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PRESSURE-TIGHT CONNECTOR

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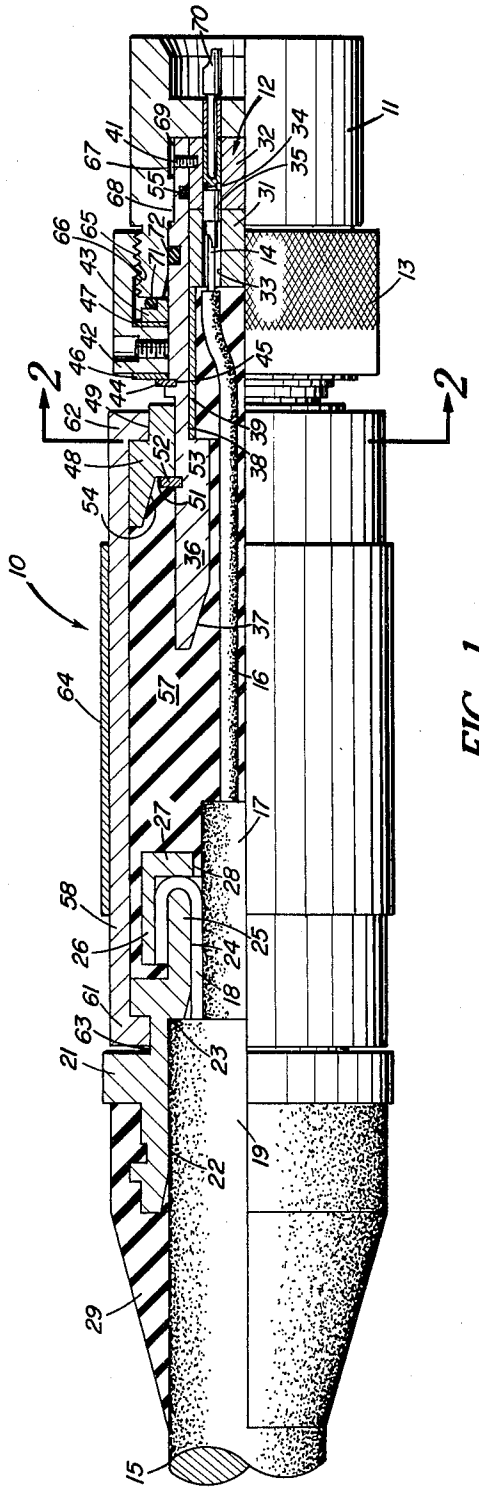

FIG. 1

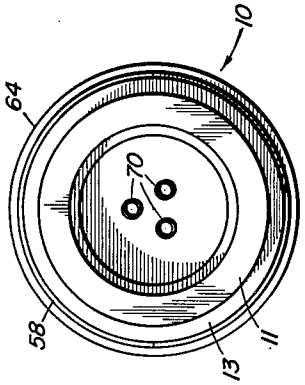

FIG. 3

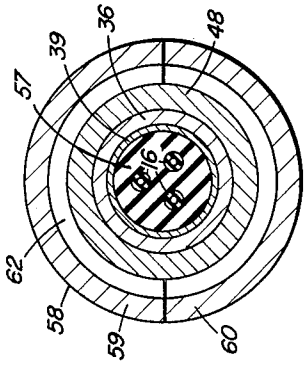

FIG. 2

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PRESSURE-TIGHT CONNECTOR

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1 Claim. (Cl. 339—102)
(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The present invention relates generally to a high potential cable connector or detachable coupling for use in a high pressure corrosive atmosphere. It is more particularly directed toward a new and improved electrical connector of this character which may be used under water to provide a high pressure gas with watertight seal between a pair of attached insulated armored cables without exerting strain on or otherwise deforming the inner insulation jackets on the individual conductors of the cable which would damage the conductors and tend to vary the electrical characteristics of the cable.

According to this invention a watertight electrical connector assembly for armored cables comprises an insulated contact means adapted to be electrically connected to the conductors of a cable, a first ring member mechanically coupled to the contact means, a second ring member adapted to be mechanically connected to the armor of the cable, a resilient collar composed of an insulating material embedding the contact means and the second ring member to provide a watertight connection therebetween, and a cylindrical sleeve surrounding said collar and interconnecting the two ring members, whereby tension applied to the cable is transmitted through the sleeve and the ring members between the armor and the contact means and strain on the conductors of the cable is thereby precluded.

Although the invention is illustrated as being embodied in the female section of a male and female readily detachable connector for armored cables it is by no means confined to this particular use.

One of the features and objects of the present invention resides in the provision of a new and improved cable connector arrangement having provision for anchoring and sealing the outer casings of adjoining ends of a pair of armored cables to the connector while also avoiding strain on the electrical connections between the conductors of the cables in response to a pullout force sometimes exerted on the cable.

Another object of the invention is to provide a gas and watertight cable connector for armoured high voltage electrical cables that may be easily assembled and disassembled by hand and without the use of special tools or equipment.

Still another object of the invention is to provide a new and improved connector for armored electrical cables which is so constructed that when its complementary coupling members are connected the corresponding conductors of the respective cables are not only automatically aligned for being electrically connected to one another but they are protected from damage due to strain.

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A further object of this invention is to provide a gas and watertight cable connector which shall be sufficiently rugged to withstand adverse operating conditions yet which may be quickly and easily joined or separated.

With the above and other objects in view which will become readily apparent as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claim, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claim.

The accompanying drawings illustrate a preferred physical embodiment of the invention constructed in accordance with the principles thereof and in which:

FIG. 1 is a longitudinal view partly in cross-section of a cable connector embodying the present invention;

FIG. 2 is a section taken along line 2—2 of FIG. 1; and

FIG. 3 is an end elevational view of the right end of the connector shown in FIG. 1.

Referring now to the drawing in which like numerals of reference are employed to designate like parts throughout the several views, there is illustrated a cable connector 10 comprising a male connector member 11, a female connector member 12, and a coupling member 13 intended for making connection between the three conductors 14 of cable 15 and the three conductors of a second cable (not shown) which are affixed to the male connector member 11. Although a three-conductor cable is shown for the purposes of illustration, the cables may have any desired number of conductors. The conductors 14 are individually enclosed in a sheath 16 of suitable insulating material such as natural or synthetic rubber. The cable 15 is flexible and, as illustrated more particularly in FIG. 1, includes an inner insulation jacket 17 enclosing the sheathed conductors 14, a layer of armor 18, and an outer insulation jacket 19.

The outer jacket 19 is removed from the cable end which is to be connected into the assembly. A molding ring or sleeve 21 having a bore 22 therein is pressed onto the cable 15. About midway on the ring 21 the bore 22 has an annular shoulder 23 and a bore section 24 of reduced diameter extending to the other end of the ring. The ring 21 is pressed onto the cable until the shoulder 23 abuts the outer jacket 19 still remaining on the cable. The cable armor 18 is then folded back over the protruding end portion 25 of ring 21 and is secured thereon by an annular clamping shell 26 having a flange 27 defining a reduced opening 28 in one end thereof for passage therethrough of the inner jacket 17 of cable 15. A compound of an appropriate elastic material such as, for example, neoprene, is then pressure molded over the ring 21 and cable 15 to provide a molded elastic coat 29, sealing the outer jacket 19 and protecting the cable armor 18.

The female connector member 12 comprises a two-part cylindrically-shaped multi-conductor housing including insulator members 31 and 32, fabricated from a suitable plastic material such as, for example, a diallyl phthalate compound with a glass fiber filler. The inner insulator member 31 is provided with three bores 33 and the outer insulator member 32 likewise is provided with three bores 34 adapted for alignment therewith. A socket contact

pin 35 fabricated from a suitable conductive material is positioned in each of the bores 34 in insulator 32. The sheathed conductors 14 are passed through a metallic sleeve 36, forming one of the principal structural elements of the present invention.

The sleeve 36 is provided with a tapered opening 37 at the forward end thereof and has an enlarged counterbore section 38 at the aft end thereof for receiving in close-fitting relation an insulating spacer sleeve 39, the inner insulator member 31, and the outer insulator member 32. The sheath portions 16 terminate within sleeve 39 and the conductors 14 are connected through the bores 33 of member 31 in the appropriate manner to the socket contact pins 35 positioned in member 32. The socket contact pins 35 extend partially into the bores 33 in member 31 to maintain the insulator members 31 and 32 in proper alignment, whereas the insulator member 32 is fixed in position within the bore 38 of sleeve 36 by a set screw 41. Rotatably disposed on the sleeve 36 is the coupling ring 13 with a flange portion 42 thereof positioned between a flange 43 encircling the sleeve 36 and a retaining ring 44 of the snap-type fixed within a circumferential groove 45 in the outer periphery of sleeve 36, thereby permitting rotation of the ring about the sleeve but preventing any relative axial movement therebetween. Thrust washers 46 and 47 on either side of flange portion 42 prevent rotation imparted to ring 13 from being imparted to sleeve 36 to thus distort it by torsional forces. Also disposed on sleeve 36 forwardly thereon of the coupling ring 13 is a thrust ring 48 having an outer annular recess 49 adapted for mating engagement with any suitable ring support structure, an inner shoulder 51 abutting retaining ring 52 disposed in an annular groove 53 in sleeve 36, and a forwardly-positioned tapered opening 54.

In assembling the parts, washers 46 and 47 with the coupling ring 13 therebetween are placed on the sleeve 36 in abutting relation with flange 43 thereon, and retaining ring 44 is slipped into groove 45, rotatably fixing coupling ring 13 on sleeve 36.

The thrust ring 48 is now placed on sleeve 36, and retaining ring 52 is slipped into groove 53 to prevent undesired removal of ring 48 from the sleeve.

Each conductor 14 is now cleaned of sheathing 16 at its end portion and the conductors are passed through the opening in sleeve 36, the insulator sleeve 39 in sleeve 36 and through the openings 33 in insulator member 31, whereupon the insulator 31 is slipped along the conductors and into the bore 38 of sleeve 36. The connections to the socket contact pins 35 in insulator member 32 are accomplished in the standard manner, and insulator 32 is positioned within bore 38 and fixed therein by set screw 41. An O-ring 55 provides a seal between insulator 32 and sleeve 36.

The molding ring or sleeve 21, the clamping shell 26, the inner jacket 17, the individual sheathed conductors 14, the sleeve 36 and thrust ring 48 are then pressure molded into a single unit with an elestic insulating collar 57 such as, for example, neoprene. The unit is thereafter enclosed in a cylindrical casing 58 comprising two half-tubular shells 59 and 60 each having flange portions 61 and 62 on its inner peripheral wall at the ends thereof and connected together over the collar 57, sleeve 21 and thrust ring 48 of sleeve 36 in a clam shell manner with flanges 61 being seated in an annular groove 63 in sleeve 21 and flanges 62 being seated in the recess 49 in thrust ring 48. Cylindrical casing 58 is encircled by a metallic band 64 which may be a strap-type band or one suitable for being driven on the casing for the purpose of keeping the casing shells locked tightly together. The band 64 may be composed of stainless steel or a stainless steel alloy, or any other suitable metal. Although a single band 64 having a width substantially relative to the length of the casing is shown, any number of such bands of lesser width and in spaced relation could be applied

to the casing. With this arrangement the connector 10 provides a seal to the outer jacket 19, inner jacket 17 and to each conductor, protects the cable shield or armor 18, and avoids conductor damage due to strain by transferring the strain from the armor to the connector jacket or sleeve 36.

The male section of the connector may be the same as the female connector aforedescribed. Accordingly only a fragmentary showing of the male connector is made and this includes a male connector member 11 having one end thereof externally threaded as at 65 to be received on threads 66 of coupling ring 13, and a bore 67 within that end of the member 11 for receiving the rear section of sleeve 36 and having formed therein an integral key or protuberance 68 extending inwardly toward the longitudinal axis of the member for sliding engagement with a slot 69 in the outer peripheral wall of the rear section of sleeve 36 to permit relative longitudinal movement between the plug member 11 and the sleeve 36, but preventing rotation therebetween. Three contact pins 70 in plug member 11 are so arranged therein that they will engage socket contacts 35 in receptacle 12 when the plug member 11 is threadably received within coupling ring 13 and thereby electrically connect conductors properly fixed to the pins 70 with the conductors 14 of cable 15. When the plug member 11 has been fully received in coupling ring 13, further sealing will be provided by resilient O-ring annular gaskets 71 and 72 formed of rubber or the like which are compressed between the threaded end of plug member 11 and the outer rear wall of sleeve 36.

While the invention has been illustrated and described in its preferred embodiment and has included certain details it should be understood that the invention is not to be limited to the precise details herein illustrated and described. For example, some cables having no outer or inner insulation jackets, such as jackets 17 and 19 in FIG. 1, may readily be sealed with this connector by applying the mold directly to the conductor sheathing 16, thus molding together the molding sleeve 21, any cable armor 18, the conductors 14, the sleeve 36 and thrust ring 48.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claim the invention may be practiced otherwise than as specifically described.

What is claimed is:

A pressure-tight electrical connector assembly for armored cables comprising insulated contact means adapted to be electrically connected to the conductors of said cable,

a first sleeve member having a central bore therethrough for receiving said armored cable and an annular groove in the outer peripheral wall thereof,

a resilient coating embedding the end of said first sleeve member receiving said cable and forming a layer of coating material between the cable and said sleeve member to provide a watertight connection therebetween,

a cylindrical shell slideably fitting over the other end of said first sleeve member to clamp outwardly bent portions of the cable armor therebetween,

a second sleeve member having an annular recess in the outer peripheral wall thereof and having a central bore therethrough for receiving in one end thereof the unarmored conductors of said cable emerging from the coupled first sleeve member and shell,

means for positioning said insulated contact means within said bore of said second sleeve member at the other end thereof,

a resilient insulating material interposed between said insulated contact means and said first sleeve member and forming a substantially cylindrical collar embedding said cylindrical shell and said one end of said second

sleeve member to provide a watertight connection therebetween,

a pair of half-tubular shells having flanges on the inner peripheral walls at the end portions thereof mounted on said first and second sleeve members with said flanges being received in the groove and recess respectively thereof to compose a cylindrical casing about the cylindrical collar of insulating material and interconnecting said first and second sleeve members whereby tension applied to said cable is transmitted through said casing and sleeve members between the armor and said insulated contact means and strain on the conductors of said cable is precluded,

and at least one metallic band surrounding said casing

and securing said casing to said first and second sleeve members.

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