

[54] **IMPROVED CONNECTORS AND GUIDE MEANS FOR ELECTRICAL HARNESS MAKING**

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[72] Inventor: James Albert Kloth, St. Petersburg, Fla.

Primary Examiner—R. Spencer Annear

[73] Assignee: AMP Incorporated, Harrisburg, Pa.

Attorney—Curtis, Morris and Safford, William J. Keating, Ronald D. Greffe, William Hintze, Adrian J. La Rue, Frederick W. Raring, Jay L. Seitchik and John P. Vandenburg

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[57] **ABSTRACT**

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Electrical harness is manufactured by positioning connector housings in back-to-back relationship, inserting wires through the aligned cavities in the housings until the housings are on an intermediate portion of the wires, applying electrical terminals to the ends of the wires, and moving the housings axially along the wires until the terminals are contained in the cavities. In accordance with alternative embodiment, the wires are inserted through cavities in a separate guide member prior to application of terminals and insertion of terminals into housing cavities. Guide is removed from wires after insertion of wires into housing cavities.

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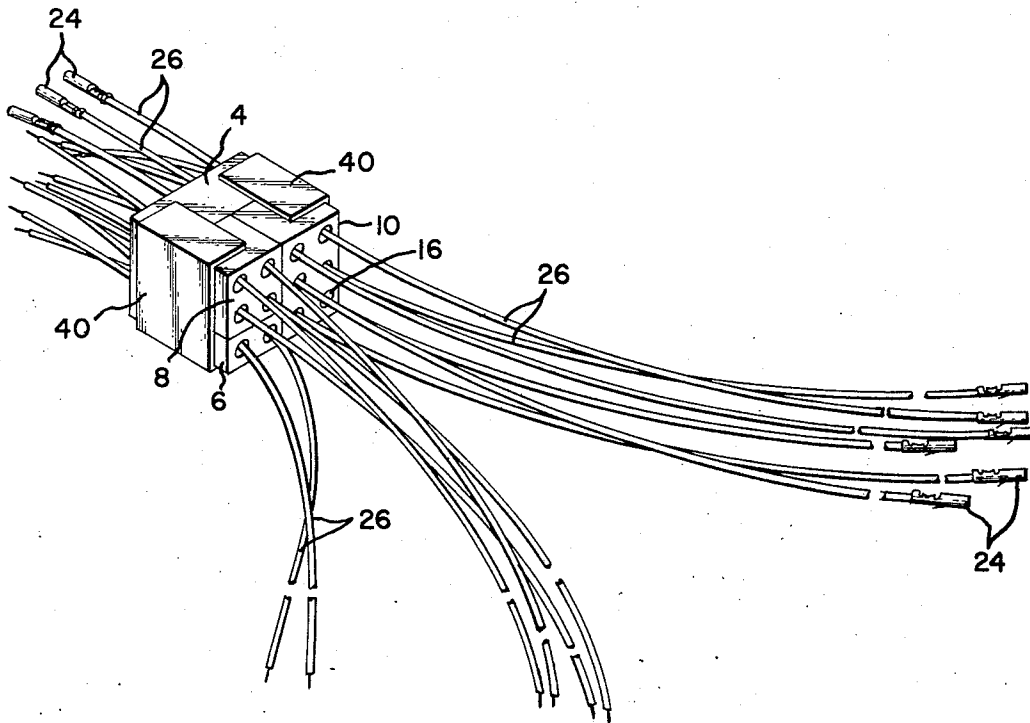
[58] Field of Search 29/203 B, 203 HC, 203 P, 203 S, 29/206, 206 D, 624; 339/28, 148

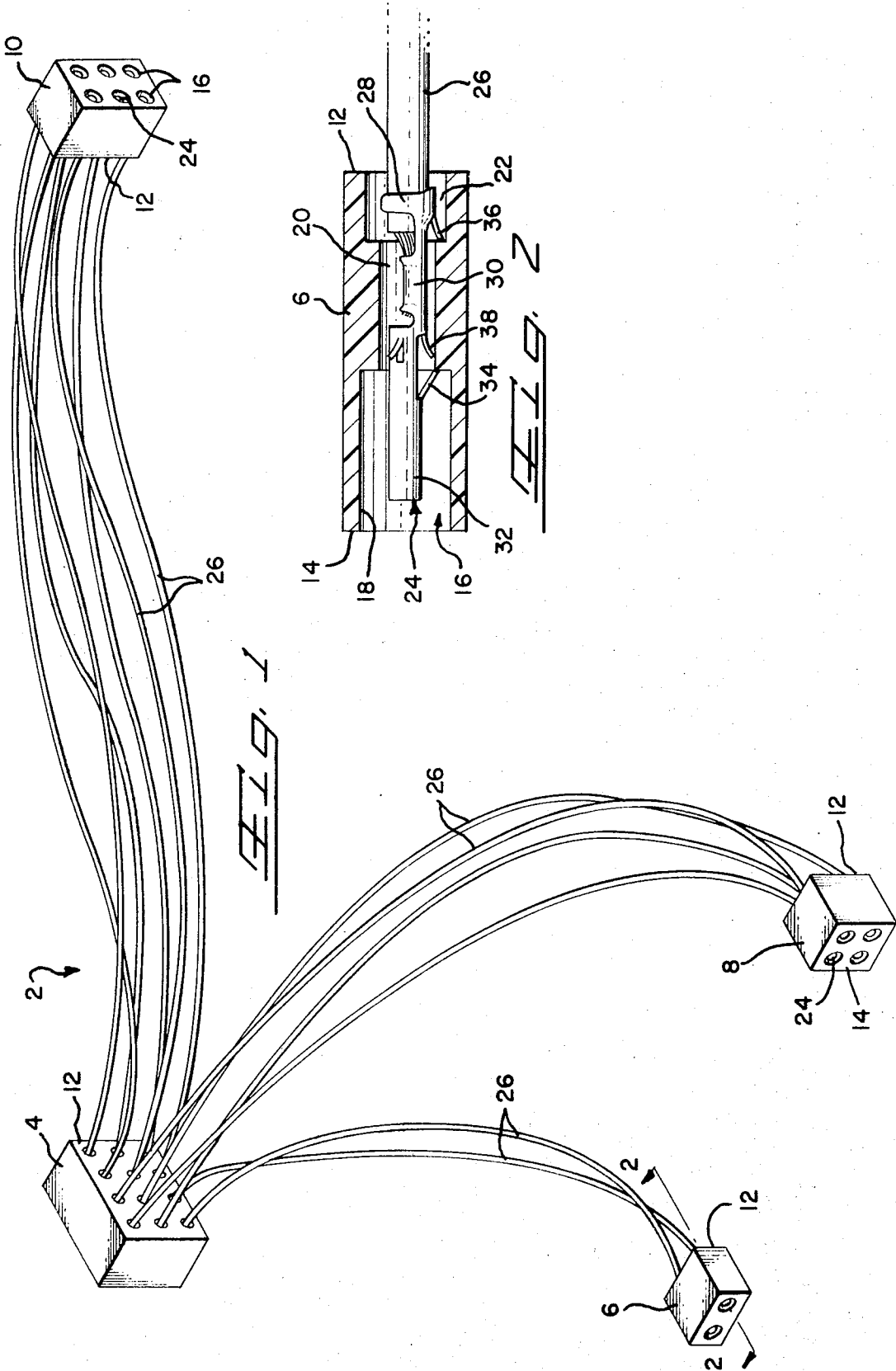
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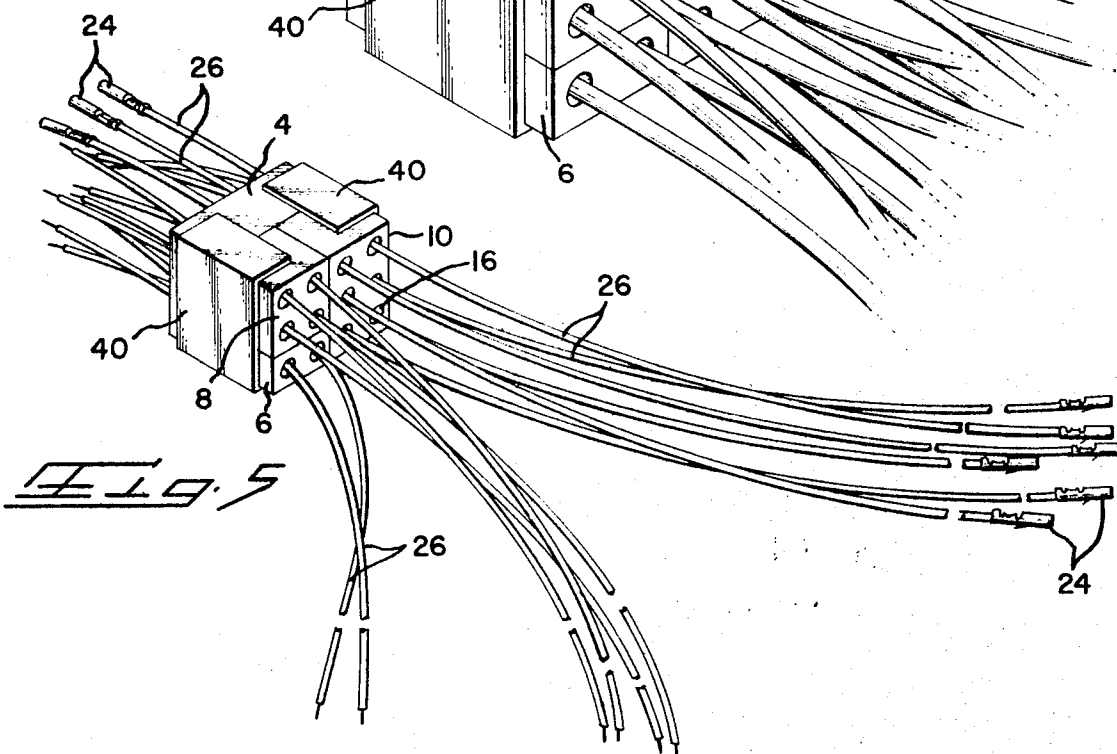
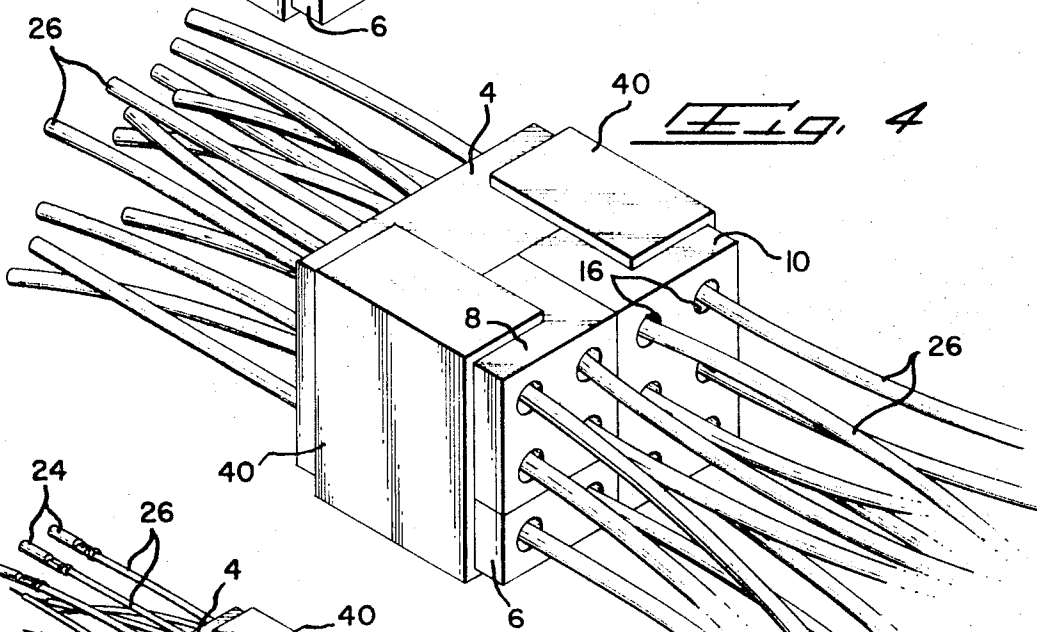
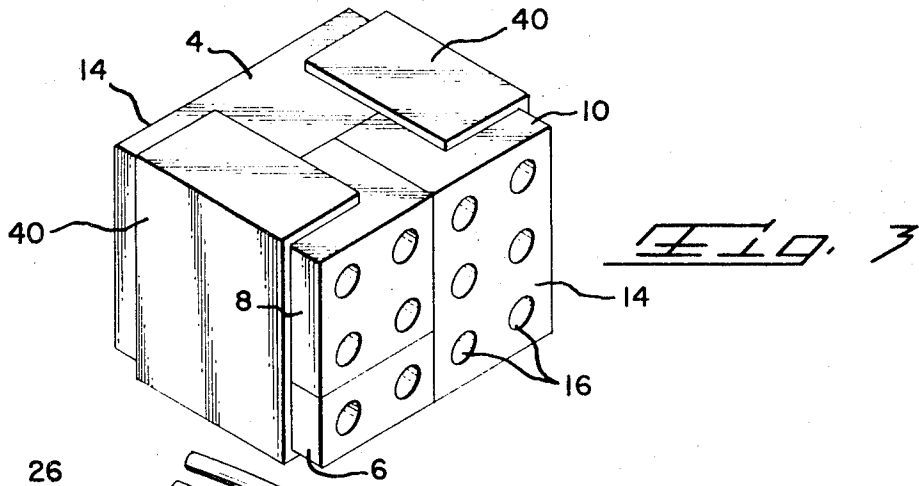
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8 Claims, 8 Drawing Figures







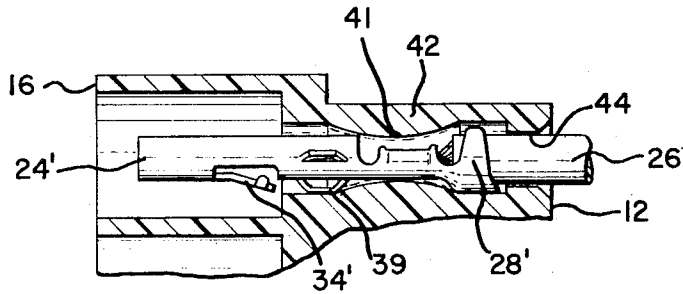


FIG. 6

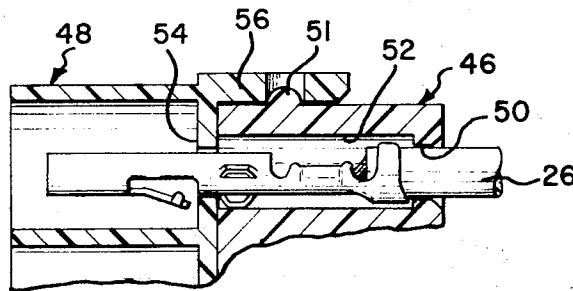


FIG. 7

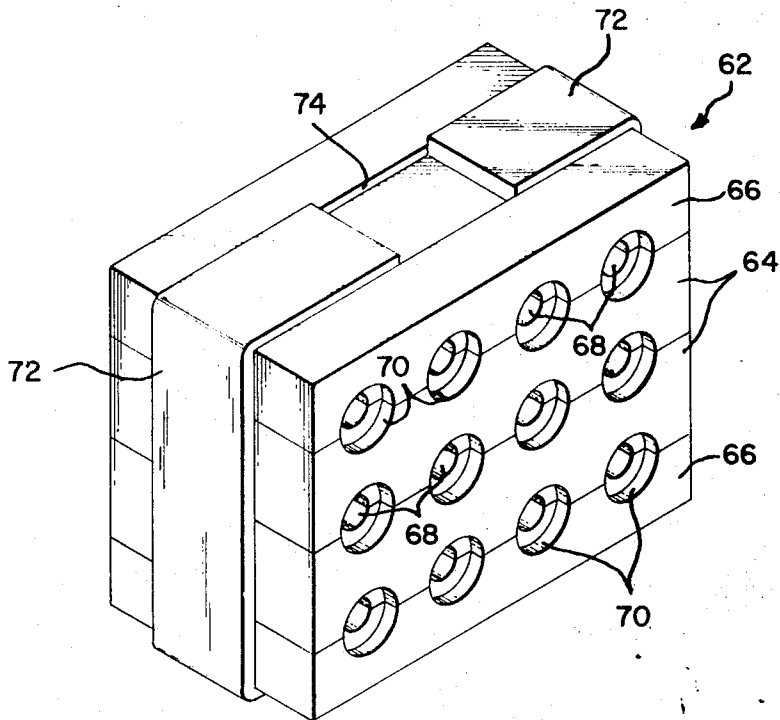


FIG. 8

IMPROVED CONNECTORS AND GUIDE MEANS FOR ELECTRICAL HARNESS MAKING

BACKGROUND OF THE INVENTION

A conventional electrical harness comprises a plurality of connector housings each of which has contact receiving cavities extending therethrough from its rearward side to its forward side and contact terminals in the cavities which are crimped or otherwise secured onto the ends of the wires. The wires will thus extend between the several housings of the harness so that electrical equipment or equipment having electrical components, can be wired by merely engaging the housings with the equipment at the appropriate locations. Harnesses are widely used in the appliance, automotive, and aircraft industries, and in many other industries, to facilitate wiring operations since it is only necessary to engage the connector housings on the harness with the various components, such as motors, timers, valves, etc., to complete the wiring operation.

In accordance with prior art practice for the manufacture of electrical harnesses, suitable electrical leads are first prepared by cutting wire to the required lengths and terminals are then crimped onto the ends of the leads. The terminals are then inserted into the cavities in the connector housings and the wires are bundled or taped, if necessary, intermediate their ends. It will be apparent that each terminal must be inserted into a specifically pre-determined cavity in one of the housings if the harness is to be manufactured in accordance with its requirements and it will also be apparent that the possibility of error exists in that one or more terminals might be inserted into the wrong cavity in one or more of the housings during manufacture. The manual steps of inserting the terminals into the cavities must, therefore, be carried out with great care; and the finished harnesses must be checked and inspected to avoid the possibility of improper wiring when the harness is put to use. It should be added that the electrical terminals on the ends of the leads are subject to damage during the interval between application of the terminals to the ends of the leads and insertion of the terminals into the housing cavities. Frequently, the leads undergo a substantial amount of handling during this interval and the possibility of damage to the terminals is very great, particularly if the terminals are relatively fragile and subject to such damage.

The instant invention is directed to the achievement of an improved method and means for manufacturing electrical harnesses which avoids the more serious problems of prior art methods. It is accordingly an object of the invention to provide a simplified method for making electrical harnesses. A further object is to provide a harness making method and apparatus which reduce the possibility of errors arising as regards the positions of the terminals in the connector housings of the harness. A still further object is to provide a harness making method which reduces the possibility of damage being sustained by the terminals prior to their being inserted into the housing cavities of the harness. A still further object is to provide a harness making method which reduces the amount of skill required on the part of the technician carrying out the manufacturing steps. A further object is to effect a reduction in the time required to manufacture an electrical harness.

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 typical relatively simple electrical harness.

FIG. 2 is a sectional view taken along the lines 2—2 of FIG. 1, showing the manner in which the contact terminals are mounted in the housing cavities.

FIG. 3 is a perspective view showing a group of connector housings clamped against each other preparatory to insertion of conductors through the housing cavities.

FIG. 4 is a view similar to FIG. 3 but showing the conductors inserted through the housing cavities.

FIG. 5 is a view similar to FIG. 4 but showing electrical contact terminals crimped onto the conductors.

FIGS. 6 and 7 are sectional views through connector housings in accordance with alternative embodiments of the invention.

FIG. 8 is a perspective view of a wire guide and identification means in accordance with a further embodiment of the invention.

A typical relatively simple electrical harness 2 (FIG. 1) comprises a plurality of connector housings 4, 6, 8, 10, each of which has contact receiving cavities extending therethrough from its rearward side 12 to its forward or mating side 14. Electrical contact terminals 24 are contained in each of the cavities 16 and wires 26, onto which the terminals are crimped, extend between the several housings of the harness. When the harness is put to use, the connectors 4-10 are engaged with other connectors or with electrical equipment such as motors, switches, or timers thereby to connect the various electrical components or electrically controlled components of the device on which the harness is used.

Each of the cavities 16 has an enlarged diameter section 18 extending inwardly from the mating side 14 of the housing, an intermediate reduced diameter section 20, and a relatively short enlarged diameter section 22 which opens onto the rearward side 12 of the housing. The contact terminals 24 each comprise a wire barrel crimp portion 30 crimped onto the conducting core of a wire 26, an insulation barrel crimp portion 28 crimped onto the insulation of the wire, and a contact portion 30 in the form of a cylindrical socket 32 which is adapted to receive a complementary contact pin. As shown in FIG. 2, the socket portion 32 is disposed in the enlarged forward cavity section 18, the wire crimp 30 is disposed in the intermediate cavity section 20, and the insulation crimp 28 is disposed in the enlarged cavity section 22. A rearwardly directed retaining lance 34 is struck from the contact section 32 and bears against the shoulder separating cavity sections 18 and 20 thereby to prevent rightward movement of the contact shown in FIG. 2 beyond the position shown. A forwardly directed lance 36 is struck from the insulation barrel portion 28 of the terminal and bears against the shoulder separating cavity portions 20 and 22 thereby to prevent forward or leftward movement of the terminal beyond the position shown in FIG. 2. As will be explained below, a terminal of the type shown in FIG. 2 is adapted to be applied to the end of a wire after the wire has been inserted through a cavity in the housing so that upon subsequent movement of the wire and terminal towards the cavity, the lance 36 will be depressed until the terminal is in the position of FIG. 2 at which time the two lances 34, 36 retain the terminal in position. Additional stabilizing lances 38 may be struck from the intermediate section of the terminal to prevent undue lateral movement if required.

In accordance with the practice of the invention to produce the harness of FIG. 1, the rearwardly facing sides 12 of the housings 6, 8, and 10 are positioned against the rearwardly facing side of the housing 4 with the cavities 16 of the smaller housings 6, 8, 10 axially aligned with the cavities of the larger housing 4. The housings are clamped together as shown in FIG. 3 by any suitable holding means such as the simple U-shaped spring clamps 40 although more sophisticated clamping devices may be preferable under some circumstances. Wires 26 of the required lengths are then inserted through the aligned cavities 16 of the housings as shown in FIG. 4 until the ends of the wires are disposed beyond the mating faces 14 of the housings and terminals 24 are then applied to the ends of the wires as shown in FIG. 5. The clamps 40 are then removed, the housing 4 is moved leftwardly in FIG. 5 until the terminals on the left-hand ends of the wires are latched in the cavities of the housing 4. In a similar manner, the housings 6, 8 and 10 are moved generally rightwardly as viewed in FIG. 5 along the wires until the terminals on the other ends of the wires are locked in the housing cavities.

Two significant advantages of the invention are that the possibility of an error being made in the placement of the ter-

minals in the housings is reduced and the possibility of any of the terminals being damaged during the manufacturing process is reduced as compared with prior art manufacturing methods. The reduction in the possibility of errors being made is a result of the fact that only one critical insertion operation is required for each of the wires 26 in the harness, this insertion operation being carried out when the wire is inserted through the aligned cavities of two terminal housings as shown in FIG. 4. After this insertion operation has been carried out for a particular pair of aligned cavities, the wire is never removed from these cavities and a subsequent change in the position of the wire is therefore impossible. In accordance with prior art methods, on the other hand, two terminal insertion operations are required for each lead since each terminal must be individually inserted into a connector housing cavity and an error might be made during either insertion.

The practice of the invention reduces the possibility of the terminals being damaged during harness manufacture stems from the fact that the terminals are inserted into the connector housings immediately after they have been applied to the wire ends and are not handled or stored after application and before insertion into connector housings. As will be apparent from the drawing, after terminals have been inserted into connector housings, they are entirely surrounded and contained in the housing cavities and thereby protected against damage.

Alternative embodiments of the invention within the scope of the appended claims will be apparent to those skilled in the harness making art. FIG. 6, for example, shows an alternative form of housing 42 having cavities with restricted entrances 44 communicating with the rearward side 12 of the housing. The opening 44 is of a diameter sufficient to permit passage of wire 26 therethrough from right to left as viewed in FIG. 6 but not sufficiently large to permit rightward movement of the terminal 24' beyond the position shown. The lance 34' is not essential in this embodiment although it may be provided to achieve added reliability. The intermediate portion of the cavity is of restricted diameter as shown at 41 and the housing material is of a nature such that the cavity walls will yield during movement of the insulation barrel clamp portion 28' of the terminal therethrough. The restricted intermediate portion 41 of the cavity thus prevents leftward movement of the terminal from the cavity. It should also be noted that dimple means 39 are provided on the terminal for stabilizing purposes rather than the stabilizing lances 38 of the embodiment of FIG. 2.

FIG. 7 shows an embodiment in which the connector housing comprises two sections 46, 48, the section 46 comprising a block of insulating material having a cavity 52 therein which is of uniform diameter throughout its length excepting for a restricted entrance portion 50 which is by diameter sufficient to permit movement of the wire therethrough as explained above. After the terminals have been applied to the ends of the wires in accordance with the embodiment of FIG. 7, the hood portion 48 of the housing is moved over the ends of the terminals until a flange or skirt 56 on this hood portion extends over surface portions of the block section 46 of the housing, the two housing sections being latched together by suitable detent means shown at 51. The hood section 48 has a thin plate section 54 which is positioned against the mating side of block section 46 when the parts are assembled and the terminals extend through openings in this plate section as indicated.

The embodiments of the invention described above require that the terminals on the wire ends be of the type which are inserted into a housing cavity from the front or mating side of the housings. Many, if not most, of the terminals used are of the type which are adapted to be inserted into housing cavities from the rearwardly facing sides of the housings. FIG. 8 shows a wire guide and identification means which permits the practice of the invention with the latter type of terminals and which achieves other advantages discussed below.

In accordance with this further embodiment of the invention, the wire guide and identification means 62 comprises a modular block or plate made up of center sections 64 and

upper and lower sections 66 which are stacked against each other as shown. The sections 64, 66 are held in assembled relationship by clamps 72 which are received in recesses 74 in the end sections 66. The abutting sides of the sections 64, 66 have spaced apart semi-cylindrical recesses which, in the assembled block, define wire receiving cavities 68. These cavities are located relative to each other at the same locations as the terminal receiving cavities of the connector housings on the harness being manufactured. The ends of the cavities are enlarged as shown at 70 to a degree sufficient to accommodate the insulation barrel crimps between the terminals and the wires for reasons which will be explained below.

In accordance with the harness making method of the embodiment of FIG. 8, the unstripped wires are inserted through the cavities 68 and terminals are applied to the wire ends as described above. The block 62 is then moved along the wires until the terminals on one end of the wire bundle are located adjacent to block 62 with the insulation barrel crimps of the terminals received in the enlarged ends 70 of the cavities so that the terminals will be supported in parallel spaced-apart relationship at locations corresponding to the locations of the contact receiving cavities of the housing which is to be applied to the end of the harness being worked on. The rearwardly facing side of the housing is then moved relatively towards the face of the block 62 until the aligned and supported terminals are inserted relatively into the contact receiving cavities of the housing. The block is then moved relatively along the wires to the other ends thereof and the same contact insertion procedure is repeated. Where several housings are required on one end of the harness, the individual housings are merely moved against the face of the block 62 until insertion is accomplished.

After all of the terminals have been inserted into housings, the wire guide and identification member 62 is removed from the harness wires by merely removing the clamp members 72 and disassembling the block sections 64, 66. If desired, a wire guide and identification device similar to the block 62 can be manufactured as a frangible and expendable item, rather than as a modular reusable block, and removed from the harness by merely breaking it.

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.

I claim:

1. Means for manufacturing an electrical harness comprising:

a plurality of electrical connector housings, each of said housings having a mating face and a rearward face, contact-receiving cavities extending through said housings from the rearward faces thereof to the mating faces, said cavities being spaced-apart by the same distance in all of said housings,

said cavities being adapted to receive contact terminals by axial movement of said terminals into said mating faces of said housings and into said cavities

said housings having external dimensions permitting a plurality of said housings to be positioned in back-to-back relationship with at least one of said housings with cavities in said plurality of housings being in alignment with cavities in said one housing whereby,

said harness can be manufactured by positioning said plurality of housings and said one housing in back-to-back relationship, passing wires through the said cavities in said one housing and said plurality of housings until intermediate portions of said wires are in said cavities, securing terminals to the ends of said wires, and moving said housings relatively towards said terminals until said terminals are in said housings.

2. Means for manufacturing an electrical harness as set forth in claim 1 including holding means for temporarily holding said one housing and said plurality of housings in back-to-back relationship.

3. Harness making means for manufacturing an electrical harness of the type comprising at least two connector housings, each of said housings having a plurality of housing cavities extending therethrough from the rearward face thereof to the mating face thereof, at least one of said housings having said cavities arranged in two rows, contact terminals in said cavities and conductors secured to said terminals and extending between the said rearward faces of said housings, said harness making means comprising:

wire guide and identification means, said guide and identification means comprising a relatively rigid member having a plurality of guide and identification openings extending therethrough at locations corresponding to the locations of said cavities in said housings, the size of said openings being sufficient to permit passage of said wires therethrough but insufficient to permit passage of said terminals therethrough,

said wire guide and identification means being removable from said wires after insertion of said wires therethrough whereby,

upon inserting wires through said guide openings in said wire guide and identification means until an intermediate portion of each wire extends through said guide openings, terminals can be applied to the ends of said wires and said guide and identification means can be moved relatively along said wires to the ends thereof thereby to align said terminals and locate said terminals in positions corresponding to the positions of said housing cavities thereby to facilitate insertion of said terminals into said housing cavities.

4. Harness making means as set forth in claim 3 wherein said wire guide and identification means comprises a block comprising a plurality of modular sections, said sections being separable from each other along planes extending through said guide and identification openings, and means for holding said sections in assembled relationship while permitting disassembly of said sections from each other.

5. Harness making means as set forth in claim 4 wherein said means for holding said sections in assembled relationship comprises clamping means surrounding said block.

6. Harness making means as set forth in claim 3 wherein said wire guide and identification means comprises a block, said guide and identification openings being enlarged on each face of said block so as to receive portions of said terminals during insertion thereof into said connectors.

7. Harness making means for manufacturing an electrical

harness of the type comprising at least three connector housings each of which contains electrical contact terminals and wires extending between said terminals, said harness making means comprising:

first, second, and third electrical connector housings, said first housing having a plurality of contact receiving cavities extending therethrough from the rearward face thereof to the forward face thereof, said cavities being arranged on a predetermined pattern,

said second and third connector housings each having a plurality of contact receiving cavities extending therethrough from the rearward faces thereof to the forward faces thereof, the sum of the cavities in said second and third housings being no greater than the number of cavities in said first housing, each of said second and third connector housings having its cavities arranged on a pattern which is a part of said predetermined pattern whereby,

upon positioning said rearward faces of said second and third connector housings against said rearward face of said first connector housing with said cavities in said second and third housing in alignment with said cavities in said first housing, upon passing said wires through said cavities in said housings, upon attaching terminals to the ends of said wires, and upon sliding said first housing toward one end of said wires and said second and third housings towards the other ends of said wires, said terminals will be properly located in predetermined cavities in said housings.

8. Harness making means as set forth in claim 7 comprising at least one additional connector housing beyond said first, second, and third housings, said at least one additional housing having cavities extending therethrough, said cavities in said at least one additional housing being arranged on a pattern which is the same as cavities in at least one of said first, second, and third housings whereby, said at least one additional housing can be positioned in juxtaposition to at least one of said first, second, and third housings with its rearward face against the rearward face of at least one of said first, second, and third housings, and wires can be passed through said cavities in said at least one additional housing and through said cavities in at least one of said first, second and third housings, terminals can be crimped onto said wires, and said terminals can be positioned in said cavities in said at least one additional housing and at least one of said first, second, and third housings.

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