United States Patent [19]

Judd

[11] **3,816,819**

[45] **June 11, 1974**

[54] **WIRE CONNECTOR WITH WIRE LOCATING DEVICE**

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[73] Assignee: **General Electric Company,** New York, N.Y.

[22] Filed: **Oct. 30, 1972**

[21] Appl. No.: **301,996**

[52] **U.S. Cl.** ..... **339/99 R**

[51] **Int. Cl.** **H01r 11/20**

[58] **Field of Search** ..... 339/99 R, 97, 98, 274

[56] **References Cited**

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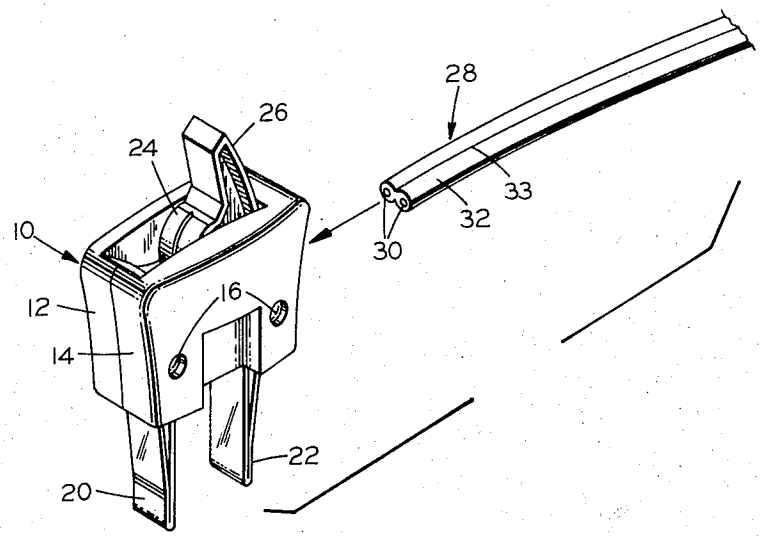
Primary Examiner—H. Hampton Hunter

Attorney, Agent, or Firm—Paul E. Rochford; P. L. Schlamp

[57] **ABSTRACT**

A wire connector with a wire locating device is provided and includes an insulating housing and a wire entry port in the housing to admit a pair of parallel stranded wires enclosed in an insulating sheath, the sheath having a cross-section of the general configuration of a figure 8 including opposed grooves. A wire passageway in the housing communicates with the wire entry port, and a pair of insulation penetrating contacts are stationed along the passageway and are pointed toward the passageway. Guide means are disposed in the passageway on at least one of the sides to cooperate with at least one of the grooves of the wire insulation to center the wire laterally in the passageway. Means are also provided for moving the wire relative to the wire penetrating contacts after the wire is centered.

5 Claims, 12 Drawing Figures



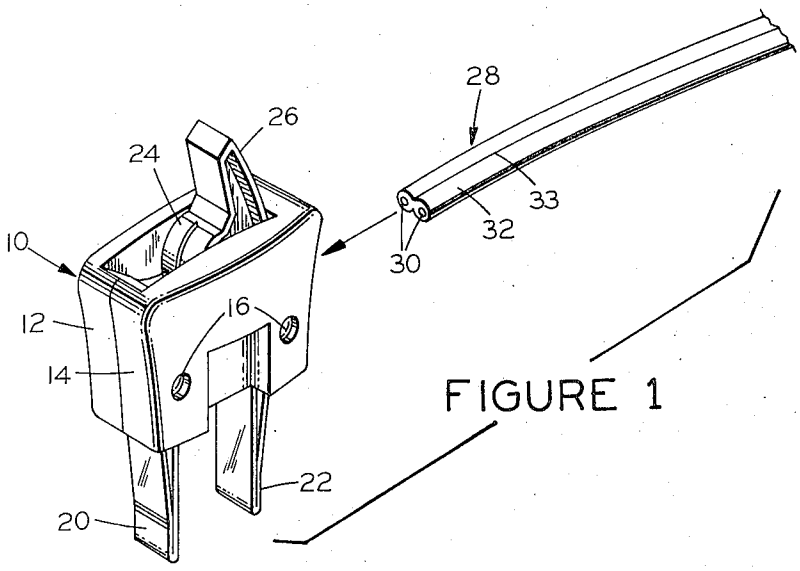


FIGURE 1

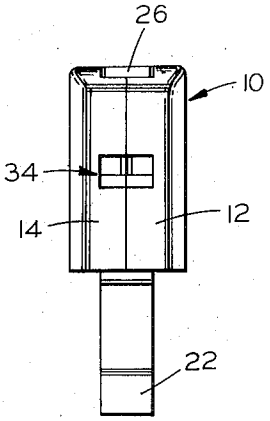


FIGURE 2

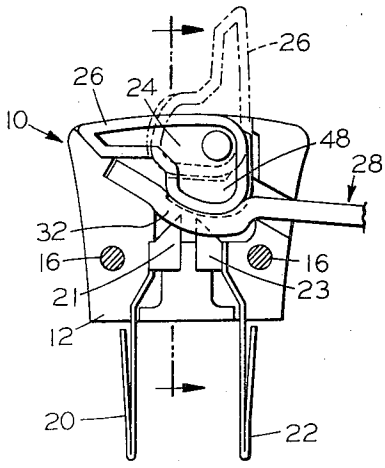


FIGURE 5

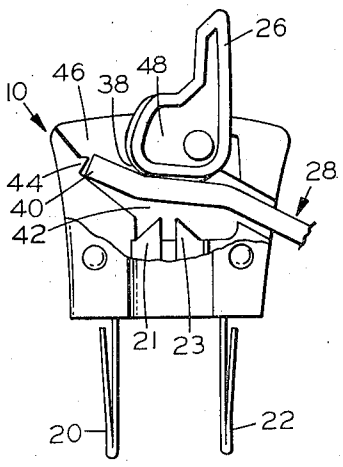


FIGURE 4

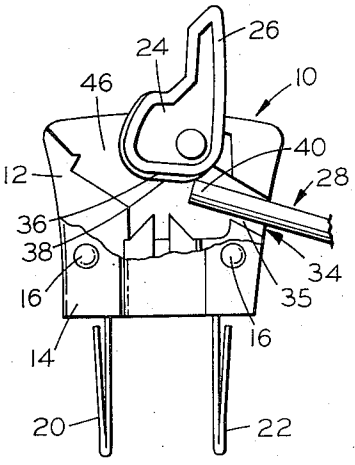


FIGURE 3

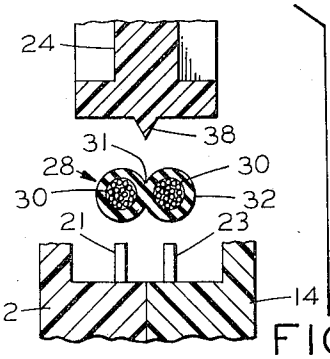


FIGURE 7

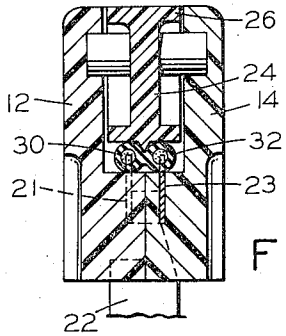


FIGURE 6

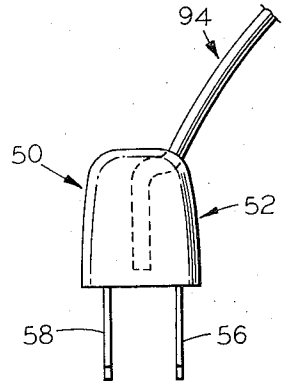


FIGURE 8

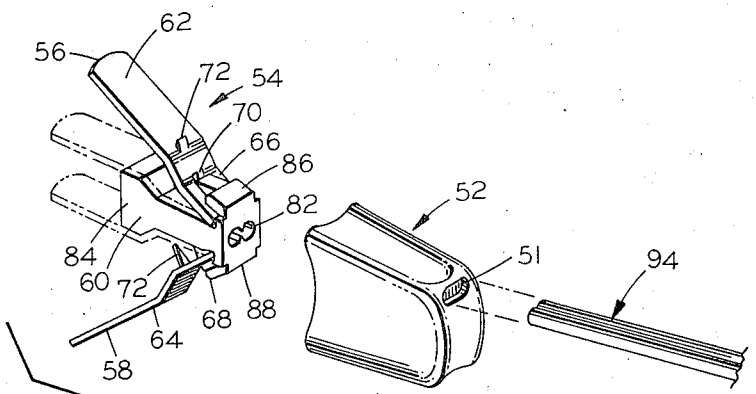


FIGURE 9

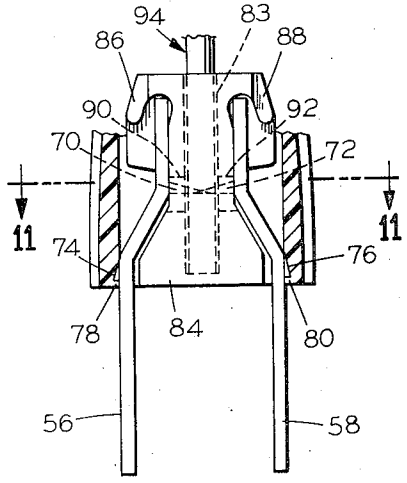


FIGURE 10

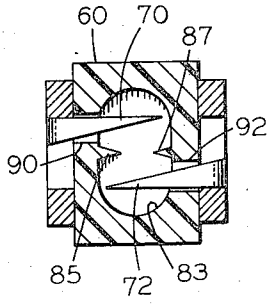


FIGURE 11

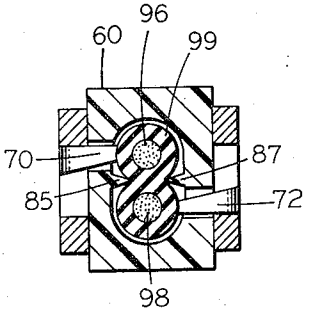


FIGURE 12

WIRE CONNECTOR WITH WIRE LOCATING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to a wire connector and particularly to a connector capable of receiving and making electrical contact with parallel wires of different wire size.

Wire connectors of the insulation penetrating type have been known for many years. U.S. Pat. No. 2,609,415, which has now expired, concerns a wire connector similar to that disclosed in the present patent application.

One problem which has arisen in connection with wire connectors of the type described in U.S. Pat. No. 2,609,415 is that due to changes in the size of the insulated wires to be connected into such connectors reliable contact is not always made. The making of an electrical contact with the stranded flexible metal wire contained within the insulating sheath was not assured mainly because wire of overall smaller size than the maximum size the connector will accommodate has been used in such connectors. It has been found that where devices designed to permit insulation penetrating contact are employed with such smaller size wire, the contact generated could not carry as much current as would normally be expected for a connection to a wire of the size for which the device was originally designed. Also, the Underwriters' Laboratories recently uprated the ampacity of standard sizes of wire and such devices had to meet higher test standards for handling the higher ampacity of such wires.

In other words over a period of years there have been changes of the wire sizes used with such devices as well as in the ampacity ratings of wires used with such devices. Accordingly, while the device as originally used in connection with wire of standard size, and standard ampacity, was able to perform adequately to contact a flexible wire to deliver up to 7 amperes of power to the wire, with changes in the wire itself the contact became progressively more unreliable as wire was employed with such connectors which was progressively further from the specification wire needed for best results.

Normally a pair of number 18 flexible stranded parallel wires are sheathed within a layer of vinyl insulation having a cross-section of a figure 8 and this pair of wires is now rated by Underwriters' Laboratories to carry up to 10 ampers of current. To be employed as a connector for a parallel pair of number 18 wires, a connector should have a capacity for handling at least the 10 amperes for which the number 18 wire is rated and in fact should have a rating higher than the rating of the wire itself.

Also, it has been found that because there are numerous products sold on the market which employ a wire designated generally as a number 20 wire, there is a likelihood that connectors of the type described in the 2,609,415 patent will be used in connection with wire of the smaller size. Such wire is used in products such as electric clocks and other articles which have only a low power demand and generally indicated to be safe for use with power levels of 3 amperes and less.

One problem which arises with the use of a number 20 wire for example is that once the wire is inserted into a wire channel or passageway within a housing it may be located at one side of the passageway so that as the insulation penetrating contacts move relative to the wire they do not make contact in the expected fashion within the insulating sheath by penetrating through the sheath to reach the stranded wire within.

In some such cases one of the contacts will simply not reach any of the metal wire at all and accordingly the expected contact is not made. In other cases it is possible for a connection to be less than adequate in that there is very little surface contact between an insulation penetrating contact and the metal of the wire within the insulation. Where such limited contact is made the connector and wire may become overheated as the electricity flows between the metal of the insulation penetrating contact and the metal of the wire.

SUMMARY OF THE INVENTION

It is accordingly one object of the present invention to provide a connector which reliably makes electrical connection between a pair of parallel conductors encased within an insulating sheath and the insulation penetrating contacts of a connector.

Another object is to provide a connector which can accommodate a plurality of wire sizes where the wires are pairs of parallel conductors within conducting sheaths having a general figure 8 cross-section.

Another object is to provide a means for centering a pair of parallel wires enclosed within an insulating sheath as such wire is introduced into and electrically connected to a pair of contacts within an electrical connector.

Still another object is to provide a means for making electrical connection between contacts of an electrical connector and parallel conductors enclosed within an insulating sheath with reliability and certainty and without attendant overheating of the wire or contacts of the electrical connector.

One way in which objects of the present invention are carried out is by providing a wire connector with a wire locating device. The wire locating device may be included in a wire entry port and passageway within an insulating housing. The wire locating device takes the form of a guide or guides which cooperate with one or both grooves on opposite sides of the insulation of the parallel conductor wires. The guides locate and center the insulated wire laterally within the passageway and, once the wire is centered, a relative movement is generated between a pair of insulation penetrating contacts and the wire to force the contacts through the insulation and into electrical contact with the electrical conductors within the wire.

In one form of device the centering means is in the form of a guide mounted on a cam so that the wire is centered by contact of the wire with a guide on the cam.

In another form of the device the guides are formed integrally with or mounted on the insulating housing at the entrance to the insulating housing or within the wire passageway within the insulating housing.

Other objects and advantages of the invention will be in part apparent and in part pointed out in the description which follows.

The description will be made clearer by reference to the accompanying drawings in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a cap with a wire poised for entry into the insulating housing thereof.

FIG. 2 is an end elevation of the cap of FIG. 1 viewed from the end toward which the wire end is pointed in FIG. 1.

FIG. 3 is a side elevation of the cap of FIG. 1 with the housing partially removed and showing an insulated wire, as seen in FIG. 1, partially inserted in the connector.

FIG. 4 is a view similar to that of FIG. 3 but showing the end of an insulated wire fully inserted.

FIG. 5 is a view similar to that of FIG. 3 but showing the fully inserted insulated wire engaged by the insulation penetrating contacts.

FIG. 6 is a vertical section of the cap of FIG. 5 taken along the line 6—6 of FIG. 5.

FIG. 7 is a partial vertical section of a portion of a device as shown in FIG. 4, illustrating the relationship of typical internal parts of a device of the present invention.

FIG. 8 is a side elevation of another form of cap having a combination of wire guide and contact means pursuant to the present invention.

FIG. 9 is a perspective exploded view of the parts of the cap of FIG. 8 prior to assembly.

FIG. 10 is a view of the cap of FIG. 8 in part in section and in part in phantom showing the relation of the contacts to the wire.

FIG. 11 is a horizontal section of the central portion of the cap as shown in FIG. 10 taken along the line 11—11 of FIG. 10 and showing the contacts extending into the wire passageway.

FIG. 12 is a view similar to that of FIG. 11 with the wire shown in place.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. 1 through 7 insulating housing 10 is made with two side by side parts 12 and 14 which are assembled together in clam-shell fashion and held in place by a pair of rivets 16. Extending from a lower part of the housing 10 is a pair of parallel power blades 20 and 22. Extending from the top of the housing 10 is a cam 24 having a handle 26. As shown in FIG. 1 cam 24 is tilted to the open position with the handle 26 extending upward out of the housing 10. An insulated wire 28 having two parallel conductors 30 and an insulation 32 having the general form of a figure 8 and having two opposed grooves 33 is seen to the right of the housing of FIG. 1 poised in a position for entry into a wire entry port at one end of the insulating housing 10 not seen in FIG. 1, but readily evident in FIG. 2 at 34.

The manner in which guidance is provided to locate a wire in the connector as provided herein is best described with reference to FIG. 3, 4 and 5. In FIG. 3 the wire connector, which may perhaps be more aptly described as a cap or plug, is shown with a portion of the interior of the device. The rear housing part 12 of the device is shown intact. Insulated wire 28 is shown enterring the port 34 on the right side of the figure and as it enters it makes a sliding contact with a lower surface 36 of the raised cam 24 shown in the open position with the handle 26 extending upward from the tab. As indicated the port 34 is oriented so that the wire entering a wire entrance passageway 35 within the housing 10 passes into contact with the lower surface 36 of cam 24. The wire is accordingly biased against the ridge from the tab. As indicated the port 34 is oriented so that the wire entering a wire entrance passageway 35 within the housing 10 passes into contact with the lower surface 36 of cam 24.

The wire is accordingly biased against the ridge bearing surface and centered precisely by the interaction of a groove of the wire insulation with a ridge of the contacted cam surface. Cam surface 36 is provided with a wire guide which is in the form of a ridge 38 extending out from the center of the cammed surface 36 and having cross-sectional dimensions of the groove 33 in the insulated wire having an insulation with the cross-section resembling a figure 8.

In FIG. 4 the wire 28 is shown with its end 40 fully inserted within the wire passageway 42 within the housing 10. Wire end 40 butts against boss 44 provided to limit movement of the wire within passageway 42 and to provide a stop for the end 40 of wire 28.

When positioned as shown in FIG. 4 the wire 28 is poised above two insulation piercing contacts 21 and 23 formed integrally with the power blades 20 and 22 respectively at the inner ends thereof. As shown, the ridge 38 fits in the groove of the insulation of wire 28.

In FIG. 5 the cam 24 is shown in phantom with its handle 26 in an upwardly extending position similar to that shown in FIGS. 3 and 4 and is shown in solid lines with its handle pivoted to the left at rest position within the conforming recess 46 in the insulating housing 10. When the cam is pivoted from its open to its closed position as shown in FIGS. 4 and 5 the driving end 48 of the cam presses the insulated wire 28 into contact with the wire piercing contacts 21 and 23 and causes the contacts to penetrate through the insulating sheath 32 of the wire 28.

The relationship of the ridge 38 to the groove 33 of insulation 32 is seen in FIG. 7 where the wire insulation 32 and wire conductors 30 as well as the cam 24 and the ridge 38 on the cam are seen in cross-section. As is evident the ridge 38 nests into the groove 33 in the insulation 32. Where the entering wire is not precisely located so that the groove 33 and ridge 38 are not aligned, the brushing of the wire end 40 against the ridged surface 36 of the cam, as illustrated in FIG. 3, serves to induce entry of the ridge 40 into groove 33 and to center the wire relative to the cam and relative to the insulation penetrating contacts 21 and 23. In this manner the ridge 38 laterally positions the wire within the wire passageway in the insulating housing. When so positioned the electrical conductors 30 within the wire 28 are disposed over and aligned with the insulation piercing contacts 21 and 23.

The relative positions of the parts are seen with the cam in its closed position in FIG. 6 where the contacts 23 and 21 are shown in contact with the conductors 30 of the wire 28.

An alternative form of the device is illustrated in FIGS. 8 through 12. In this form a cap 50 includes an outer insulating jacket 52 and an inner power blade vice 54. The blade vice 54 is made up of a pair of power blades 56 and 58 held within an insulating wire guide 60. The blades 56 and 58 have respectively contact ends 62 and 64, opposite pivot ends 66 and 68 with insulation penetrating contacts 70 and 72 formed out of metal of the pivot ends of the blades.

They also have respectively outwardly extending latches 74 and 76 which interlock with mating latch re-

cesses 78 and 80 on the inner surface of insulating jacket 52.

Insulating wire guide 60 is an elongated body of insulating material having a wire entry port 82 at one end and an outwardly flared insulating blade spacer 84 at the other end.

On each side of the guide 60 at the wire entry end, two hinge clasps 86 and 88 hold the pivot ends of the power blades in pivoting relation to the wire guide. Prong entry ports 90 and 92 in the sides of the guide 60 communicate with the wire channel 83 along the axis of guide 60.

Channel 83 is provided with internally extending ribs 85 and 87. These ribs extend along the channel 83 from wire entry port 82 to and below the prong entry ports 90 and 92 where the insulation penetrating prongs 70 and 72 enter channel 83 as best seen in FIG. 9 and 11.

The internally extending ribs 85 and 87 are spaced in entry port 82 and in channel 83 to permit a wire having opposed grooves 95 to be directed as it enters port 82 and passes into channel 83 to be properly positioned and centered in this channel. By properly positioned is meant a positioning which ensures a penetration by contacts 70 and 72 through the insulating sheath 99 of an insulated wire, such as 94, into electrical contact with the parallel stranded conductors 96 and 98 within the insulating sheath 99 of the wire 94.

When the cap as described above is to be put to use the jacket 52 and wire guide 54 of the cap are first separated by compression of the two blades 56 and 58 to release latches 74 and 76 from conforming recesses 78 and 80.

After separation, an insulated wire such as 94, having two stranded parallel conductors 96 and 98 and an insulating sheath 99 having the general cross-sectional configuration of a figure 8, and having opposed grooves 95, is threaded through port 51 of jacket 52.

With the jacket 52 on the wire, the blades 56 and 58 are opened from the position shown in phantom in FIG. 9 to the position shown in solid lines. The insulated wire, such as 94 is then inserted through port 82 into channel 83 and is guided as it enters the channel and also as it moves into the channel by the interaction of the ribs 85 and 87 with the grooves 95 on each side of the insulation 99.

After the wire has been thus fully inserted in the channel 83 the blades 62 and 64 are pushed or pinched back again from the position shown in solid lines in FIG. 9 to the position shown in dashed lines. The result of such movement is to introduce the contacts 70 and 72 through the contact entry ports 90 and 92 into channel 83 through insulation 99 and into contact with conductors 96 and 98 respectively of wire 94. Reliable electrical contact between conductors 96 and 98 and the respective power blades 56 and 58 is established in this way.

After such contact has been established the insulating jacket 52 is moved along wire 94 into its jacketing position about the body 60 and the upper portions of blades 56 and 58 to give the wired device the appearance shown in FIG. 8. Additional variations of the wire locating device of this invention will be apparent to those familiar with the art. What is needed for reliable contact of insulation penetrating contacts and the conductors within such insulated sheaths is a guide or rib disposed in the wire entry path of the wire and in the wire passageway for such a wire within a connector so that the insulated wire is properly located in the passageway prior to a relative movement of wire and penetrating contact. Such relative movement can then generate a reliable electrical connection between the sheathed conductors and the insulation penetrating contacts.

By relative movement is meant a movement of wire with respect to contacts or of contacts with respect to wire and does not mean or require that either the wire or the contacts must remain stationary as the other is moved. In other words if both contacts and wire are moved simultaneously relative to the device in which they are present, or if either remains stationary relative to the device and the other moves, such movement is to be understood as a relative movement as the term relative movement is used in this application so long as there is a change in the distance separating the wire and the contacts.

Similarly a relative movement of contacts and passageway wall has a similar meaning. For purposes of this application a surface such as 36 of cam 24 which confronts a passageway such as 42 is considered to be a wall of said passageway.

What is claimed as new and designed to be secured by letters patent of the United States is:

1. A wire connector which comprises an insulating housing,

said housing including a wire entry port adapted to receive an end of a parallel pair of insulated wires

said housing also including a passageway for said wire pair in said housing communicating with said port,

at least one guide extending into said passageway to cooperate with a groove in the insulation of said wire pair,

said guide having the form of at least one ridge extending along a length of a wall of said passageway and being supported from said wall,

two wire penetrating contacts extending into said passageway and disposed laterally generally symetrically one on each side of said ridge,

means opposite said contacts for moving a wire received in said passageway toward said contacts,

said means including a movable wall portion in said passageway and said wall portion including said wire guide.

2. The connector of claim 1 in which a cam is mounted for pivoting motion in said housing and a surface of said cam forms at least a portion of a wall of said passageway.

3. The connector of claim 2 in which the ridge extends from a surface of said cam facing said passageway.

4. The connector of claim 1 in which the wire connector has electrical contacts and in which the insulation penetrating contacts are integral with said electrical contacts of said connector.

5. The connector of claim 1 in which said ridge is supported to one wall of said passageway and the contacts are mounted on opposite sides of the long axis of the ridge for advance relative to the wall on which the ridge is supported.

* * * * *