

[54] APPARATUS FOR CONNECTING CONDUCTORS TO TWO CONNECTORS WHICH ARE BACK TO BACK

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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 DT, 203 D, 29/203 R, 203 J, 203 DS

[56] References Cited

UNITED STATES PATENTS

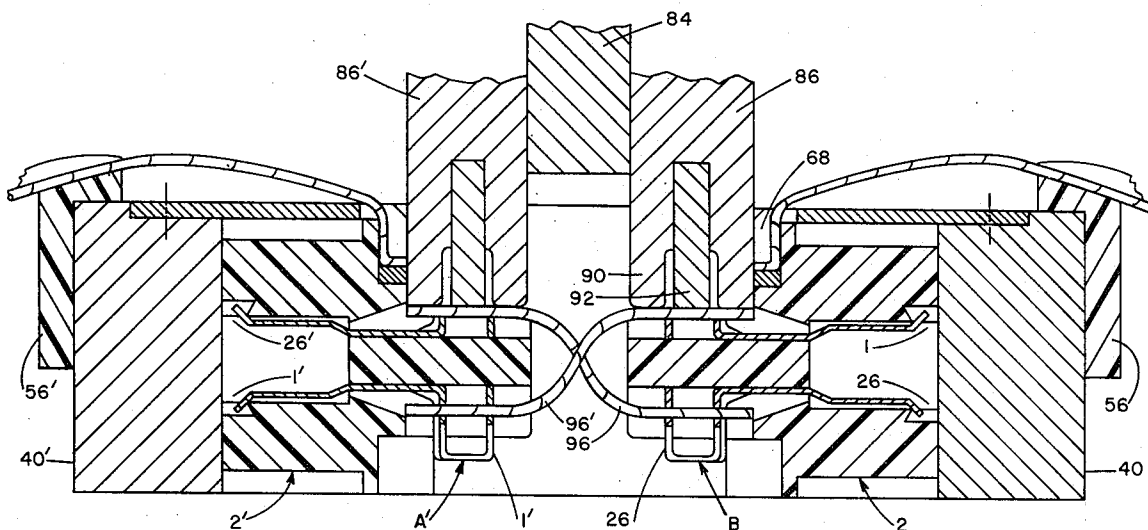
3,758,935 9/1973 Long et al. 29/203 MW
3,766,622 10/1973 Brehm et al. 29/203 MW

Primary Examiner—Thomas H. Eager
Attorney, Agent, or Firm—Frederick W. Raring; Jay L. Seitchik; William J. Keating

[57] ABSTRACT

Apparatus for connecting the corresponding terminals in two identical two-row electrical connectors comprises connector jig for locating the connectors in back-to-back relationship with the corresponding ends of the connectors proximate to each other but with the corresponding rows of terminals offset from each other. In use, the ends of wires are first connected to one row of terminals in each connector, the row in each connector being non-corresponding to the row in the other connector. The connectors are then placed in the jig and the wires are laced diagonally from each connector to the other connector and into alignment with the corresponding terminals of the other connector. The apparatus includes means for shearing the wires thus laced and inserting the trimmed wires into the terminals in the other connector.

9 Claims, 10 Drawing Figures



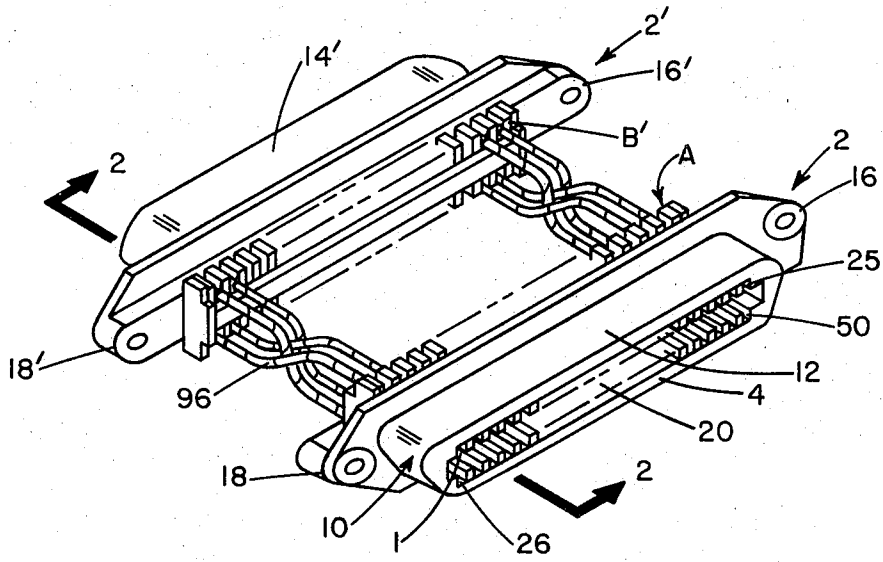


FIG. 1

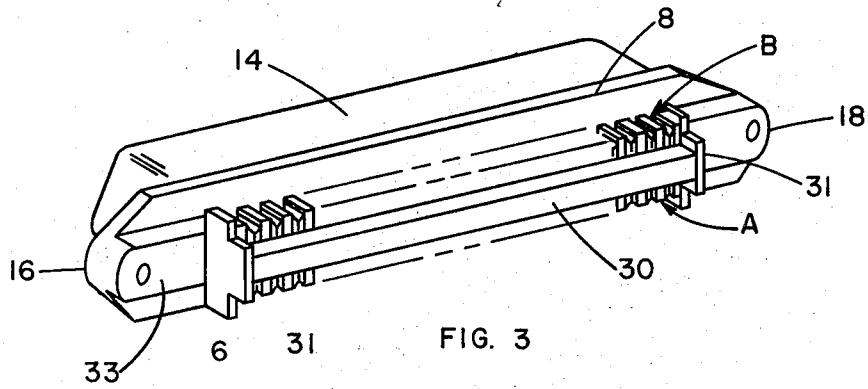


FIG. 3

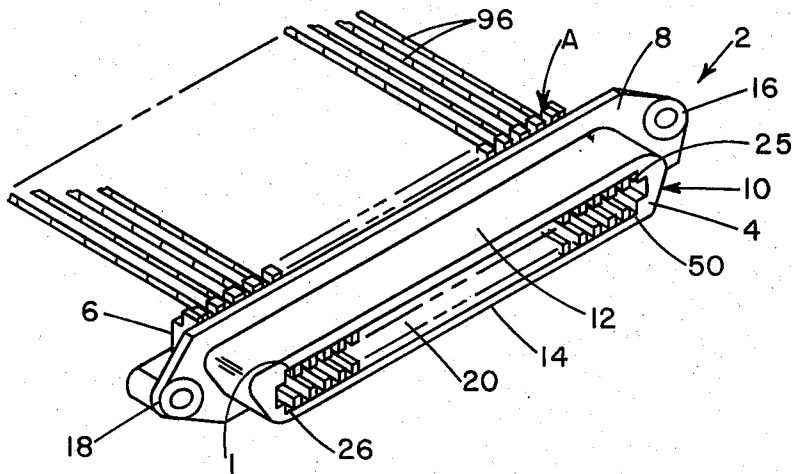


FIG. 4

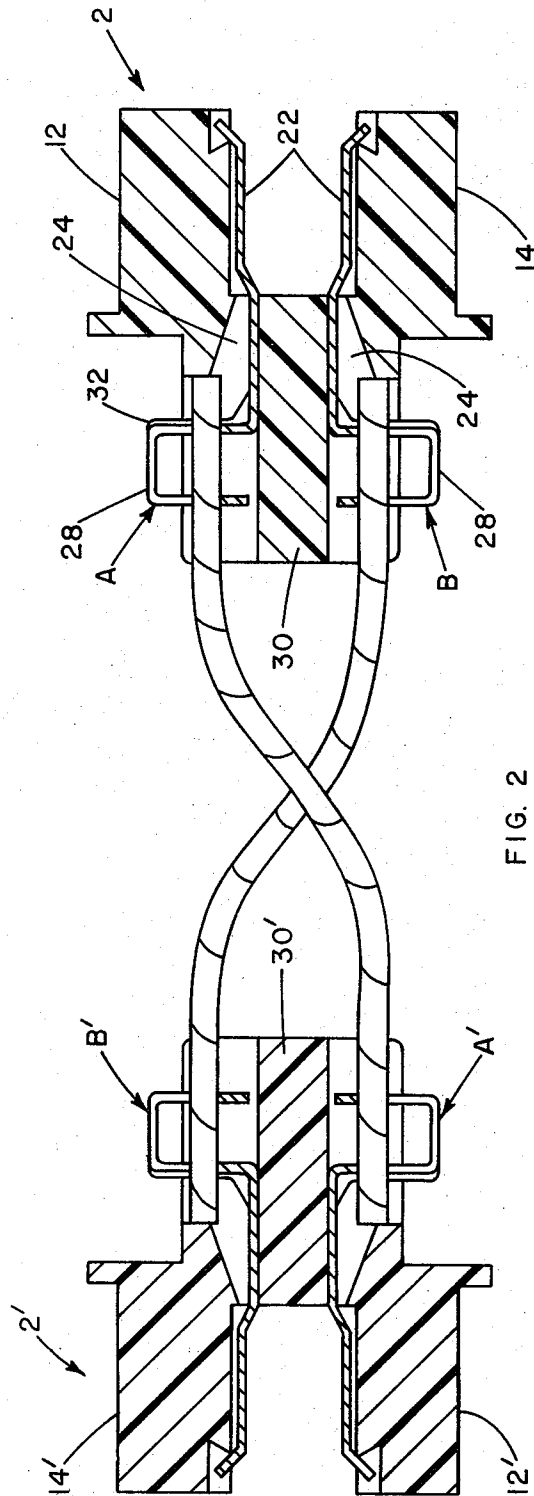


FIG. 2

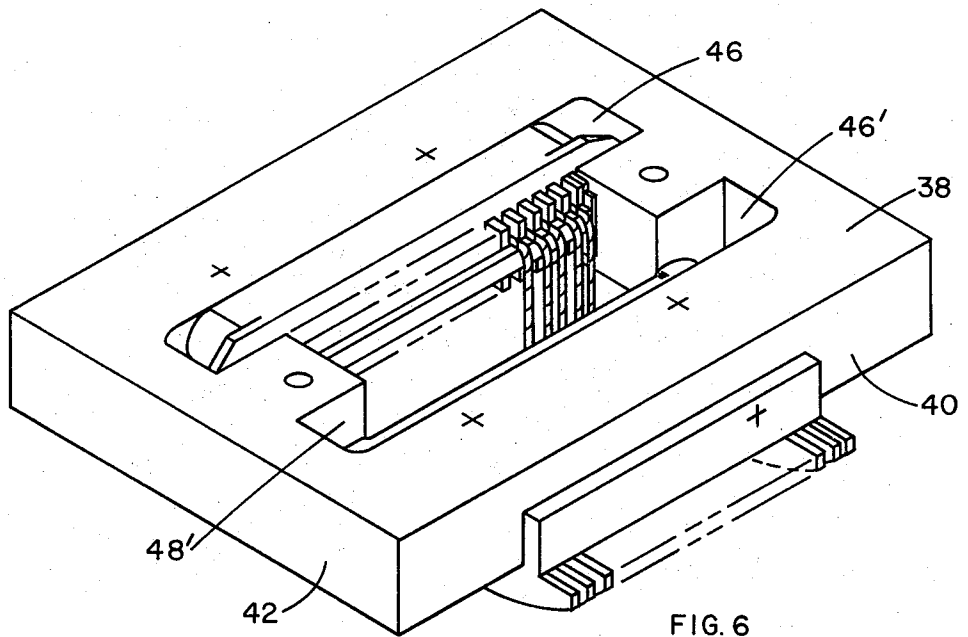
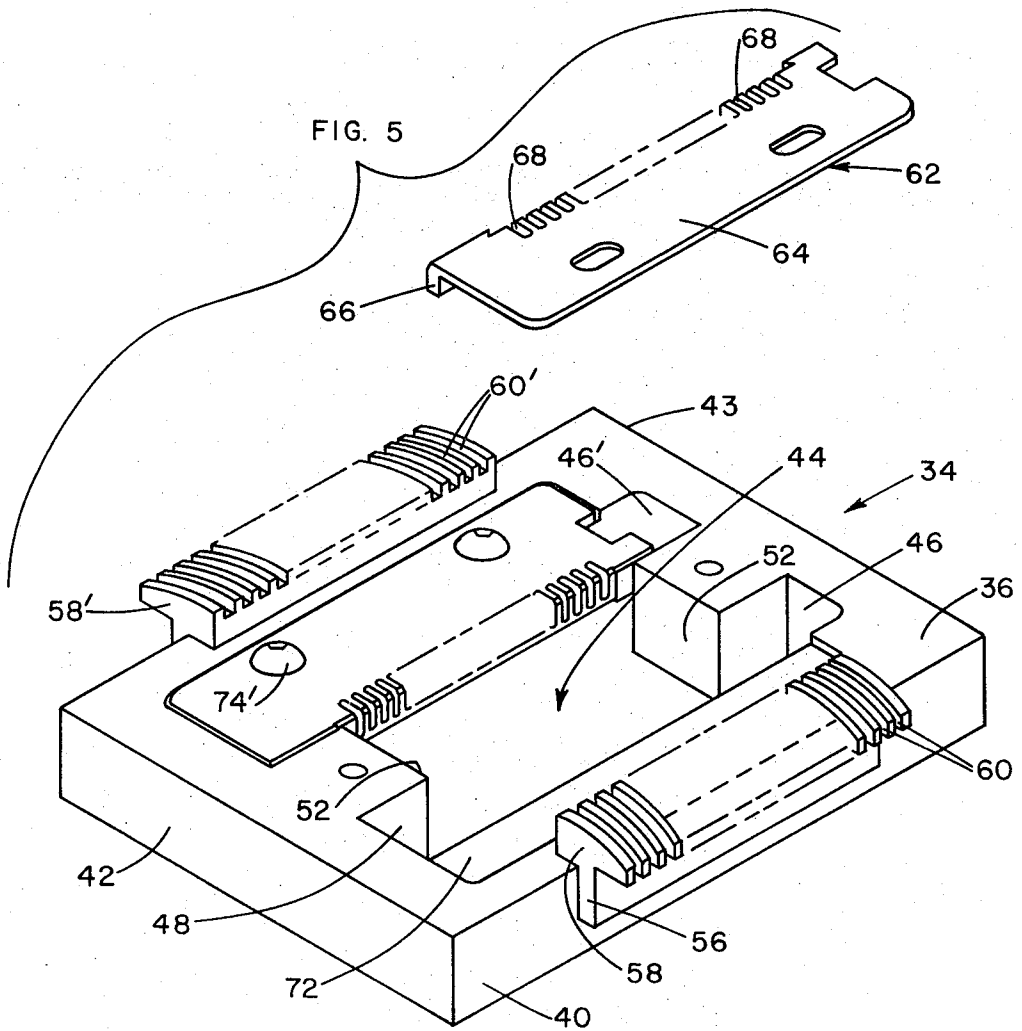


FIG. 6

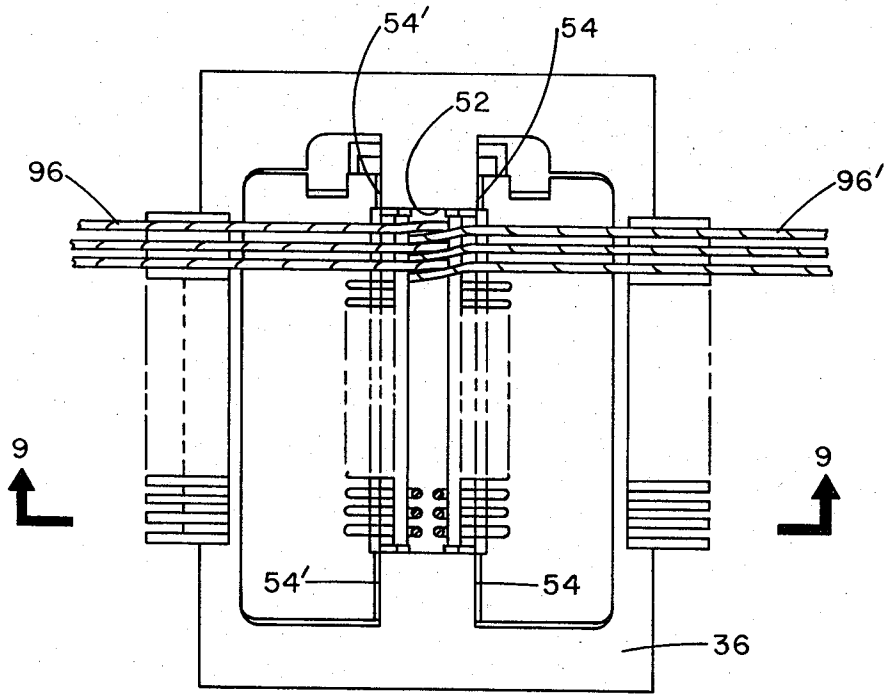


FIG. 7

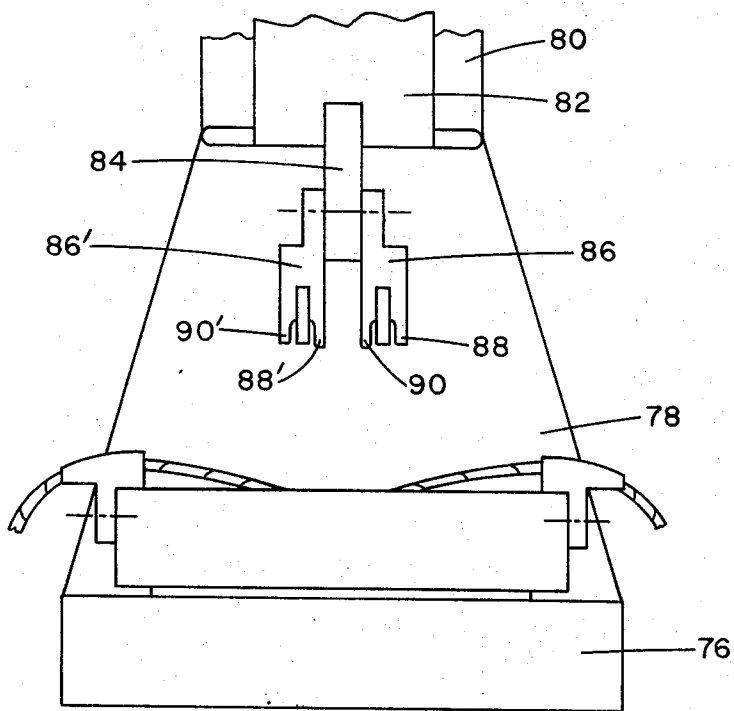


FIG. 8

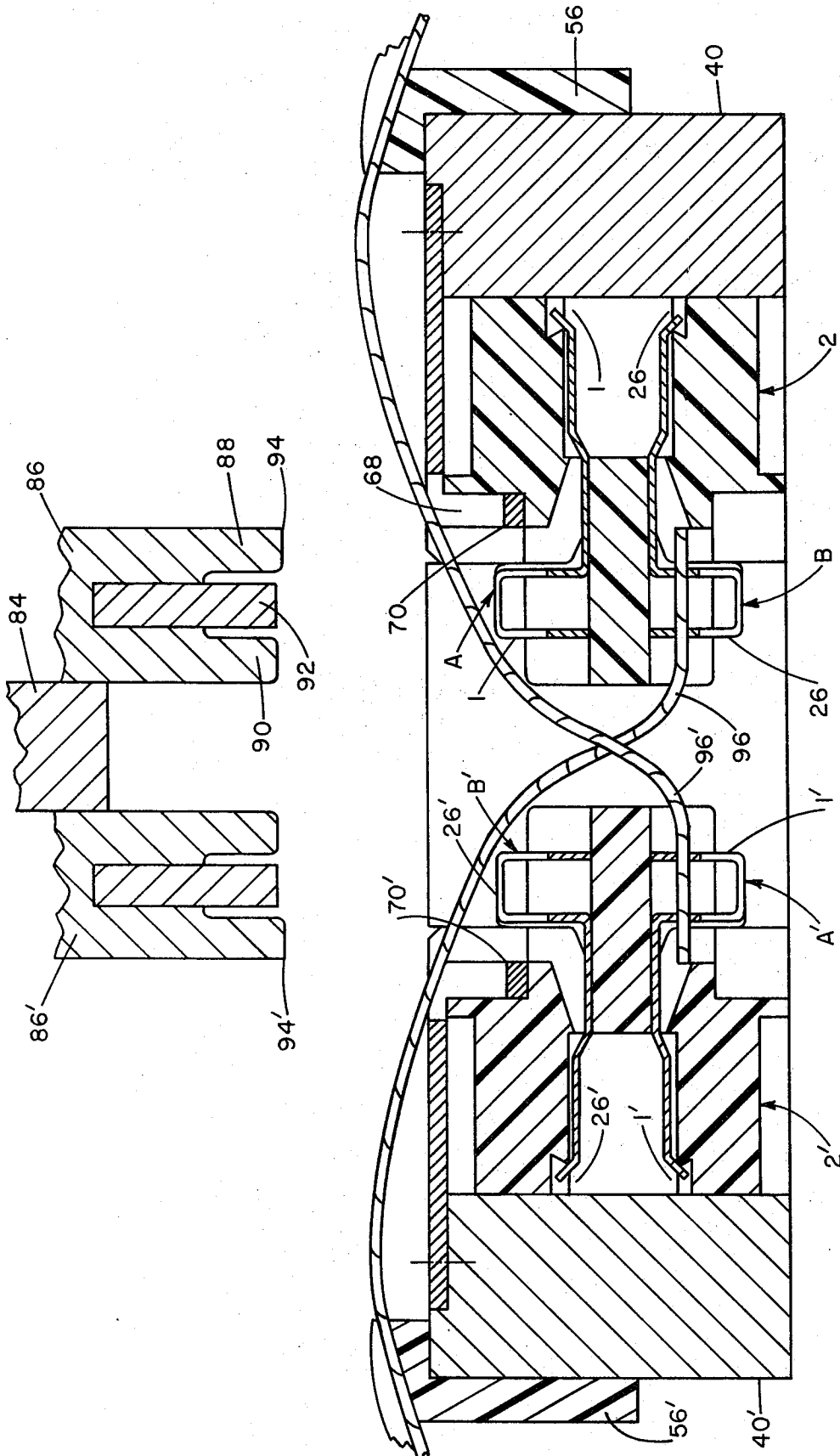


FIG. 9

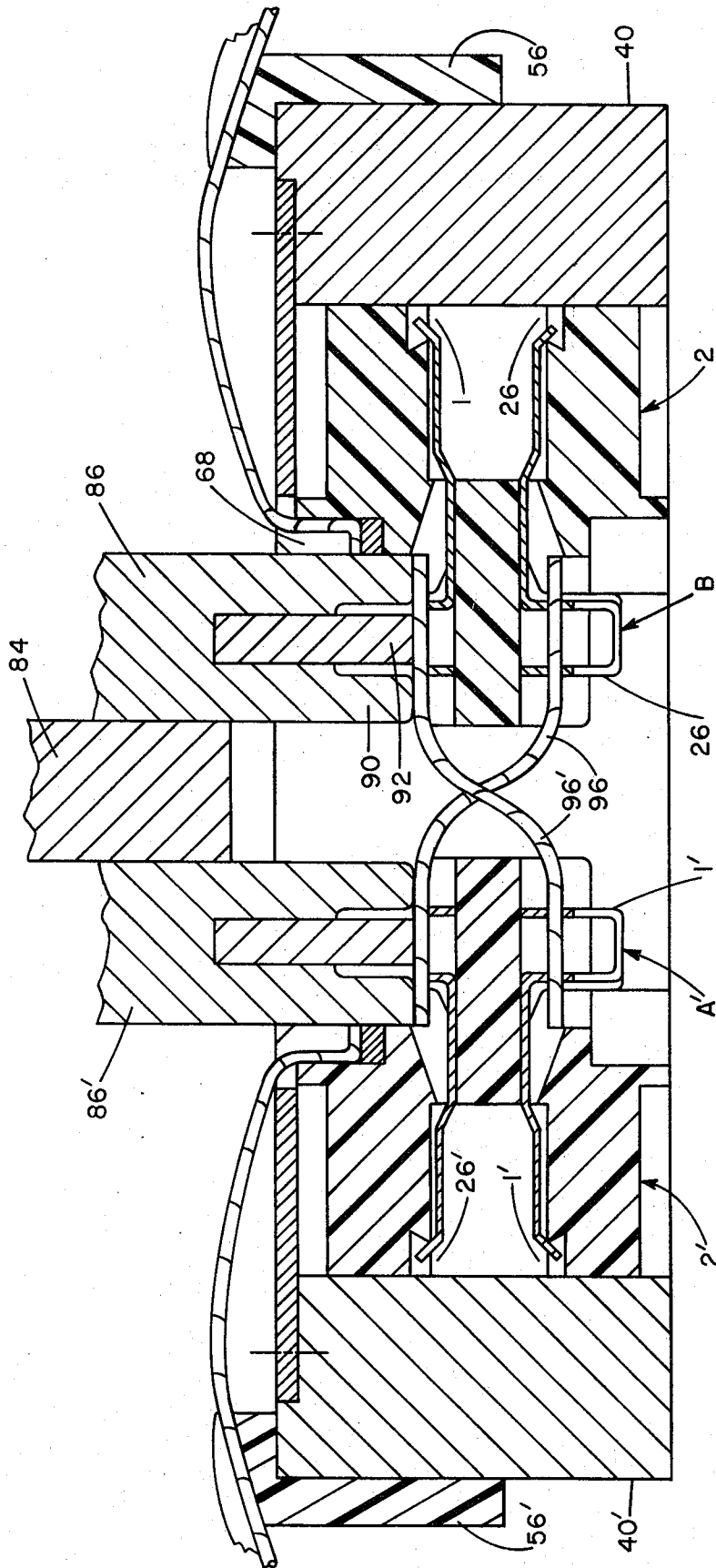


FIG. 10

APPARATUS FOR CONNECTING CONDUCTORS TO TWO CONNECTORS WHICH ARE BACK TO BACK

BACKGROUND OF THE INVENTION

This invention relates to apparatus for connecting the corresponding terminals in each of two two-row connectors to each other to produce an electrical connector adapter assembly of a type which is required under some circumstances when complex electrical harnesses are coupled to each other. The invention is herein disclosed as an embodiment containing two electrical connectors of the type disclosed and claimed in U.S. Pat. No. 3,760,335. The instant application is also related to the inventions disclosed in applications Ser. Nos. 442,958, 442,959, 442,960, in that the instant embodiment has one or more structural parts which are interchangeable with the inventions shown in those applications. Also, application Ser. No. 442,959, discloses another form of adapter containing two electrical connectors of the type shown herein.

U.S. Pat. No. 3,760,335 discloses an improved two-row electrical connector having two rows of electrical terminals which are adapted to be connected to the conductors in a multi-conductor cable. The terminals each have a plate-like wire-receiving portion and the wires can be connected to the terminals by simply moving them laterally of their axes and into the slots in the plates in the terminals. U.S. Pat. Nos. 3,760,335, 3,758,935 and 3,766,622 show improved apparatus for inserting the wires into the slots in the plate-like sections of the terminals and simultaneously trimming the ends of the wires.

The connectors shown in U.S. Pat. No. 3,760,335 has been received very favorable and is widely used for connecting the ends of cables and in the manufacture of complex electrical harnesses. The tooling shown in U.S. Pat. Nos. 3,758,935 and 3,766,622 is also widely used to install the connectors on the ends of cables.

Connectors of the type shown in the above-identified U.S. Pat. No. 3,760,335 are provided as male and female mating connectors which are adapted to be coupled to each other. On occasion, and where previously manufactured harnesses are being assembled to each other, if frequently happens that two identical connectors (male or female) are on the ends of portions of the harness which are to be connected to each other and these portions of the harness cannot be directly coupled. This situation commonly arises where previously prepared cables which have connectors on their ends are being added to pre-existing harness systems or electrical interconnection systems. A possible solution would be to remove one of the pre-extending connectors from the harnesses and replace it with a connector which will mate with the newly added cable, however, this is a time-consuming and expensive operation particularly if it must be carried out in a wiring bay or a similar location. It is preferable to have a supply of adapters on hand each of which comprises two identical (male or female) connectors to permit coupling of the ends of two cables which also have identical connectors on their ends.

The adapter must, of course, have the corresponding terminals in the one identical connector directly connected to the corresponding terminals in the other connector and this requires crossing of the wires in the adapter for the reason that when two identical two-row

connectors are positioned back-to-back, their corresponding terminals can not, under any circumstances, be directly in alignment with each other. The instant invention provides an apparatus which permits the rapid assembly of such adapters by relatively unskilled labor and under circumstances which virtually precludes the possibility of errors in the wiring.

It is accordingly an object of the invention to provide an improved apparatus for the manufacture of electrical connector adapters. A further object is to provide an apparatus for the manufacture of adapters composed of two identical two-row connectors in which the terminals of one connector are directly connected to the corresponding terminals of the other connector. A further object is to provide an apparatus which is relatively simple in construction and which can be used with previously known types of apparatus for connecting wires to terminals in electrical 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 a preferred form of adapter in accordance with the invention.

FIG. 2 is a sectional view taken along the lines 2—2 of FIG. 1.

FIG. 3 is a perspective view of the rearward side of an electrical connector of the type for which the instant embodiment is intended.

FIG. 4 is a frontal view of a connector having wires connected to one of the rows of terminals.

FIG. 5 is a perspective view of a connector jig in accordance with the invention showing the obverse side thereof.

FIG. 6 is a perspective view of the jig of FIG. 5 showing the reverse side thereof.

FIG. 7 is a plan view of the obverse side of the jig, the jig having connectors mounted therein in this view and wires extending from the connectors having been positioned on the jig in preparation for the wire inserting and cutting operation.

FIG. 8 is a frontal view of a complete apparatus in accordance with the invention.

FIG. 9 is a view taken along the lines 9—9 of FIG. 7.

FIG. 10 is a view similar to FIG. 9 but showing the positions of the parts at the completion of the conductor trimming and inserting operation.

A connector adapter assembly in accordance with the invention (FIG. 1) comprises two two-row electrical connectors 2, 2' which are in back-to-back relationship and which have their corresponding contact terminals electrically connected to each other. Since an understanding of some of the structural features of the connectors is required for an understanding of the invention, the connector 2 will be described below to the extent necessary for such an understanding. The connector 2' is identical to the connector 2 but it is in a different orientation and its parts are identified by the same reference numerals, differentiated by prime marks, as are used in the description which follows:

The connector 2 comprises an insulating housing having a forward or mating face 4, a rearward face 6, and a flange 8 which extends radially approximately mid-way between the faces. The forward portion 10 of the housing, which is between the mating face 4 and the flange 8, is generally trapezoidal and has a longer side

12 and a shorter side 14, this trapezoidal shape being provided for polarization purposes. The flange 8 has laterally extending ends 16, 18 which are specifically identified for the reason that the orientation of the connector in the apparatus is critical as will be described below. The forward portion of the housing has a trough-like recess 20 which is adapted to receive portion of a male connector and a plurality of contact terminals are provided in the housing which have forward contact portions which extend into this recess. Each terminal (FIG. 2) extends through a cavity 24 and has a wire-receiving portion 28 which is adjacent to the rearward face 6 of the housing, the wire-receiving portions being generally U-shaped and having wire-receiving slots which receive the ends of the wires as shown in FIG. 2. The contact terminals 22 are arranged in two parallel rows identified as A and B and are further identified by position numbers, the reference numeral 1 in FIG. 4 indicating the location of position number one, the reference numeral 25 indicating position number 25, numeral 26 indicating position number 26 which is below position number one in FIG. 4 and numeral 50 indicating position number 50 which is below position number 25. The intermediate number positions in the rows A, B are between those positions specifically identified in FIG. 4.

The rearward side 6 of the housing has a transversely extending rib 30 and the rows A, B are on opposite sides of this rib. In each row, adjacent contact terminals are separated from each other by barriers 32 which are integral with the housing and the ends of the rib 30 have integral therewith oversized barriers which provide laterally oppositely directed surfaces 31. The surfaces 31 merge with surface portions 33 of the rearward face and both of these surfaces serve to locate the connector in the jig as will be described below.

Turning now to FIGS. 5 and 6, the disclosed embodiment of the invention comprises a generally rectangular metallic jig plate 34 having a surface 36 herein identified as the obverse surface and a surface 38 identified as the reverse surface. The jig plate has sides 40 and ends 42 and a central opening 44 is provided which is generally H-shaped and symmetrical about its center line. Opening 46 thus has recesses 46, 46' on each side of its center line adjacent to the end 43 and recesses 48, 48' adjacent to the end 42. The central opposed surfaces 52 are spaced apart by a distance which is substantially equal to the distance between the surfaces 31 of the connector housing so that the connectors 2, 2' can be positioned in the jig plate as shown in FIG. 10 with the surfaces 31 of each connector against the opposed surfaces 52 and with the surfaces 33, 33' of each connector against the surfaces 54, 54' which intersect the surfaces 52 (see FIG. 7).

Wire locating means 56, 56' are provided on each of the sides 40, 40' of the jig plate, each of these wire locating means comprising a generally T-shaped block having a head portion 58, 58' on the upper surface of which there are provided spaced apart grooves or recesses 60 which are adapted to receive wires as described below. The spacing between adjacent recesses 60 is the same as the spacing between adjacent terminal positions in the connectors.

Fixed shear members 62, 62' are provided on the obverse surface 36, each shear member comprising a flat relatively thin metal plate 64 having a depending lip or flange 66. The plate 62 has notches 68 which extend in

the plate and in the flange as best shown in FIG. 9 and the inner ends of the notches in the flange provide outside edges 70 which function as fixed shearing edges in cooperation with movable shearing edge means as will be described below. The fixed shear 62 has its plate portion 64 positioned in a shallow recess adjacent to the opening 44 on the side 40 and is held in place by suitable fasteners as shown. The fixed shear 62' is a mirror image of the fixed shear 62 and is similarly mounted on the lefthand side as viewed in FIG. 5 of the jig plate.

The jig plate is mounted on the base or platen 76 of a suitable press (FIG. 8) having a neck portion 78 and having a head portion 80 in which contains a reciprocable ram 82. The movable or upper tooling comprises a pair of tool blocks 86, 86' which are secured to a tool mounting block 84 on the ram 82. Each tool block has depending flanges 88, 90 on its lower end and a plurality of wire inserting punches 92 mounted in the tool block between these flanges. The individual punches 92 are dimensioned to move into the wire-receiving portions 28 of the terminals and the flanges are spaced apart by a distance such that they straddle the wire receiving portions and the barriers when the movable tooling is in the lowermost position (FIG. 10). The outside edges 94, 94' of the flanges on the tool blocks 86, 86' serve as movable shearing edges in cooperation with the fixed shearing edges 70, 70' during downward movement to shear the wires immediately prior to insertion into the wire-receiving portions of the terminals.

In use, and to produce an adapter as shown in FIG. 1, it is first necessary to connect the ends of wires to the row of terminals in the connector 2 and to connect different wires to the terminals in the row A' of the connector 2'. This step in the process may be carried out by an apparatus of the type shown in my co-pending application Ser. No. 442,958 or by an apparatus of the type shown in U.S. Pat. No. 3,758,935.

The two connectors are then positioned in the jig plate as shown in FIG. 9 with the row A' of terminals of the connector 2' and the row B of terminals in the connector 2 both proximate to the reverse surface 38 of the jig plate. The wires 96 which extend from the row B of terminals in the connector 2 are passed through the opening in the jig plate to the obverse side 36 and dressed leftwardly in FIG. 9 and positioned in the recesses 60' in the wire locating means 56'. After this has been done, each wire will be in alignment with the terminal in the row B' which corresponds to the terminal in the row B to which it was previously connected. Similarly, the wires 96' which were previously connected to the terminals in the row A' of the connector 2' are pressed through the opening in the jig block and dressed rightwardly in FIG. 9 and positioned in the recesses 60 of the wire positioning means 56. These wires 96' will each be in alignment with a terminal in the row A which corresponds with the terminal in the row A' to which its end has been connected. The sectional view of FIG. 9 is thus taken such that a wire extends from position 1' (row A') in connector 2' above position 1 in row A of connector 2. This view also shows a wire extending from position 25 of row B (connector 2) to and above position 26' of row B' of connector 2'.

After the wires have been positioned as shown in FIG. 9, the jig block is mounted on the press platen by

suitable locating means such as locating pins (not specifically shown) so that the rows A and B' will be beneath, and in alignment with the tool blocks 86, 86'. The press ram is then caused to descend to the position of jig 10 to shear the wires by the cooperative action of shearing edges 94, 70, 94', 70', and insert the trimmed wires into the wire receiving portions of the terminals.

It will be apparent from the foregoing description that the invention provides an extremely simple and efficient apparatus for the manufacture of adapters of the type shown in FIG. 1. FIG. 7 shows that the operation of positioning the wires 96, 96' in the wire positioning means is extremely simple and that the likelihood of a mistake on the part of the operator is remote. The procedure outlined above thus produces two identical two-row connectors with their corresponding terminal positions connected to each other which in turn can be used to connect two cables which have connectors of the same sex on their ends.

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 the corresponding terminals in each of two identical electrical connectors to each other, said terminals in each of said two connectors being arranged in two parallel rows having wire-receiving portions which are adjacent to the rearward ends of said connectors, said apparatus comprising:

connector jig means for positioning said connectors in back-to-back relationship with corresponding ends of said connectors proximate to each other and with the said rows of each connector offset relative to the corresponding rows of the other connector,

wire locating means on said jig means for locating wires in alignment with said wire receiving portions of said terminals in each of said connectors,

fixed wire shearing means on said jig means having fixed shearing edges extending beside said rows, and

movable shearing and insertion means having movable shearing edges cooperable with said fixed shearing edges and having insertion punch means for inserting wires into said wire-receiving portions, said movable shearing and insertion means being movable towards and away from said connectors in said jig means whereby,

upon connecting the ends of wires to the wire receiving portions in the non-corresponding rows of said connectors, positioning said connectors in said jig means, dressing the wires from each of said connectors towards the other connector and positioning the dressed wires in alignment with the corresponding wire receiving portions of said terminals in the other connector by means of said wire locating means, and moving said movable shearing and inserting means towards said connectors, said wires will be sheared and inserted into said wire-receiving portions.

2. Apparatus as set forth in claim 1, said connector jig means comprising a plate-like member having a central opening therein, said opening being dimensioned to receive said connectors and to hold said connectors in back-to-back relationship.

3. Apparatus as set forth in claim 2, said fixed wire shearing means comprising a fixed shearing plate means secured to said plate-like member.

4. Apparatus as set forth in claim 2, said fixed wire shearing means comprising two shearing plates, said shearing plates being on one face of said plate-like member on opposite sides of said central opening, each of said shearing plates having overhanging portions which overhang said opening, said fixed shearing edges being on said overhanging portions.

5. Apparatus as set forth in claim 4, said wire locating means comprising two wire combs mounted on said plate-like member on opposite sides of said opening.

6. Apparatus as set forth in claim 5 including a bench press having a platen, a press head, and having a reciprocable ram in said press head, said plate-like member being removably mounted on said platen, said movable shearing and insertion means being on said ram.

7. Apparatus as set forth in claim 6, said movable shearing and insertion means comprising two tooling plates mounted on said ram in parallel spaced-apart relationship, each of said tooling plates having a shearing edge which is cooperable with said fixed shearing edges and having insertion punches for inserting said wires into said conductor-receiving portions of said terminals.

8. Apparatus for connecting corresponding contact terminals in first and second identical electrical connectors to each other, said connectors having rearward ends, each of said terminals each having a wire-receiving portion adjacent to the rearward end of its respective connector, said wire receiving portions in each connector being arranged in two parallel rows, said apparatus comprising:

connector jig means comprising a plate-like frame member having a central opening therein which is adapted to receive said connectors and to position said connectors in back-to-back relationship with corresponding ends of said rows proximate to each other and with said rows of said first connector laterally offset relative to the corresponding rows of said second connector,

first and second wire locating means on one surface of said plate member, said first and second wire locating means extending parallel to, and on each side of, said first and second connectors respectively, said locating means having means for locating wires in alignment with said wire-receiving portions of the rows which are proximate to said one side of said plate-like frame member, and

movable shearing and insertion means, said shearing and inserting means being reciprocable along a predetermined path which extends towards and away from said first and second connectors mounted in said connector jig means, said shearing and insertion means having first and second shears for cooperation with said first and second fixed shears and having insertion punch means for inserting wires into said wire-receiving portions of said terminals in said rows which are proximate to said one surface whereby

upon securing wires to each of the terminals in one row of each of said connectors, and positioning said connectors in said connector jig means, dressing said wires through said opening and locating the wires extending from one connector with their axes extending across the wire-receiving portions of the terminals in the other

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connector by means of said wire locating means, and moving said movable shearing and insertion means towards said connector jig means, said wires will be sheared and inserted into said wire receiving portions such that adjacent wires cross each other diagonally to connect corresponding terminals in said two connectors to each other.

9. Apparatus for connecting the wire-receiving portions of corresponding terminals in each of two identical electrical connectors to each other, each of said connectors having a rearward side and having said wire receiving portions arranged in two parallel rows which are proximate to said rearward side, said rows in each connector being herein identified as the A row and the B row, said apparatus comprising:

a connector jig comprising a frame plate having a central opening therein which is adapted to receive and locate said first and second connectors in back-to-back relationship with the corresponding ends of said connectors adjacent to each other and with the A and B rows of said first connector laterally displaced and offset from the A and B rows of said second connector,

first and second wire locating means on said frame plate associated with said first and second connectors respectively, said first wire locating means being spaced from said first connector on one side of said plate and extending parallel thereto, said second wire locating means being spaced from said second connector and extending parallel thereto, each of said wire locating means having means for locating a wire in alignment with a wire-receiving portion of a terminal in its respective associated connector

first and second fixed shear means on said one side

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of said plate, each of said shear means having fixed shearing edges extending parallel to said row of wire receiving portions of terminals in its respective connector,

and movable shearing and insertion means movable towards said first and second connectors and having movable shearing means cooperable with said first and second fixed shearing means, said movable shearing and insertion means having insertion punches for inserting wires into said wire receiving portions whereby

upon connecting the ends of wires to the wire receiving portions of said terminals in said A row of said first connector, connecting the ends of wires to the wire receiving portions of terminals in the B row of said second connector, positioning said connectors in said jig means with the B row of said first connector proximate to said one side and the A row of said second connector proximate to said one side, and dressing said wires through said opening, between said connectors and to said one side, and locating said wires from said first connector in said second wire locating means so that said wires from said first connector are in alignment with said wire receiving portions in said A row of said second connector and locating said wires from said second connector in said first wire locating means associated with said first connector so that said wires are in alignment with said wire receiving portions of said terminals in said B row of said first connectors, and upon thereafter moving said movable shearing and insertion means towards said jig plate, said wires will be trimmed and inserted into said wire receiving portions and corresponding terminals in said two identical connectors will be connected to each other.

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