Nov. 14, 1961 C. E. KIRK, JR 3,009,129

MULTIFORM STRAIN-ABSORBING CABLE-CONNECTOR ASSEMBLY

Filed May 12, 1959

FIG. 1.

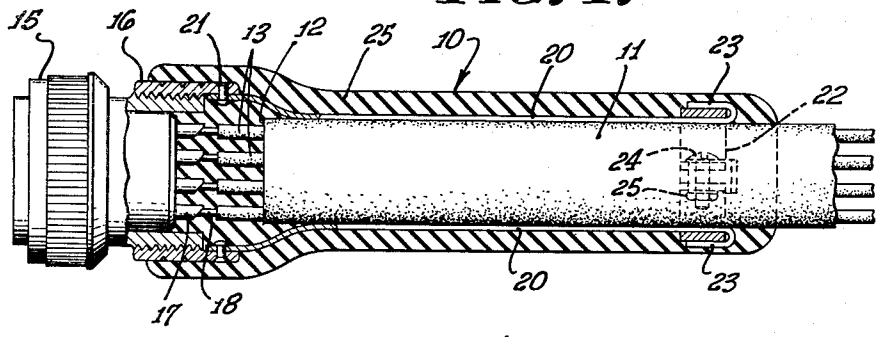


FIG. 2.

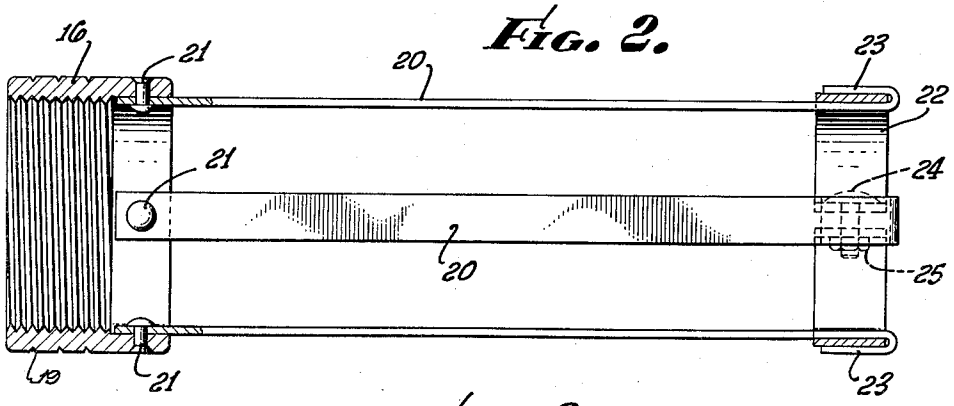
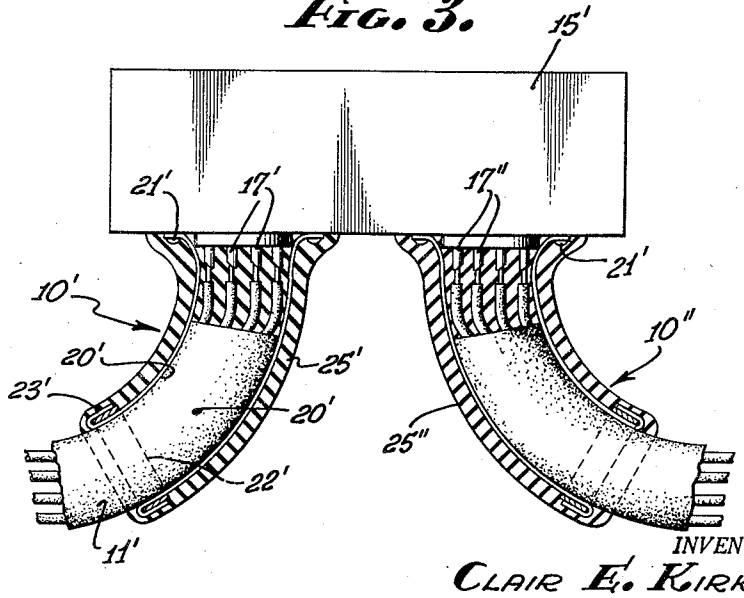


FIG. 3.



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MULTIFORM STRAIN-ABSORBING CABLE-CONNECTOR ASSEMBLY

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This invention relates to a strain-absorbing cable-connector assembly and particularly to the type which can easily assume and hold a cable at any desired curved or angular relation with respect to a connector associated therewith.

When a multiconductor cable is electrically connected to a connector, it is quite common to provide a rigid sleeve or backshell threadedly connected to the rear of the connector for protecting the electrical connections between the terminals in the connector and the conductors carried by the cable. The rigid sleeve or backshell is clamped to the outer jacket of the cable and prevents strain from being transmitted to the electrical connections. However, due to the rigidity of this type of cable-connector assembly only one predetermined form or shape can be utilized. The axis of the sleeve is normally coincidental with the axis of the connector and in line with the terminal pins of the connector. This has been found to be objectionable in some instances where a cable-connector must assume various forms during normal use and installation.

For example, the connectors are often plugged into receptacles located in extremely crowded panels, junction boxes or other related equipment. Due to the lack of space, the cable-connector assembly is required to be bent, curved or to otherwise conform to the conditions which may exist at the time of installation. But regardless of what form the cable-connector assembly is required to assume, the electrical connections between the connector terminals and the electrical conductors must be protected from any strain which could cause damage or failure.

The present invention provides a cable-connector assembly which can assume and hold various forms, either straight or curved, and prevents strain from injuring the electrical connections between the cable and connector. The assembly includes an electrical multiconductor cable having its protective insulating jacket removed from one end thereof to expose the conductors electrically connected to terminals in the connector. A plurality of elongated, bendable, strain-resisting strips extend in spaced relation from the connector. One end of each strip is attached to the connector and the free ends of the strips are firmly clamped and connected to the cable. A resilient molded synthetic rubber composition embeds and covers the conductors, electrical connections and strips to form a bendable cable-connector assembly. It is preferred that the strips are of metal and when the cable-connector assembly is bent, the metal, strain-resisting strips are adapted to hold the assembly in the bent or curved form and also prevent strain on the cable from being transmitted to the electrical connections.

An object of the present invetnion is to provide a cable-connector assembly which can assume and hold many curved, angular or bent forms.

Another object of the invention is the provision of a cable-connector assembly for preventing damage to the electrical connections between the cable and connector when the assembly is adapted to be bent into different forms.

A further object is to provide a novel strain-resisting cable-connector assembly which is non-rigid, and is adapted to be flexed and bent.

Other objects and advantages of this invention will be

readily apparent from the following description when considered in connection with the appended drawings.

In the drawings:

FIG. 1 is a longitudinal section through one form of cable-connector assembly of the present invention.

FIG. 2 is an enlarged longitudinal section of a preassembled unit of a backshell, the bendable strain-resisting strips, and the clamp means.

FIG. 3 is a side elevation of a rectangular connector with two sets of terminals, two cables having axes at an angle to the axes of the terminals being shown in section and protected by the means of this invention.

The strain-absorbing cable connector assembly **10** illustrated in FIG. 1 includes an electrical multiconductor cable **11** having a protective insulating jacket thereon, the jacket being removed from the end portion of the cable as indicated at **12** to expose the electrical conductors **13** in splayed form. It is preferred that the insulating jacket be made of a synthetic rubber composition such as neoprene.

A rigid electrical connector **15** having prongs or sockets correlated with terminals **17** may have a housing or backshell **16** threadedly secured on the rear thereof and enclosing the plurality of electrical terminals **17**. The insulation is removed from each of the electrical conductors **13** to expose bare wires **18** which are electrically connected to the terminals **17**, preferably by soldering.

A plurality of elongated, bendable, strain-resisting strips **20** extend in spaced relation from the backshell **16**; one end of each of the strips **20** is attached to the connector housing or backshell **16** by any suitable means. As shown in FIGS. 1 and 2, the attaching means may be a rivet **21**. However, other attaching means such as screws, bolts and hooks and eyelets are contemplated. The attaching means, such as rivet **21**, need not provide a rigid attachment; some pivotal movement of a strip about its rivet is often desirable to facilitate orientation of the strip into desired angular or bent position.

The free end of each strip **20** is firmly clamped around and connected to the insulating jacket of a cable **11** in a zone spaced from the connector **15**. Any suitable fastening device **22** may be provided to clamp the free ends of the strips around the insulating jacket of the cable **11**. In the clamping device illustrated, the free end portions of the strips **20** are hooked around the clamping device **22** which may consist of a metal band encircling the cable **11** and capable of being tightened, as by having its ends adjustably connected by a bolt **24** and nut **25**. In this manner at least some of the strips **20** are under tension when the cable connector assembly is formed.

As seen in FIG. 2, the backshell **16**, strain-absorbing strips **20** and clamping device **22** may form a preassembled unit which can be easily placed around the end portion of the cable **11** and slid upwardly around the cable while the soldered electrical connections are made between the bare wires **18** and the terminals **17**. After the connections are completed, the preassembled unit is slid forwardly and the backshell **16** is threadedly secured on the rear of the electrical connector **15**. The clamping device **22** is then tightened so that the free ends of the strips **20** are firmly clamped around and connected to the insulating jacket of the cable. Tightening band **22** may be tightened to such extent that it is deformed at zones crossing the edges of strips **20**, causing the strips to become partly embedded in the jacket of the cable and held against displacement. If it is desired that the axis of the cable be held at an angle to the axis of terminals **17**, then two or more of strips **20** will engage tightening band **22** at a shorter distance from backshell **16** than the other strips. Such arrangement places some of the strips under tension and others may be under compression. The

strips **20**, backshell **16** and tightening device **22** form a protecting and positioning assembly. Any longitudinal pull or strain exerted on the cable **11** will be transferred to the strips **20** and will not be transmitted to the electrical soldered connections between the conductors **13** and the terminals **17**.

A resilient, waterproof and dielectric synthetic composition **25** is then applied in semiliquid or pasty form to the assembly to embed and cover the splayed conductors **13**, the electrical connections and the strips **20** are molded and cured in place. Circumferential grooves **19** may be provided around the outer surfaces of the backshell **16** to assist the synthetic rubber composition to adequately bond and adhere to the backshell. The resulting cable connector assembly as shown in FIG. 1 presents a smooth, waterproof, wear-resistant, electrically insulating surface covering in which the reinforcing form imparting and strain relieving structure is embedded.

It is contemplated that the bendable strain-absorbing strips **20** may be made of various metals such as aluminum, copper, steel, stainless steel or even fiberglass composition, or other plastic compositions which have tensile strength, are adapted to resist strain and are flexible and not brittle to enable the cable connector assembly to bend to various shapes or forms.

FIG. 3 illustrates that a cable connector assembly as taught by the present invention can be used to form a flexible assembly which is desired to have a substantially predetermined form. The connector **15'** may be provided with two sets of electrical terminals **17'** and **17''**, each of which is provided with a cable connector assembly **10'** and **10''** substantially the same as the cable connector assembly **10** described hereinabove. A plurality of elongated bendable strain-resisting strips **20'** may be secured as at **21'** directly to the rear face of the connector **15'** and extend therefrom in spaced relation. The free ends of the strips **20'** are firmly clamped around and connected to the insulating jacket of the cable **11'** in a zone spaced from the connector **15'**. The end portions **23'** of the strips **20'** are hooked around a clamping device **22'** in a manner similar to that illustrated in FIGS. 1 and 2. However, in this form of the invention, it should be noted that the strips **20'** are of unequal length as the strip having the smaller radius is of shorter length than the strip having a greater radius. A synthetic rubber composition **25'** embeds and covers the strips, electrical connections and conductors in the same manner as the composition **25**.

This form of the invention can be used when a predetermined curve or form is contemplated thus helping to ensure that the cable connector assembly assumes and holds a predetermined form. However, even in this form of the invention, the assembly is still flexible and can be bent and flexed in various directions without any strain being transmitted to the electrical connections. The clamping device **22'** still firmly clamps the free ends of the strips **20'** to the cable **11'** thus ensuring that the strain placed on the cable **11'** will be transferred through the strips **20'** and not to the electrical connections between the conductors and the terminals **17'** and **17''**.

When the strips **20'** are made of metal or other material which is deformable and will hold its new shape or form, the cable connector assembly of the present invention can merely be bent or the cable can be moved so that its axis is at an angle to the axis of the rigid connector and the cable connector assembly will assume and hold the particular bent form. As can be well understood by those skilled in the art, this can have many advantages during actual use of the assembly.

It can therefore be understood, that the present invention discloses means for providing a strain-absorbing cable connector assembly which can assume and hold various forms or shapes. Obviously many modifications and variations of the present invention are possible in the light of the above teachings. For example, various types of materials can be utilized for the bendable strain-absorbing strips. While it is preferred that neoprene be used as the resilient composition for embedding and covering the connections, other compositions such as thiacol, polyurethene, polyalkalene polysulfide polymers, or natural rubber can be utilized. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

I claim:

1. A multiform, strain-absorbing cable-connector assembly for preventing strain from being transmitted to the relatively weak electrical connections between electrical conductors in the cable and terminals in the connector, comprising: an electrical multiconductor cable having a protective insulating jacket, said jacket being removed from the end portion of said cable to expose the conductors in splayed form; a rigid connector having a housing enclosing a plurality of terminals, said terminals being electrically connected to the conductors of said cable; a plurality of elongated, bendable strain-resisting strips extending in spaced relation from said connector housing and surrounding said electrical connections, one end of each of said strips being rigidly attached to the connector housing and being out of engagement with said insulating jacket, separate clamping means for firmly clamping the free ends of said strips around and to said insulating jacket of the cable in a zone spaced from the connector whereby any axial or transverse strain on the multiconductor cable will be transmitted around the electrical connections between the conductors and terminals and directly to said rigid connector; and a resilient composition embedding and covering said splayed conductors, electrical connections and strips, said composition being bonded to the connector and cable jacket.

2. A cable-connector assembly as stated in claim 1, wherein said strips are metal and will hold a desired bent form so that at least some of said strips are under strain when the axes of said conductors are at an angle to the axis of said connector, whereby bending or transverse strain on the cable-connector assembly will still be transmitted around said electrical connections and continuous bending movement on said assembly will not loosen the connections of said strips with the connector housing and cable jacket.

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