

[54] ELECTRICAL CONNECTOR

[72] Inventor: **Ralph T. Iversen**, Los Angeles, Calif.
 [73] Assignee: **Viking Industries, Inc.**, Chatsworth, Calif.
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 [51] Int. Cl. **H01r 13/58, H01r 13/54**
 [58] Field of Search **339/75 M, 75 MP, 92 R, 92 M, 339/103 R, 103 M, 176 M, 122 P, 123, 192 RL, 101, 102; 220/41**

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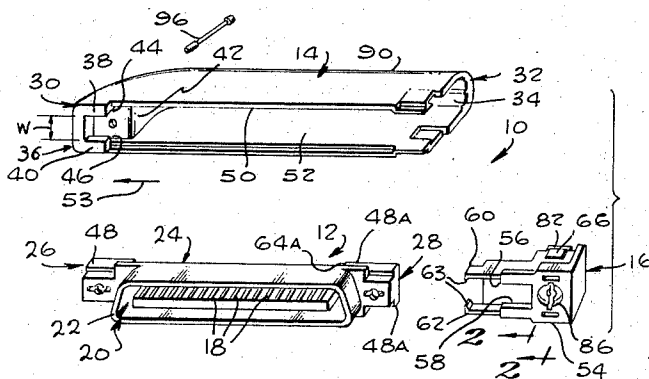
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Primary Examiner—Marvin A. Champion
Assistant Examiner—Lawrence J. Staab
Attorney—Lindenberg, Freilich & Wasserman

[57] ABSTRACT

An electrical connector is described which includes male and female frames that can be rapidly coupled to interconnect multiple contact elements on each frame, and which also includes a hood for each frame to cover the face of the frame where wires can be soldered or crimped to the contact elements. Each frame and hood is constructed to allow the hood to be mounted in either of two positions, to lead the wires in either of two directions. Each end of a frame has a pair of flanges for reception at a first end of the hood. A clamp is provided which can firmly engage a second end of the hood and either end of the frame, to securely hold the frame to the hood, the clamp also serving to securely hold the wires which pass through the second end of the hood.

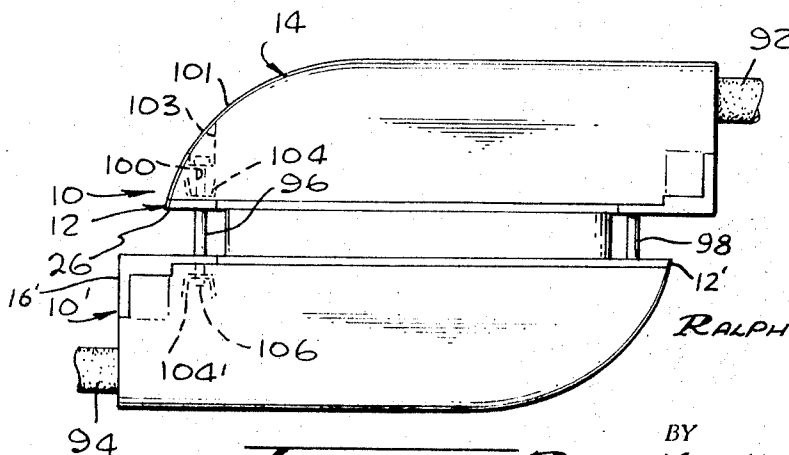
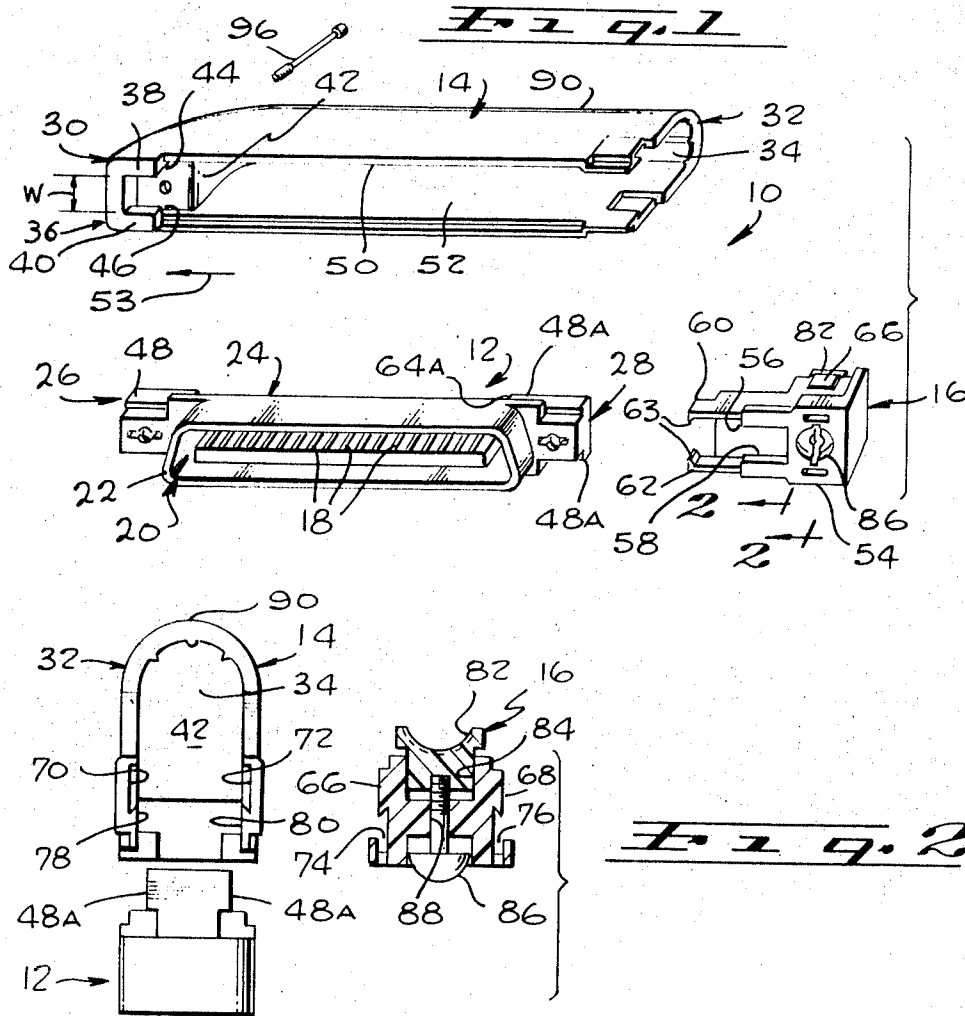
7 Claims, 10 Drawing Figures



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RALPH T. IVERSEN
INVENTOR.

BY
Lindenberg, Freilich & Wasserman

ATTORNEYS

Fig. 4

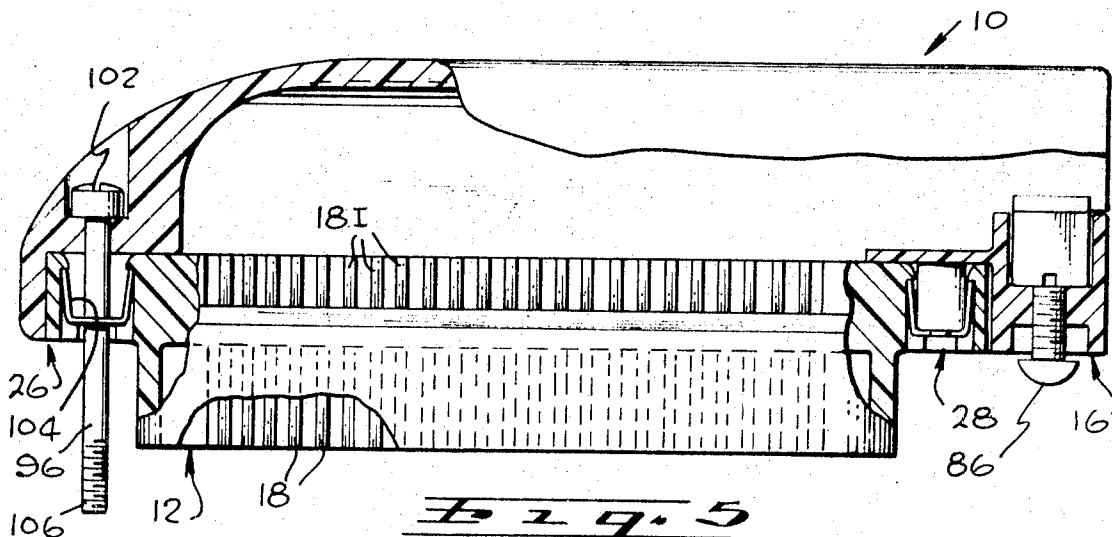
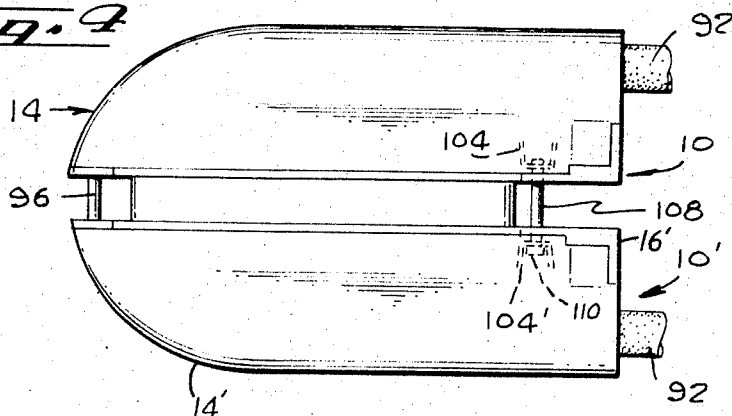


Fig. 5

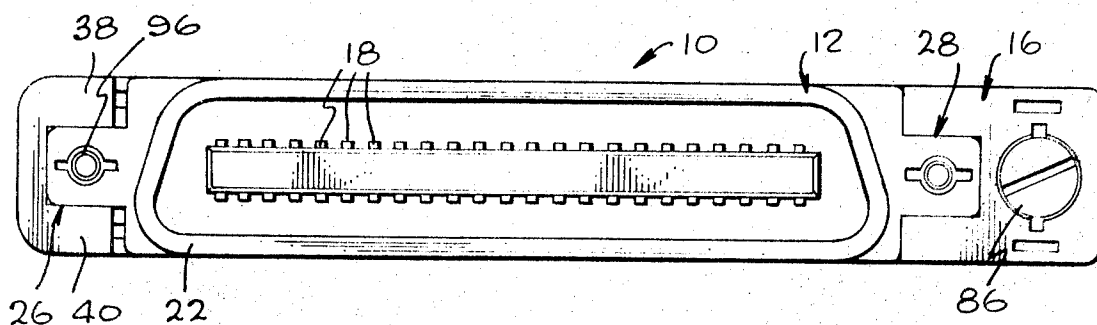


Fig. 6

RALPH T. IVERSEN
INVENTOR.

BY
Lindenberg Freilich & Wasserman
ATTORNEYS

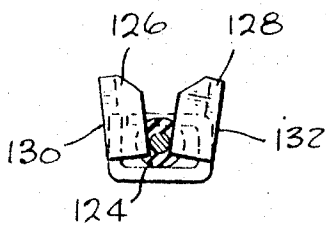
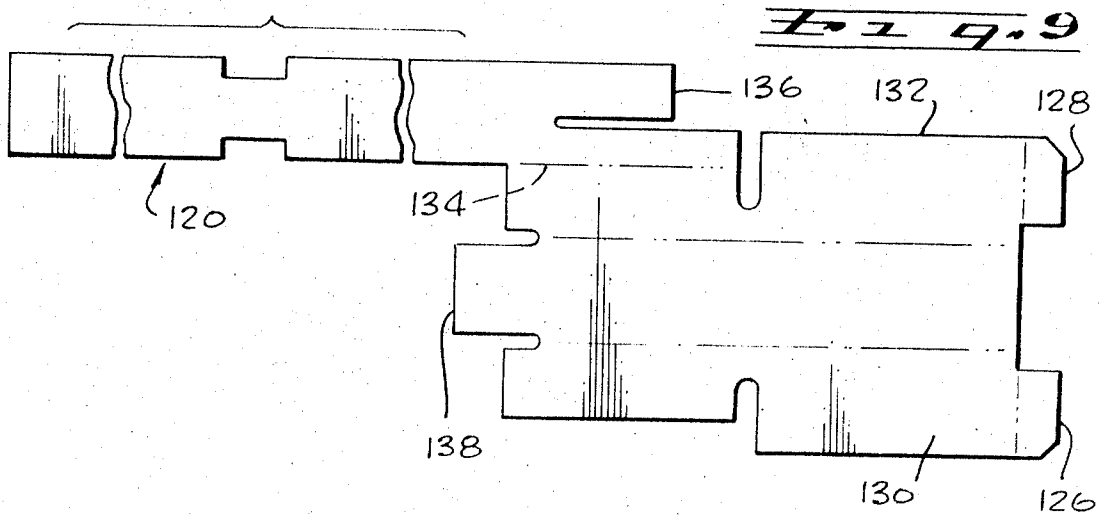
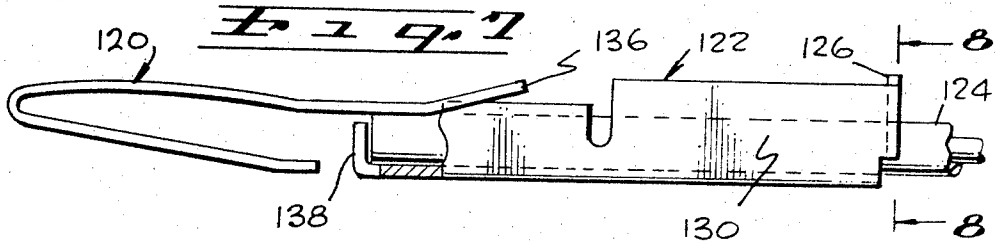
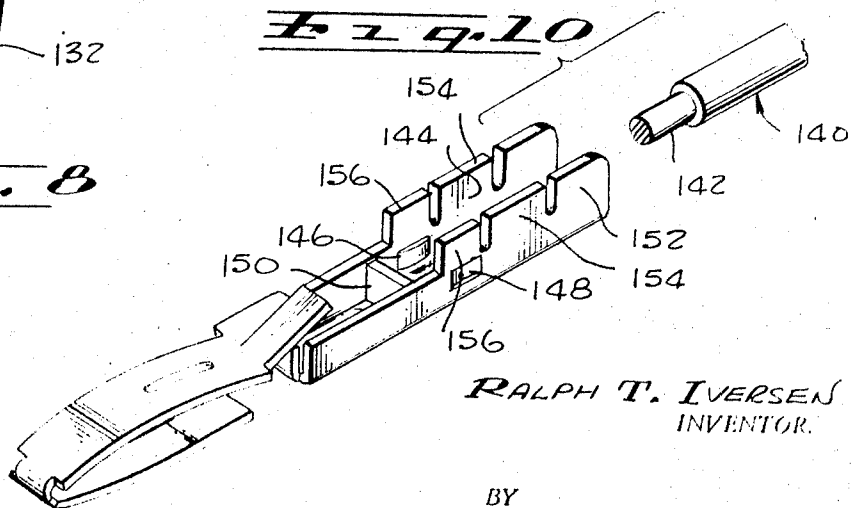


Fig. 8



RALPH T. IVERSEN
INVENTOR.

BY
Lundberg, Freilich & Wasserman
ATTORNEYS

ELECTRICAL CONNECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to electrical connectors.

2. Description of the Prior Art

One type of plug or connector assembly includes male and female frames that can be rapidly joined or separated to make or break contact between multiple contact elements. Each frame has a front face which can engage the other frame and a rear face where wires can be soldered or otherwise connected to the contact elements. A hood is generally provided to completely enclose the rear face of the frame where wires are connected, except for an opening through which the multiple wires pass. The connector assemblies generally have been constructed so that the hood fits on the frame in only one orientation, to lead wires in a particular direction away from the frame. In some cases it is desirable to have the wires pass in another direction, and this may be discovered only during the actual installation. A connector assembly which allowed the hood to be readily installed in either of two opposite orientations and which was rugged and neat in appearance would facilitate the installation of connectors and provide a neater appearing installation.

OBJECTS AND SUMMARY OF THE INVENTION

An object of the present invention is to provide a connector assembly which is easily converted to pass wires in either of two directions.

Another object is to provide a connector assembly that is neat and easy to assemble.

In accordance with one embodiment of the present invention, a connector assembly is provided which includes a pair of mating frames for establishing contact between multiple contact elements. The assembly also includes hoods for shielding the ends of wires that connect to the contact elements. Each hood can be readily assembled in either of two opposite positions to lead wires in either of two opposite directions from a frame.

Each of the frames is elongated and has a pair of sidewardly extending flanges at either end. The hood has a first end with a pair of slots which can receive the pair of flanges at either end of the frame. The hood also has a second end with an aperture for passing wires that connect to the contact elements on the frame. A clamp assembly which can be mounted on either end of the frame, is mounted on the end of the frame which will lie next to the second end of the hood. The clamp assembly has projections that are received in a pair of slots at the second end of the hood, so it holds the hood to the frame. The hood can be reversed by removing it from the frame and clamp, repositioning the clamp at the opposite end of the frame, and reinstalling the hood in a reversed orientation. Installation of the hood is accomplished by merely sliding the frame and clamp in place. A pair of screws can be employed to more securely hold the hood and frame together and to the mating frame and hood.

The novel features of the invention are set forth with particularity in the appended claims. The invention will be best understood from the following description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective exploded view of a connector constructed in accordance with one embodiment of the present invention;

FIG. 2 is an exploded end view of the connector of FIG. 1, with the clamp thereof shown in a section taken at 2—2 of FIG. 1;

FIG. 3 is a side elevation view of a pair of mating connectors installed for leading wires in opposite directions;

FIG. 4 is a view similar to FIG. 3, but which the connectors arranged to lead wires in the same direction;

FIG. 5 is a sectional view of the connector of FIG. 1;

FIG. 6 is a bottom view of the connector of FIG. 5;

FIG. 7 is a sectional side view of a contact element which can be used in the connector of FIG. 1;

FIG. 8 is a view taken on the line 8—8 of FIG. 7;

FIG. 9 is a plan view of the contact element of FIG. 7 prior to folding to a use shape; and

FIG. 10 is a perspective view of another type of contact element which can be used in the connector of FIG. 1.

10 DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a connector 10 which includes a frame 12, a hood 14 and a clamp 16. The frame 12 is of male form and is designed to couple to another fragmentary female frame so that a plurality of contact elements 18 in each frame are electrically connected together. The frame has a front face portion 20 with a shroud 22 for enclosing the region where contact is made between the elements 18 and corresponding elements on the other frame, and has a rear face portion 24 where inner ends 181 of the contact elements 18 are soldered or otherwise connected to wires. A pair of substantially identical fastener portions 26, 28 are formed at either end of the frame 12 at its rear face portion, either fastener portion capable of fastening directly to the hood 14. The hood 14 serves to cover the rear face portion 24 of the frame to shield the region where solder connections or the like are made between wires and the connector elements 18 of the frame.

The hood has a first end 30 which can engage one of the fastener portions 26 or 28 to hold the hood against the frame, and has a second end 32 with an aperture 34 for passing the wires that are connected to the contact elements 18. The clamp 16 can be fastened to the second end 32 of the hood and can fasten to either fastener portion 26 or 28 of the frame to hold down, or clamp, the second end of the hood to the frame. The clamp also serves to firmly clamp the wires that pass through the aperture 34 in the hood. Thus, the first end 30 of the hood is directly fastened to the frame while the second end 32 of the hood is fastened to the frame by means of the clamp.

An understanding of the manner in which the connector 10 can be assembled will be obtained by assuming it is desired to attach the hood 14 so that its first end 30 is engaged with the fastener portion 26 of the frame. The first or closed end 30 of the hood has a fastening portion 36 with a pair of flanges 38, 40 and an inner wall 42 that form two slots 44, 46. The fastener portion 26 of the frame has a pair of outwardly extending flanges 48 which can be received in the slots 44, 46 to hold the hood to the frame. Such fastening is achieved by inserting the rear face portion 26 of the frame between a pair of side walls 50, 52 of the hood, and sliding the frame in the direction of arrow 53 so that the flanges 48 pass into the slots 44, 46. Although this secures the first end 30 of the hood to the frame, the second end 32 of the hood is still not held down and it could be pried up. The clamp 16 serves to hold the second end 32 of the hood against the other fastener portion 28 of the frame.

The clamp 16 includes a clamp housing 54 which can be attached to the fastener portion 28 of the frame. To enable this, the clamp housing is constructed with walls that form a pair of slots 56, 58 that can engage the flanges 48A on either side of the fastener portion 28. In addition, the clamp has a pair of fingers 60, 62 with inwardly directed hooks 63 at their ends which can fit behind stepped portions 64A of the fastener portion. When the flanges 48A are held in the slots 56, 58 of the clamp and the hooks on the fingers 60, 62 are behind the stepped portions 64A, the clamp is firmly held on the frame 12. The housing 54 of the clamp is constructed of a resilient material, and is installed by first separating the fingers 60, 62 so they can fit over the flanges 48A until their hooks engage the stepped portions 64A.

The clamp 16 also has a pair of flanges or projections 66, 68 (also shown in FIG. 2) which can be received in corresponding slots 70, 72 formed in the second end 32 of the hood, to retain the clamp on the hood. The clamp also forms a pair of

slots 74, 76 below the projections, which receive corresponding flanges 78, 80 on the hood. Thus, when the clamp has been mounted on the frame 12, it can be firmly attached to the hood to hold one end of the frame to the second end 32 of the hood.

The assembly of the connector is accomplished by first installing the clamp 16 on one end of the frame 12, such as the end where the fastener portion 28 is located. The frame and clamp combination is then installed on the hood 14 by first placing the rear portion 24 of the frame between the side walls 50, 52 of the hood. Then, the frame and clamp combination is slid in the direction of arrow 53 so that the flanges 48 on the fastener portion 26 of the frame slide into the grooves 44, 46 at the first end 30 of the hood, while, at the same time, the projections 66, 68 on the clamp assembly slide into the slots 70, 72 at the second end 32 of the hood. Once the frame and clamp are thus slid into place, the hood and frame are relatively securely held together. To reduce the possibility of accidental separation, the hood 14 is formed of a resilient material and the walls of the slots 44, 46 are dimensioned for an interference fit with the flanges 48 on the frame. The length of the slots 44, 46 is at least one-half the width W of the narrowest opening between the slots, so the interference fit holds the hood and frame securely together.

The clamp 16 includes a clamp member 82 which is slidably mounted in a passage 84 formed in the clamp housing. A screw 86 which has threads engaged with walls 88 of the clamp housing and an end disposed against the clamp member 82, can be turned to advance the clamp member 82 towards the top wall 90 of the hood. When the screw 86 is turned to advance the clamp member 82 towards the top wall 90, the clamp member 82 bears against wires which pass through the aperture 34 in the hood to clamp the wires firmly in place.

The connector 10 is often used with another similar connector 10' as shown in FIG. 3, the connector 10' being substantially identical to connector 10 except that its frame has a female configuration for receiving the male frame 12 shown in FIG. 1. The connectors are often utilized in a configuration where one connector 10 is oriented to pass wires 92 in one direction while the other connector 10' passes wires 94 in the opposite direction. Although the two connectors will tend to remain together, a pair of screw fasteners 96, 98 is generally employed to make sure that the connectors 10, 10' remain together. The screw 96 extends through an aperture 100 in a rounded end wall 101 of the hood, with its head 102 in a well 103. The screw 96 also passes through a hole in the frame 12 and is threadably engaged with a threaded hole in the male frame of the connector 10'. The frame of each connector 10, 10' has a threaded insert 104, 104' that can threadably engage the screw 96. The screw 96 has threads only along its extreme end 106, so that the connectors are held together between the head 102 of the screw and the threaded end 106 which engages insert 104'. The other screw 98 is similarly engaged with elements of each connector.

In many situations, it is desirable that both bundles of wires 92 and 94 pass in the same direction, as shown in FIG. 4. The configuration of FIG. 3 can be readily changed to the configuration of FIG. 4 by removing the hood 14' of the connector 10' and reinstalling it in the reverse position as shown in FIG. 4. In order to reverse the hood of connector 10', a workman first removes the hood 14' by unscrewing the screws 96 and 98, removes the clamp 16' from the frame 12' of the connector 10' and installs the clamp at the other end of the frame 12'. Removal of the clamp 16' is accomplished by manually spreading the fingers 60, 62 of the clamp and sliding off the clamp from the frame. Prior to reinstalling the clamp 16' on the opposite fastening portion of the female frame 12', a short screw 108 is installed to hold the male and female frames of the connectors 10, 10' securely together. The screw 108 has a head 110 which is received in a recess of the insert 104', and its threaded end is engaged with the insert 104' of the male frame 12. After the clamp is reinstalled, the hood 14' is again installed on the female frame 12', in the position shown in

FIG. 4, and the screw 96 is refastened. Such a reversal of hood position can be readily accomplished in the field so that a workman can choose the most appropriate direction in which to lead off the wires.

The male and female frames are each formed of insulating material in a single injection molding process, except for the pair of inserts 104 and the multiple contact elements 18. The hood 14 can be formed of insulating material in a single molding process, and does not require inserts. The clamp 16 can be formed from two molded elements. In addition to these members, only several screws are required to complete the assembly. The molded parts provide a neat and uniform appearance to the apparatus and allow smooth interfiting of the parts.

A variety of different types of contact elements 18 can be employed in the connectors, including types which require a wire with a bared end which is soldered and/or crimped to a contact element. However, a contact element which could be used with unbared wires would enable even easier assembly. FIGS. 7 through 9 show a type of contact element which can be employed as the elements 18 in the connectors, to allow connection of unbared wires. The element includes a looped front portion 120 for making sliding contact with another element and a rear portion 122 which receives and makes electrical connection with an unbared wire 124. The electrical connection is accomplished by means of a pair of cutting blades 126, 128 on side walls 130, 132 of the rear portion, which cut through the insulation of wire 124 and contact the conductor therein.

The contact element is originally punched out of a sheet or otherwise formed in the shape shown in FIG. 9. The front portion 120 is then bent into a loop, and bent 90° sidewardly along fold line 134, with a tang portion 136 bent up slightly. An end wall 138 and the cutting blades 126, 128 are then bent up by 90° and the side walls 130, 132 are bent up by an angle such as 45°. The wire 124 is then inserted until it hits the end wall 138, and the side walls 130, 132 are bent towards each other. As the side walls are bent together, the blades 126, 128 cut into the insulation, as shown in FIG. 8, and contact the conductor within the insulation. The blades are tapered like a knife to facilitate cutting. The contact elements may then be inserted into a connector frame.

FIG. 10 illustrates another type of contact element which can be employed, which is of a more conventional type. This contact element can receive a wire 140 which has a bared end 142 by crimping and soldering it in place. The element has walls forming a pocket 144 for accepting the wire and a pair of indentations 146, 148 for centering the central conductor of the wire. An end wall 150 serves as a stop for the wire and also prevents solder from flowing out of the pocket. The wire is connected by laying it in the pocket and bending over, or crimping wall portions 152, 154 and 156 against the wire. Portions 152 crimp against insulation, portions 156 crimp against the bared conductor 142, and portions 154 may crimp against insulation or the bared conductor. After crimping the wire, the conductor may be soldered into place.

Thus, the invention provides a connector which is easy to install so that wires pass into it in either of two directions. The connector utilizes an elongated frame and an elongated hood which can be readily joined at one end. A clamp serves to join the other ends of the frame and hood securely together. The clamp also provides a movable clamp member that holds down wires passing through the hood. Once the frame, hood, and clamp are fastened together, they securely remain together, although a workman can quickly pull them apart in the field. The connector can be readily coupled to another complementary connector and can be fastened to it with screws to prevent accidental disconnection. The connector can employ a variety of contact elements including elements that have blades to cut through wire insulation so that connections can be readily made to unbared wires.

Although particular embodiments of the invention have been described and illustrated herein, it is recognized that

modifications and variations may readily occur to those skilled in the art and, consequently, it is intended that the claims be interpreted to cover such modifications and equivalents.

What is claimed is:

1. An electrical connector comprising:
 - a first frame for coupling to another frame, said first frame having a plurality of contact elements for making contact with corresponding contact elements in the other frame, said first frame having opposite ends and having a pair of outwardly extending flanges and a pair of inwardly stepped regions at each end;
 - an elongated hood having a first end with a pair of slots for receiving the outwardly extending flanges at either end of said first frame and having a second end with an aperture for passing wires that connect to said contact elements; and
 - a clamp having flanges defining a pair of slots for receiving the flanges on an end of said first frame, a pair of resilient fingers for reception behind the inwardly stepped regions on an end of said first frame, and a pair of outwardly extending hood-engaging parts, said hood having a pair of slots at its second end for receiving said hood-engaging parts on said clamp.
2. An electrical connector for connecting to a complementary connector and to a plurality of wires comprising:
 - an elongated first frame having a first face with a plurality of contact members for making contact with contact members of another complementary frame, and a second face for receiving a plurality of insulated wires that join to said contact members of said first frame, said first frame having a pair of sidewardly extending flanges at each end;
 - a hood for enclosing the region over said second face, said hood having top and side walls and first and second ends, said second end having a pair of slots, and said second end having an aperture for passing said wires that connect to said contact members and said first end having a pair of flanges extending toward each other to form undercut slots with parallel side walls for slidably receiving said sidewardly extending flanges at either end of said first frame; and
 - coupling means including a pair of protuberances for reception in said slots at said second end of said hood and a pair of inwardly extending flanges forming a pair of undercut slots for receiving the outwardly extending flanges on an end of said first frame, whereby to hold said second end of said hood to said first frame.
3. The connector described in claim 2 wherein:
 - said coupling means includes a clamp housing forming said protuberances and said inwardly extending flanges thereof, and a clamp member slidably mounted on said clamp housing for movement along said aperture in said hood to clamp against wires passing therethrough.
4. In an electrical connector which includes an elongated frame with electrical contacts and an elongated hood for enclosing one face of said frame, each end of said frame having a pair of sidewardly extending flanges and a pair of stepped regions on either side thereof and said hood having a pair of slots at a first end portion for receiving said flanges at either end of

said frame and an aperture at a second end portion for passing wires, the improvements comprising:

a clamp having a pair of slots for receiving the flanges at an end of said frame, a pair of fingers for engaging said stepped regions on an end of said frame, first means for removable attachment to said second end portion of said hood, and second means for adjustably engaging wires passing through said aperture in said hood to clamp them in place.

5. The improvement described in claim 4 wherein:

said first means on said clamp includes walls defining a pair of outwardly extending flanges; and

said hood has walls at said second end portion thereof for receiving said outwardly extending flanges on said clamp, whereby, when said clamp is fastened to said frame, sliding of the frame and clamp assembly along said hood engages opposite ends of said hood with the flanges on said frame and clamp.

6. An electrical connector comprising:

a first elongated frame having a plurality of contact elements for making contact with corresponding elements in another frame;

a hood for mounting on said first frame and passing wires that connect to said contact elements, said hood having first and second ends;

said first elongated frame having opposite ends and having means defining at least one inwardly stepped region at a location near each of said ends; and

a coupling member for attachment to either end of said first frame, said coupling member having at least one resilient finger extending in a direction primarily along the length of said first frame and having a projection for reception behind the inwardly stepped region on either end of said first frame, and means for attaching the coupling member to an end of said hood to hold an end of said first frame to said hood.

7. An electrical connector comprising:

a first frame having a plurality of contact elements for making contact with corresponding contact elements in another frame, said frame having first and second end portions and having a pair of outwardly extending flanges at each end portions, said flanges extending outwardly by the same distance at each end portion;

a hood for mounting on said first frame, said hood having side walls, an enclosed first end and a second end with an opening for passing wires that connect to said contact elements, said hood having a first pair of slots in said side walls near said first end for closely receiving one of said pair of flanges at an end of said first frame, and having a second pair of slots in said side walls near said second end which are located out of line with said first pair of slots; and

a coupling member having first means for attachment to either end of said first frame and having a pair of outwardly extending flanges for close reception in said second pair of slots of said hood when the flanges on the frame are slid into the first pair of slots in the hood.

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