ELECTRICAL CONNECTOR WITH EXTENDED CABLE SUPPORT

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References Cited

UNITED STATES PATENTS
2,035,345 3/1936 Schaefer............................... 339/101
3,197,829 8/1965 Caveney et al. ......................... 24/16 PB

3,622,942 11/1971 Rynk ................................. 339/107

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ABSTRACT

A plastic conduit affixed to and extending from the end of an electrical connector to transmit radial and axial forces, acting on the electrical wires leading to the connector, away from the connection of the connector contacts and electrical wires. The plastic cable support includes a plurality of axial slots that permit the cable support to be compressed into the wires passing through the conduit so that the wires may be retained in a fixed position. The plastic cable support transmits the radial and axial forces away from the connection of the wires to the contacts at least the distance of the cable support.

7 Claims, 6 Drawing Figures
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ELECTRICAL CONNECTOR WITH EXTENDED CABLE SUPPORT

BACKGROUND OF THE INVENTION

This invention relates to electrical connectors of the axial connecting type wherein a plurality of electrical wires are connected into a predetermined circuit relationship with a plurality of electrical contacts. The invention is more particularly related to an improved electrical connector that includes means for removing the stress that would normally be applied to the connector of the connector contacts and wires by forces external to the connector operating on the wires. This invention is related to the invention disclosed in patent application Ser. No. 156,638 filed June 25, 1971 and entitled “Electrical Connector with Improved Cable Support” and patent application Ser. No. 156,639 filed June 25, 1971 and entitled “Plastic Cable Support.”

It has been a continuing problem to prevent forces applied to a cable from being transmitted to an electrical connector associated therewith. However, most of the devices devised to avoid this problem are costly, complicated and generally require too many additional components to be added to the connector to avoid the problem. An example of one such device to prevent the transmission of the forces applied to a cable to the connector associated therewith is a metal clamp which is attached to the housing of the connector by a retaining ring. Such a clamp had to be machined and required nuts and bolts to compress the clamp into the cable. In many instances, the clamp was tightened too much causing the rigid metal clamp to cut into and sometimes through the cable. Certainly this was undesirable as the electrical signals traveling through the wires were conducted to the connector body and, where a high voltage is involved, a hazardous condition exists. Therefore, prior art cable support devices do not satisfactorily transmit radial and axial forces away from the connector contact wire junction.

SUMMARY OF THE INVENTION

This invention provides a plastic sleeve of simple construction, that is connectable to an electrical connector to prevent the transmission of radial and axial forces applied to the wires from being transmitted to the wire terminals in the connector.

The invention is a multi-contact axial type connector characterized by a plastic sleeve having one end connected to the electrical connector and the other end of the plastic sleeve in pressed contact with the wires leading to the connector. This arrangement permits the use of the connector to connect electrical connectors of the type having a metal housing, a resilient body located in the housing, a plurality of electrical contacts located in the resilient body, and a plurality of wires each of which has one end electrically connected to a contact and the other end extending away from the connector, and means for supporting the electrical wires a predetermined distance from the connector which comprises: A plastic conduit having a shape similar to the shape of the connector and a tapered portion that tapers away from the first end portion and terminates in an opening smaller than the opening in the first end portion, the tapered portion having at least one axial slot therein extending from the opening in the tapered portion so that the tapered portion is radially compressible; means for radially compressing the tapered portion of the conduit, e.g., such as a plastic belt, so that the electrical wires extending through the conduit are retained in fixed positions; and means for demountably attaching the conduit to the connector, e.g., a retaining ring that threads onto the connector so that the first end portion of the conduit is closer to the connector than the tapered portion whereby when the plastic conduit is attached to the connector and the tapered portion is compressed against the wires connected to the connector, the wires leaving the connector are supported by the conduit for at least the distance of the conduit.

Accordingly, it is an object of this invention to provide an inexpensive cable support that may be connected to an axial type electrical connector to transmit radial and axial forces applied to the wires outside the connector away from that portion of the wire connected to the contacts in the electrical connector.

Another object of this invention is to provide an inexpensive device for preventing the breakage of wires from the electrical contacts in a connector.

It is another object of this invention to provide a non-metallic cable support.

It is still another object of this invention to provide an improved type axial mating connector.

It is yet another object of this invention to support and protect that portion of the resilient insert that may extend beyond the connector housing.

It is still a further object of this invention to provide a cable support device that does not require the necessity of tools to attach the device to an electrical connector.

The above and other objects and features of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings and claims which form a part of the specification.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 through 4 are illustrations of preferred embodiments of the cable support for a connector.

FIG. 5 illustrate the cable support shown in FIG. 2 attached to a connector and supporting an electrical cable.

FIG. 6 is a plastic belt which is used to tie down the cable support in a fixed position around the cable support.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, FIG. 1 illustrates a plastic conduit 10 having a configuration that embodies the principles of this invention. The conduit has a tapered portion 5 and cylindrical portions 1, 7 at each end of the conduit 10. Generally, the tapered portion 5 is frusto-conical in shape so that one end of the conduit has a large opening which is connected to the connector and the other end has a smaller opening which provides for the passage of wires to the connector. The large cylindrical portion 1 of the conduit 10 includes a shoulder 2 which, in conjunction with a retaining ring
(not shown), cooperates to fasten the conduit 10 to a connector. At the smaller cylindrical portion 7 of the conduit 10 there is a second shoulder 9 which, in conjunction with the tapered portion 5, operates to prevent the fastening means (FIG. 6) from moving axially beyond the cylindrical portion 7. The conduit 10 includes a slot 11 which extends from the opening in the smaller cylindrical portion 7 toward the opposite ends 1. When the conduit 10 is fabricated completely from a rigid material, such as plastic, which cannot be compressed, the axial slot 11 allows the smaller opening in the conduit to be reduced when a compressive force is applied to the cylindrical portion 7 of the conduit. Since the conduit is comprised of a rigid material the cylinder cannot be bent and, hence, the wires within the cylinder cannot be bent.

FIG. 2 is an elongated version of the conduit shown in FIG. 1. In this embodiment, the tapered portion 5 has a more gradual slope and extends further. In this embodiment, the entire conduit 10 is also comprised of rigid material, such as plastic, which is not compressible, therefore, it is necessary to have slot 11 in the conduit so that when a compressive force is applied to the cylindrical portion 7 the opening at the smaller end of the conduit is reduced.

FIG. 3 illustrates a conduit that may be divided into two functional portions. A first rigid (e.g., plastic) cylindrical portion 1 having a shoulder 2 and an extension 12 and a second compressible portion 4 which may be comprised of a resilient material that may be repeatedly compressed. The resilient material has an inner diameter about the same as the diameter of the extension 12 so that the compressible material 4 may be permanently secured to the extension 12 of the rigid portion 1 of the conduit 10. No axial slots are necessary in this embodiment in view of the fact that the end portion is comprised of a compressible material as opposed to the previous embodiments where the material was not compressible but the conduit in general was because of the axial slots.

FIG. 4 illustrates a conduit that is generally frustoconical in shape and does not have any axial slots. When fabricated entirely from plastic, this type of support would be designed so that the opening at the smaller end of the frusto-conical conduit would be a specific size to receive a predetermined number of wires going to the connector. Although this type of conduit prevents radial forces from being transmitted to the connector, it does not do much to reduce any axial forces that would be applied to wires passing through the conduit from reaching the contacts in the connector. Therefore, in applications where axial forces applied to the wires is not a factor, this type of conduit, since it requires one less operation to fabricate (no slot), would be most suitable as it is less expensive and would do the job. As an alternate embodiment, the smaller end portion 7 could be comprised of a resilient material, or the end portion 7 and the tapered portion 5 could be comprised of a resilient material so that the conduit 10 could be radially compressed against a plurality of wires passing therethrough.

FIG. 5 illustrates the functional advantages of the plastic conduit and how it cooperates with the electrical connector 49 and the wires 40 connected thereto to transmit axial and radial forces away from the connection. The right-hand portion of the figure illustrates a partial cross-sectional view of a connector 49 that includes a resilient insert or body of nonconductive material (e.g., dielectric) 42, an electrical contact 43, and a metal housing 41 that includes a plurality of threads 46 for receiving a retaining ring 47. The retaining ring 47 threadably engages the electrical connector and as it is tightened down interacts with the shoulder 2 of the conduit 10 to bring the conduit into contact with the housing 41 of the electrical connector. The wires 40, having electrical conductors 45 therein, extend through the conduit 10 and to the electrical connector contacts 43 where they are either crimped or soldered to the contacts 43. The conduit 10, being comprised of a rigid material, protects the wires 40 within the conduit from being subjected to radial and axial forces. Without the conduit, movement of the wires 40 would weaken the connection of the wires to the contact 43, and in some instances, break away entirely. When the cylindrical end portion 7 of the conduit is compressed by some means, such as the tie down strap 50, the wires 40 extending from the connector and within the conduit are both radially and axially supported.

FIG. 6 is one preferred device for compressing the conduit which incorporates the principles of this invention. This particular means for compressing the conduit 10 is a belt of plastic 50 that has a plurality of directional ridges or teeth 51 along one surface thereof, a friction buckle 52, and an enlarged end portion 53. The opening in the buckle 52 is larger in size than twice the cross-sectional area of the smaller remaining end portion of the belt but smaller in size than the combined cross-sectional area of the larger end portion 53 and the smaller end portion so that both end portions of the belt may not pass through the buckle together whereby when both of the end portions of the belt are drawn into the buckle together, the teeth in both of the end portions engage each other and force the belt into pressurized contact with the inside of the buckle thereby preventing further movement of the end portions of the belt into said buckle. When the belt is tightened around the conduit 10, the teeth 51 engage the teeth in the end portion 53 so that the belt cannot move in a direction that will enlarge the loop A. This results from the end portion 53 being drawn into the friction buckle 52 so that the teeth of the end portion 53 engage the teeth in another portion of the belt to stop the movement of the belt in a direction that would enlarge the loop A. Removing the expansive forces from the loop A allows the end portion 53 to move outside of the friction buckle 52 and therefore allow the belt to move in either direction as the teeth 51 are no longer engaged.

Referring now to FIG. 5, the essential objects of the invention are obtained in the following manner. Wires 40 to be connected to an electrical connector 49 are inserted through a retaining ring 47 and then through a plastic conduit 10 in such a manner that the retaining ring 47 will abut against the shoulder 2 of the conduit 10 and the larger cylindrical portion 1 of the conduit 10 will be closer to the connector 49 than the smaller cylindrical portion 7 of the conduit 10. The electrical wires 45 are then connected by suitable means to the contacts 43 of the connector. After the wires 45 are connected to the contacts 43 the retaining ring 47 and
the conduit are ready to be located. The retaining ring 47 is tightened down on the connector housing 41 until the cylindrical portion 1 of the conduit 10 abuts the connector housing 41 and is firmly locked into position between the housing 41 and the retaining ring 47. The plastic belt 50 is then placed around the narrow cylindrical portion 7 of the conduit 10 and the leading end of the belt passed through the opening in the friction buckle 52 and pulled tight. This action compresses the conduit into the insulation of the wires 40 and locks the belt 50 in a fixed position. Once assembled in this manner, axial and radial forces acting upon the wires 40 beyond the conduit 10 are prevented from reaching the connection of the wire 45 to the contacts 43.

While a preferred embodiment of the invention has been disclosed, it will be apparent to those skilled in the art that changes may be made to the invention as set forth in the appended claims, and, in some cases, certain features of the invention may be used to advantage without corresponding use of other features. For example, the general shape of the conduit shown has been cylindrical, however, electrical connectors and the conduit 10 take many physical configurations, e.g., rectangular, octagonal, etc., while the objects of this invention may still be obtained. Accordingly, it is intended that the illustrative and descriptive materials herein be used to illustrate the principles of the invention and not to limit the scope thereof.

Having described the invention, what is claimed is:

1. In combination with an electrical connector of the type having several wires connected thereto, the improvement comprising:
   means for supporting said wires a predetermined distance from said connector, said supporting means including a conduit comprised of non-resilient material through which said wires pass, said conduit being a unitary integral structure comprising:
   a frusto-conical conduit portion
   a first cylindrical and rigid conduit portion extending from the larger end of said frusto-conical portion, said first cylindrical portion including a shoulder thereon facing said frusto-conical portion;
   a second cylindrical conduit portion extending from the smaller end of said frusto-conical portion and terminating in a free end, said second cylindrical portion including a shoulder at said free end that faces said frusto-conical portion; and
   at least one axial slot in said second cylindrical portion and said frusto-conical portion that extends the entire axial length of said second cylindrical portion and along at least a portion of said frusto-conical portion whereby said second cylindrical portion is compressible;
   means for engaging said shoulder on said first cylindrical portion of said conduit and demountably attaching said wire supporting means to said connec-

2. The combination as recited in claim 1 wherein said frusto-conical portion and said first and second cylindrical portions of said conduit comprise a unitary integral structure.

3. The combination as recited in claim 1 wherein said conduit is comprised of plastic.

4. The combination as recited in claim 2 wherein said conduit is comprised of plastic.

5. In combination with an electrical connector of the type having several wires connected thereto, the improvement comprising:
   a demountable strain relief conduit, through which said wires pass, for supporting said wires a predetermined distance from said connector, said conduit comprising a unitary integral structure having a frusto-conical conduit portion,
   a first rigid cylindrical conduit portion at one end of said frusto-conical portion, said first cylindrical portion including a shoulder thereon that faces said frusto-conical portion,
   a second cylindrical conduit portion at the other end of said frusto-conical portion that includes a shoulder thereon that faces said frusto-conical portion, and a plurality of axial slots in said second cylindrical portion and said frusto-conical portion that extends the entire axial length of said second cylindrical portion and along at least a portion of said frusto-conical portion, said axial slots defining at least three axially rigid but radially moveable fingers that extend in a direction away from said first cylindrical portion, said fingers comprising greater than one half of the circumference of said second cylindrical portion; and
   coupling means engaging the shoulder in said first cylindrical portion of said conduit and demountably attaching said clamp to said connector.

6. The combination as recited in claim 5 wherein said strain relief conduit is comprised of plastic.

7. The combination as recited in claim 5 wherein said strain relief conduit includes means for retaining said second cylindrical portion in pressurized contact with said wires passing therethrough whereby said electrical wires in said conduit are protected from radial and axial forces.