conclusion of the wire inserting operation.

FIG. 9 is a sectional frontal view of the apparatus which illustrates the ability of the apparatus to insert wires into each of two parallel rows of terminals in the connector.

FIG. 10 is a fragmentary perspective view showing details of the type of connector for which the herein disclosed embodiment of the invention is intended.

The embodiment of the invention disclosed herein is specifically intended for inserting wires into a connector of the general type shown in FIG. 10 and disclosed more fully in the above-identified U.S. Pat. No. 3,760,335. An understanding of some of the structural features of this connector will facilitate an understanding of the instant invention and the connectors shown in FIG. 10 is, therefore, briefly described below.

In accordance with the teachings of U.S. Pat. No. 3,760,335 wires 2 are connected to the wire receiving portions 4 of electrical contact terminals 6 which are contained in the housing 10 of the connector 8. The housing has a mating face 12 and a rearward face 14. A central rib 16 extends from the rearward side or face and a plurality of side-by-side contact receiving cavities 18 extend through the housing on the upper and lower sides of the rib. Each cavity contains an individual terminal 6 and each terminal has a forward contact portion 20, an intermediate shank 22, and the previously identified wire receiving portion 4 which comprises two plate-like members 24, 26 which are connected at their upper ends by strap sections 28. The wire 2 is moved laterally of its axis into the gap between the strap members 28 and into slots 30 in the plate sections, the width of these slots being such that the insulation of the wire is penetrated and electrical contact is established with the conducting core. When the terminals are mounted in the cavities, the contact portions extend forwardly and into a trough-like recess 32 in the mating face 12 which is adapted to receive a complementary male connector.

Adjacent terminals in the two rows are separated from each other by barriers 36 and the end end barriers 38 extend somewhat beyond the other barriers 36 as shown. The housing 10 is provided with a radially extending flange 34 by means of which it may be mounted in a panel or the like.

Turning now to FIGS. 3-6, a preferred form of apparatus 40 in accordance with the invention may comprise a conventional punch press having a base or



platen 42, a neck 44, and a head 46 which contains a reciprocable ram 48. The lower or fixed tooling (FIG. 3) comprises a connector jig plate 50 which is mounted on the press platen 42 and which has an upper surface 52 which is opposed to the ram. Jig means are provided on this upper surface for precisely locating the connector with reference to the ram, this jig means comprising a pair of spaced apart blocks 54 which are adjacent to opposite side edges of the plate 50 and a transversely extending barrier 56, the ends of which are integral with the blocks. The ends of this barrier 58 are relatively more thick than the central portion which is recessed as shown at 60 to provide clearance for wires in the connector as will be described below.

The connector 8 is located on the jig plate by positioning it against the rightwardly facing surfaces 64 of the barrier and locating the projecting end barriers or ears 38 of one of the rows in notches 62. In the barrier 56, as shown in FIG. 9, the rearwardly facing surface of the flange 34 will then be disposed against the surfaces 64 of the end portions 58 of barriers 56 when the connector is mounted on the jig plate and the rearward portion of the connector housing, including the two rows of terminals, will be disposed between the opposed surfaces 66 of the blocks 54.

The individual wires are located relative to the terminals in the connector by means of two wire combs, one of which 70 comprises a bar like member having recesses or notches 72 extending inwardly from its upper edge 73 for the wires. These recesses are spaced apart by distances corresponding to the spacing between adjacent terminals in the connectors and are in alignment with the terminals when the comb 70 is mounted on the jig plate. The precise location of the comb on the jig plate is achieved by cavities 68 in the opposed surfaces 66 of the blocks 54, these recesses being dimensioned to receive projecting end portions 74 on each end of the comb 70. As shown in FIG. 4, springs 75 are provided in the recesses 68 and the comb is supported on the upper ends of these springs. The comb can be moved downwardly with accompanying compression of the springs during the wire insertion process as will be described below.

An additional comb 76 is provided in the form of an elongated T-shaped member having wire-receiving spaced apart recesses 78 on the upper surface of its head portion. Comb 76 is mounted on a bar 80 which extends beyond the ends of the comb as shown at 81. These end portions have depending pins 82 extending from their undersides which straddle the jig plate when the second comb is so mounted on the jig plate. As shown in FIGS. 5 and 6, when the comb 76 is mounted against the mating face of the connector housing the recesses 78 will be in alignment and the contact terminals in the upper row will be in alignment with the recesses 72 in the first comb 70. It is desirable to provide an additional supporting means for this second comb member in the form of latch arms 84 which are pivoted to the outer ends 81 of the block 80 and which have inwardly turned ends 86. The latch arms are swung into embracing relationship with the blocks 54 and the ends of the arms extend around the blocks and are latched into shallow depressions 87 on the leftwardly facing sides of the blocks 54 as shown best in FIG. 6.

An additional fixed comb is provided on the left-hand side edge of the jig block 50 and comprises a simple T-shaped block having recesses 90 on its upper surface

which are in alignment with the recess in the other two combs.

The movable or upper tooling comprises a tool block 102 which is secured to a tool mounting block 100 on the lower end of the ram 48. The lower end of tool block 102 has two depending flanges 104, 106 and a plurality of spaced apart insertion punches 108 are mounted between these flanges, one punch being provided for each terminal in the row of terminals. As is evident from FIG. 8, the dimensions of the lower end of the flanges 104, 106 are such that the flanges straddle the wire receiving portions of the terminals and the punches are dimensioned to enter the wire receiving portions between the connecting straps 28 so as to push the wires into the slots. The press 40 can be of a conventional arbor type or alternatively, the tooling can be mounted in another type of actuator such as a hand tool.

In use, the connector is mounted on the upper surface of the jig plate 50 as shown in FIG. 2 with its rearwardly facing side against the surfaces 64 and with its end barriers 38 extending into the notches 62. The wire positioning jig 70 is then located on the jig plate and latched to the blocks 54 as shown in FIG. 6. Thereafter, the wires are located in the recesses, 90, 72 and 78 so that an intermediate portion of each wire extends over a contact terminal in the upper row of the connector housing. The ram 48 is then moved downwardly to accomplish insertion of the wires into the terminals as illustrated in FIGS. 7 and 8. During this operation, the comb or wire jig 70 will move down with concomitant compression of the springs 75 so that the wires will remain accurately located relative to the terminals during their movement into the terminals. After the wires have been inserted as shown in FIG. 9, the comb 70, 76 and the connector are removed from the jig plate. The connector is then reversed, that is the row of terminals to which wires have been connected is located immediately adjacent to the surface 52 and the combs 70, 76, are again assembled to the jig plate. As shown in FIG. 9, the central recess 60 of the barrier, and the fact that the connector is supported above the surface 52 of the jig plate, provides adequate clearance for the previously applied wires.

Wires are then again located in the combs and the ram is lowered to connect wires to the remaining row of terminals. The comb 76 can then be removed from the jig plate and the connector with wires connected to both rows of terminals removed.

As shown in FIG. 1, it is desirable to provide a two-part back cover to the connector before it is put to use. Each part of the back cover comprises a flat molded member 94 which extends across the rearward side of the connector. At one of its ends, each section has a latch arm 92 and has a flange 96 at its other end on which a boss is provided so that the two latch arms can be engaged with each other as shown. Further details of this back cover are described in my previously identified U.S. application Ser. No. 312,394 now U.S. Pat. No. 3,803,695. Electrical connectors having wires connected intermediate their ends to the terminals are used under circumstances described in my previous U.S. Pat. No. 3,803,695, identified above.

It will be apparent from the drawing and from the foregoing description that the fact that both of the combs or wire jigs 70, 76 can be removed from the jig plate facilitates the terminating procedure. After wires

have been connected to one row of terminals in the connector, it can be placed on the jig plate as shown in FIG. 9 only if both of the combs are removed since the lower row of wires in FIG. 9 extends beneath the combs and the upper surface of the jig plate. The arrangement is such that both of these combs can be removed from an assembly to the jig plate very easily and these operations do not seriously impede the process. It is also advantageous that the comb 70 is located very close to the terminals into which wires are being inserted since the close proximity of this comb to the terminals minimizes the possibility of a wire being inserted into the wrong terminal. The downward movement of the comb 70 during wire insertion further ensures accurate wire placement.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only.

What is claimed is:

1. Apparatus for connecting an intermediate portion of each of a plurality of wires to each of a plurality of electrical contact terminals, said terminals being arranged in first and second rows which extend parallel to each other and which are on oppositely facing sides of an electrical connector housing, said terminals having wire-receiving portions which are adapted to receive wires upon movement of said wires laterally of their axes and into said wire-receiving portions, said apparatus comprising:

a connector jig plate having a supporting surface and having connector locating means for locating said connector housing spaced from said supporting surface with said first row extending parallel to, and proximate to, said surface and with said second row remote from said surface, said locating means having recessed surface portions which provide clearance between said first row of contact terminals and said supporting surface,

a wire positioning comb comprising a bar-like member having a plurality of spaced-apart wire-receiving notches therein which is equal to the member of said contact terminals in one of said rows, said notches being spaced apart by distances equal to the spacing between said contact terminal in said rows,

comb locating means for removably mounting said comb in alignment said second row of contact terminals in a housing mounted on said jig and in spaced relationship to said surface, and

wire inserting means for inserting wires into said terminals, said wire inserting means being movable along a predetermined path towards and away from said surface whereby,

wires positioned in said wire positioning comb are in-

serted into said contact receiving portions of said second row upon movement of said inserting means towards said surface, and said connector can be reversed on said jig plate and wires can be inserted into said one row of terminals.

2. Apparatus as set forth in claim 1, said apparatus having a second wire positioning comb, and means for removably mounting said second wire positioning comb on said jig plate.

3. Apparatus for connecting intermediate portions of each of a plurality of wires to the wire-receiving portions of electrical contact terminals, said terminals being arranged in side-by-side relationship in two parallel rows on opposite sides of an electrical connector housing, said apparatus comprising:

a connector jig plate having means thereon for mounting said electrical connector housing in a predetermined position on, and spaced from, said jig plate with one of said rows proximate to said jig plate and with the other one of said rows remote from said jig plate,

first and second wire positioning combs, each of said combs having a plurality of spaced-apart wire-receiving notches therein equal to the number of said contact terminals in one of said rows, said notches being spaced apart by distances corresponding to the spacing between said contact terminals in said rows,

means for removably mounting said combs on said jig plate on each side of a connector housing mounted on said jig plate with said notches in alignment with each other and with contact terminals in said housing whereby continuous lengths of wire positioned in said notches will be in alignment with terminals in one of said rows, one of said combs being resiliently supported on said jig plate and movable relatively towards said jig plate, and

wire inserting means movable along a predetermined path extending towards and away from said connector jig plate, said inserting means having inserting punches for inserting wires positioned in said combs into said contact-receiving portion of said terminals,

said apparatus being capable of inserting wires into both of said rows by virtue of the fact that said connector is supported in spaced relationship to said jig plate whereby clearance is provided for wires inserted into one of said rows.

4. Apparatus as set forth in claim 3, one of said combs comprising a thin bar-like member, said one comb being resiliently supported on said jig plate.

5. Apparatus as set forth in claim 4, said means for mounting said connector on said jig plate comprising a barrier extending across said jig plate, said barrier having supporting surfaces at its ends for engagement with said connector.

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