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[54] **ELECTRICAL CABLE CONNECTOR ASSEMBLY**
9 Claims, 8 Drawing Figs.

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 339/196 M, 339/273 R, 24/126 R, 279/50
 [51] Int. Cl. **H01r 13/58,**
 H01r 33/06
 [50] Field of Search **339/63, 94**
 R, 94 L, 94 M, 95 R, 95 A, 103, 196 R, 196 A, 196
 M, 174, 273, 177 R, 177 E; 24/124, 126, 136, 260;
 279/50

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ABSTRACT: A cable connector assembly to connect an electrical cable to a plug or a light socket and positively securely retain the cable in assembly with the plug or socket. The assembly is comprised of a main body portion defining the plug or socket provided with prongs extending therefrom for electrical connection with an outlet or the like, and which is constructed in the form of a cup member to receive a cable and wire retaining member which is provided with conductor means in contact with the wires of the cable which are adapted to be engaged by the inner ends of the prongs of the plug or socket. The cable-retaining member is constructed and has provisions to cooperate with a cable-clamping member adapted to be inserted over a portion of the cable-retaining member and which is provided with resilient cable-clamping means in the form of resilient fingers extending through slots provided in the cable-retaining member, and a pressure ring is provided having internal cam surfaces located on varying radii adapted to be pushed over the clamping and cable-retaining member to cam the resilient fingers inwardly through the slots in the cable-retaining member into engagement with the cable to lock the cable to the cable-retaining member; the assembly of the electrical connector is completed by a sealing ring and an end cap adapted to be screwed into the main body portion of the plug or light socket to thereby confine the cable retaining and clamping members in between them. All of the parts, except for the prongs on the plug or light socket and the wire-connecting means in the cable-retaining member, are made of a nonconductive material.

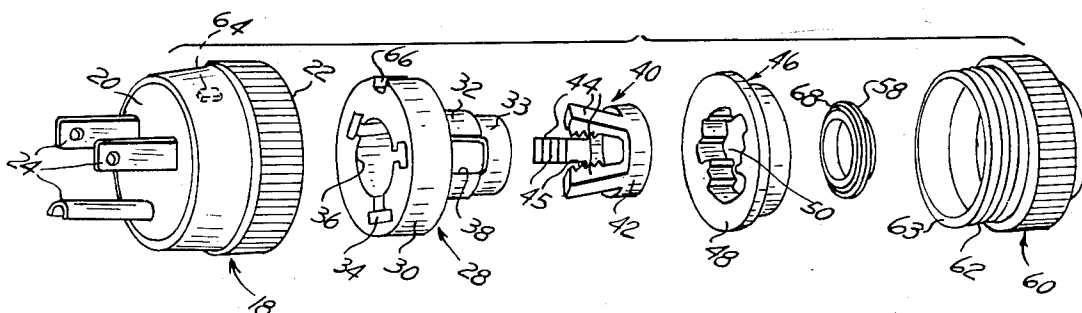


FIG. 1

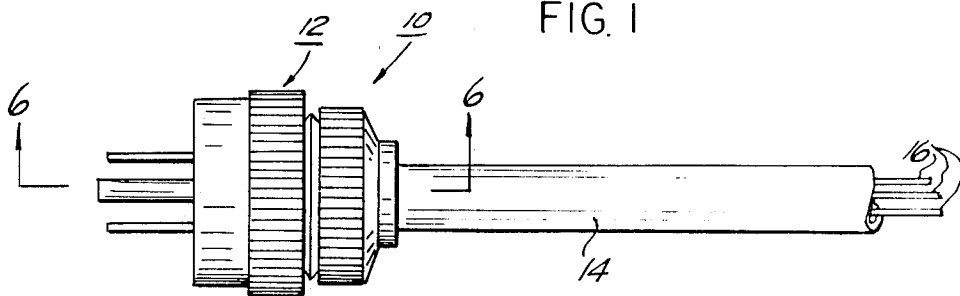


FIG. 2a

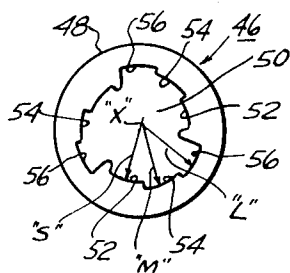


FIG. 2

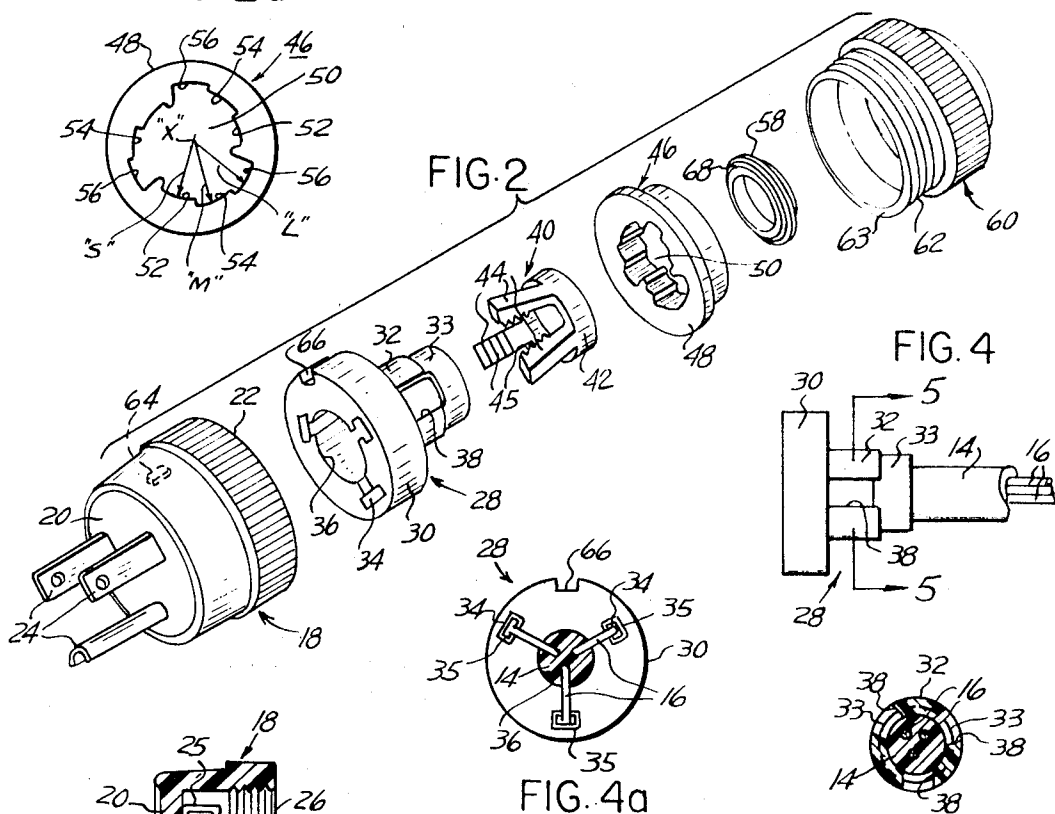


FIG. 4

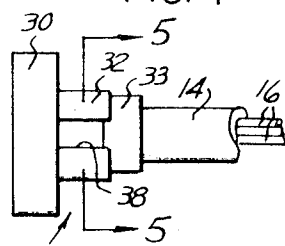


FIG. 4a

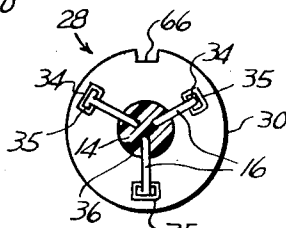


FIG. 5

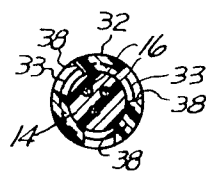


FIG.3

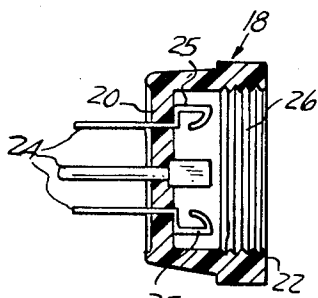
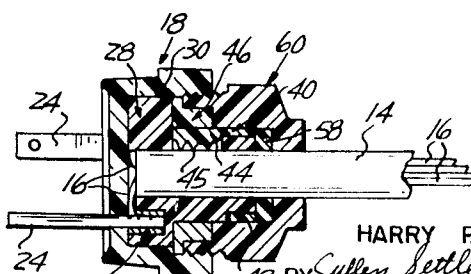


FIG.6



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ELECTRICAL CABLE CONNECTOR ASSEMBLY

BACKGROUND OF THE INVENTION

The present invention relates to an electrical cable connector assembly for a plug or light socket which is constructed such as to be particularly applicable for outdoor use or marine applications.

Plugs or light sockets for electrical connections are known which have been constructed to be particularly applicable for outdoor or marine use. For these particular uses rigid, standard requirements have to be met with and complied with in accordance with the standards set by the Underwriters Laboratories Inc.

In conventional plug or light socket cable connections of the kind herein referred to, serious difficulties have been encountered as for instance, by the requirement to provide adequate fluid sealing at the plug and cable connection to prevent any moisture from entering the plug and causing a short circuit. In addition, there has been problems in connecting the plug or light socket tightly enough to the cable to grip the cable firmly so that it cannot be pulled from the plug or light socket. In many instances, the user jerks the cable to pull the plug from its connection and in instances, where the cable is not tightly gripped by clamping means associated with the plug, the cable will be pulled from the plug. In this connection, it should be mentioned here that the cable must be tightly and securely gripped behind the wire connections of the cable to the conducting members of the plug so that, if the cable is being jerked, the wires will not be pulled loose from the conductors in the plug. To be more particular, United States Coast Guard regulations require the wire-to-conductor connections within the plug or light socket to be completely free of any strain, such as a pulling force exerted on the cable, thus, making it mandatory to provide a means to securely clamp the cable in the assembly to absorb any jerking or pulling force on the cable before it reaches the terminal wire connections.

A further difficulty with this type of cable connection to the plugs, has been encountered by the use of uninsulated external conducting materials used in the connection of the cable to the plug, which tend to cause short circuits when the plug is electrically connected within a receptacle. One means to overcome this difficulty has been to use a three wire system to comply with the requirement for a plug to have a ground connection prong to ground the conducting material of the plug. This arrangement is in no way foolproof, since it cannot always be insured that the electrical receptacle to be engaged by the plug is properly grounded.

Thus, the present invention provides an improved electrical cable connection assembly, which in most instances, eliminates or considerably reduces the aforementioned difficulties heretofore encountered.

SUMMARY OF THE INVENTION

The present invention provides an improved cable and plug assembly which is foolproof, watertight and which cannot be pulled apart by a force exerted on the cable.

The assembly consists of several parts homogeneously assembled into a unit and comprise a cup-shaped main portion having prongs extending from the closed end thereof to provide an electrical receptacle engaging means and a plurality of intermediate cable and electrical wire-securing means and a sealed end cap adapted to be tightly secured to the main portion retaining the intermediate members in between them and sealingly enclosing them for protection against atmospheric influences or entrance of fluid.

The intermediate cable clamping and electrical wire securing means are comprised of at least three members assembled in coacting relationship with each other and cooperating with each other to securely clamp the cable against axial movement after assembly. There is provided one member adapted to receive the end of the cable and having conducting means for attachment of the cable wires thereto which are arranged to engage the inner ends of the prongs provided on the main por-

tion for electrical connection therewith. The intermediate clamping member comprises resilient means in the form of radially inwardly depressable fingers having gripping means at the inner end for biting engagement with the cable and which is adapted to be assembled over a portion of the cable-retaining member which is slotted to permit extension of the resilient fingers therethrough, and a separate clamping ring is provided to be pushed over the subassembly of the cable-retaining member and clamping member and which is provided with internal cam surfaces adapted to compress the resilient fingers radially inwardly into biting engagement with the cable. A sealed end cap having a threaded engagement with the main portion completes the assembly.

The particular advantages and novel features of the present invention will become more readily apparent by reference to the following detailed description in connection with the attached drawings illustrating a preferred embodiment thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate a preferred embodiment of the invention in which:

FIG. 1 is a side view of the complete assembly of the improved cable connector means;

FIG. 2 is a perspective exploded view of the improved plug and cable connector means;

FIG. 2a is a front plan view of the cam locking ring illustrated in FIG. 2;

FIG. 3 is a longitudinal cross section through the main body portion of the plug assembly shown in FIG. 2;

FIG. 4 is a separate side view of the intermediate cable and electrical wire retaining member shown in perspective in FIG. 2;

FIG. 4a is a front view of the cable-retaining member shown in FIG. 4; and

FIG. 5 is a transverse cross section through the assembly of the intermediate cable-clamping members shown separate in the exploded view in FIG. 2.

FIG. 6 is a section taken in the direction of arrows 6-6 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. 1, the present improved cable and plug assembly is comprised of a plug unit 12 attached to the end of a cable 14, which retains a plurality of electrical wires 16. The cable 14 is adapted to be securely clamped within the plug unit 12 as will be described hereafter.

With further reference to the remaining figures in the drawings, the plug unit 12 is composed of a plurality of interconnected and coacting members, as seen in the exploded view in FIG. 2, comprising a cup shaped main body portion 18, which has a closed end 20 and an open end 22.

As seen in FIG. 3, the cup shaped main body portion 18 is provided with a plurality of prongs 24 (in this instance 3), which are secured in the closed end 20 and extend axially outwardly therefrom for insertion into a corresponding receptacle (not shown). A portion 25 of the prongs 24 extends inwardly of the cup-shaped body portion 18, as seen in FIG. 3, for a purpose to appear. Preferably, the main body portion 18 is molded from an electrically insulating material, such as polycarbonate or nylon, and the prongs 24 are imbedded in and integrally molded into the closed end portion 20 providing a sealtight connection around the prongs to prevent any moisture from entering into the cup-shaped body portion 18 along the prongs. The open end 22 of the cup-shaped body portion 18 is preferably provided internally with threads 26 for a purpose to appear hereafter.

A cable retaining and wire-securing member 28 is adapted for insertion into the cup-shaped body 18, and constructed of a radial flange portion 30 from which extends, axially, a hub portion 32. The flange portion 30 substantially corresponds in diameter to the internal diameter of the cup-shaped body portion 18 and, as seen in FIGS. 4 and 4a, is provided with a plu-

ality of apertures 34 equally angularly disposed around a central bore 36, which extends through both the flange portion 30 and hub portion 32. The cable-retaining member 28 is likewise made from an electrically insulating material and each of the apertures 34 in the flange portion 30 are provided with a metal insert 35, which are molded in place within the apertures. In assembly, the central bore 36 is adapted to receive the end of a cable 14 as shown in FIG. 4, and the electrical wires 16, extending from the end of the cable 14 are adapted to be bent over for insertion into the apertures 34 to be placed in contact with the metal inserts 35. The apertures 34 in the flange portion 30 are radially spaced in correspondence with the radial spacing of the inner prong portions 25 of the prongs 24 in the cup-shaped body portion 18, so that, upon insertion of the cable retaining member 28 within the cup-shaped body portion 18, the inner prong portions 25 will engage within the corresponding apertures 34 to clamp the wires 16 between the prong portions 25 and the inner surface of the metal inserts 35 to thereby establish electricity conducting contact between the wires of the cable 14 and the prongs 24, which, of course, are made of metal.

The hub portion 32 of the cable-retaining member 28 is provided with a plurality of axially longitudinally extending slots 38, which extend from the outer surface into the bore 36. The slots 38 are radially spaced around the hub portion 32 and extend a length from the inner end of the flange portion 30 towards the end of the hub portion 32. The end of the hub portion is provided with a reduced diameter portion 33 which provides a seat for a cable clamping member 40.

The cable clamping member 40 comprises a ring portion 42 having an internal diameter to snugly fit onto the reduced diameter seat portion 33 of the hub 32 of the cable-retaining member 28. A number of resilient fingers 44 extend axially from the ring portion 42 which correspond in number to the number of slots 38 in the hub portion 32 of the cable-retaining member 28. The resilient fingers 44 normally are inclined upwardly from the radial surface of the ring portion 42 and are angularly spaced in correspondence with the spacing of the slots 38. Each of the resilient fingers 44 is preferably provided, at its inner surface, with gripping means 45, such as teeth or notches, so that when the cable-clamping member 40 is assembled to the cable-retaining member 28 the gripping means 45 of the fingers 44 will be caused to extend into the slots 38 in the hub portion 32 of the cable retaining member 28 for locking engagement of the gripping means with the cable 14 when the fingers 44 are depressed further inwardly of the slots 38.

The means to resiliently depress the fingers 44 of the cable-clamping member 40 inwardly through the slots 38 in the cable-retaining member 28, comprises a clamping ring 46 provided at one end with a circumferential flange 48 having a diameter corresponding to the diameter of the flange portion 30 of the cable-retaining member 28.

The clamping ring 46 is provided with an aperture 50 for insertion over the cable-clamping member 40. The aperture 50 of the clamping ring 46, as particularly seen in FIG. 2a, is contoured to provide a plurality of cam surfaces which are disposed on varying radii. In the present instance there is provided a group of cam surfaces 52 corresponding in numbers to the number of fingers 44 of the cable clamping member 40, i.e. 3 in this instance, and which are radially spaced from each other corresponding to the radial spacing between the fingers 44.

The first group of cam surfaces 52 are disposed on a small radius "S" from the axial center "X" of the clamping ring 46. Adjacent to each of the cam surfaces 52 another group of cam surfaces 54 is disposed corresponding in number to the cam surfaces 52, and which are located on a radius "M" (medium) which is slightly larger than the radius "S." Finally, a cam surface 56 is disposed next to each of the cam surfaces 54 to thereby complete the contoured internal surface of the aperture 50. The cam surfaces 56 are located on a radius "L" (larger than both of the radii "S" and "M").

Thus, the clamping ring 46 comprises cam surfaces of different diameters to selectively engage the fingers 44 in correspondence with the diameter of the cable 14. Thus, as in this instance, cables 14 of three different diameters can be accommodated by the coaxing cable retaining and clamping members 28, 40 and 46.

In assembly and after the cable clamping member 40 has been moved into place on the hub portion 32 of the cable retaining member 28 for engagement of the resilient fingers 44 within the slots 38, the cable-clamping ring 46 is moved over the cable-clamping member 40 and a selected group of cam surfaces 52, 54 or 56 is brought into engagement with each of the fingers 44. By pushing the clamping ring 46 forwardly towards the flange portion 30 of the cable-retaining member 28 the selected group of cam surfaces act to depress the resilient fingers 44 inwardly of the slots 38 to permit the gripping means 45 of the fingers to bite into and firmly grip the cable 14 inserted through the bore 36 of the cable-retaining member. Maximum gripping action is obtained after the cable clamping ring has been moved all the way up on the hub portion 32 of the cable-retaining member 28 so that the flange portion 48 will be in flat abutment against the rear side of the flange portion 30 of the cable retaining member 28.

As seen from the exploded view in FIG. 2 of the assembly, next to be assembled over the cable 14 is a sealing ring 58 of rubber or the like material adapted to abut against the rear end of the hub portion 32 of the cable retaining member 28 when the members 40 and 46 are in assembled position on the cable retaining member.

The assembly is completed by the provision of an end cap 60 inserted over the cable 14 which has a reduced diameter portion 62 provided with external threads which, in assembly, are adapted to mate with and engage the internal threads 26 in the main body portion 18.

The assembly of the present improved cable connector unit 12 is as follows: the members 60, 58, 46, 40 and 28 are moved over the end of the cable 14 in succession and in that order. Thereafter, the ends of the wires 16 extending from the end of the cable 14 are secured within the conductor sleeves 35 in the cable-retaining member 28 as previously described. The cable-clamping member 40 is then placed over the hub 32 of the cable-retaining member 28 for seating engagement on the reduced diameter hub portion 33 and for engagement of the fingers 44 within the slots 38. Hereafter, the clamping ring 46 is pushed over the cable-clamping member 40 for engagement of a selected group of cam surfaces 52, 54 or 56 with the resilient fingers 44 to thereby move the fingers 44 into the slots 38 into tight clamping engagement with the cable 14 when the ring 46 is moved all the way up into abutment with the flange portion 30 of the cable retaining member 28. The sealing ring 58 is then moved against the end of the hub portion 32 of the cable-retaining member. The main body portion 18 is now moved over the cable clamping subassembly, comprising the members 28 40 and 46, in such fashion that the inner prong portions 25 of the prongs 24 engage within the apertures 34 in the flange portion of the cable-retaining member to establish electric contact with the wires 16 and the conductor sleeves 35 within the apertures 34.

If desired, or necessary, the main body portion 18 may be provided inwardly with a protrusion 64 adapted to engage within a slot 66 provided in the radial surface of the flange portion 30 of the cable-retaining member 28 to provide alignment of the apertures 34 with the inner prong portions 25 and to prevent the subassembly from rotating movement within the main body portion 18.

The assembly is then completed by moving the end cap 60 along the cable for threading engagement within the main body portion 18. After the end cap 60 has been tightly screwed into the main body portion 18, the inner end 63 of the threaded, reduced diameter portion 62 of the end cap tightly clamps the flange 48 of the clamping member 46 against the rear surface of the flange portion 30 of the cable retaining member 28 to thereby securely retain the clamping member 46 in maximum cable locking position.

It will be evident from the foregoing description and the accompanying drawings that the present invention provides an improved cable connector assembly between an electrical cable and a plug or a light socket, particularly adapted for outdoor use.

The improved cable connector unit comprises relatively few parts which can be easily and quickly assembled without the use of any tool and which are made from a lightweight non-conductive material such as polycarbonate or nylon which lends itself to molding at relatively low cost.

Except for the prongs 24 no metal parts adapted to conduct electricity are employed outwardly of the plug assembly. The only metal parts being used in the assembly, aside from the prongs 24, comprise a number of metal inserts internally of the plug assembly to provide conductive contact between the wires of the cable and the prongs 24.

The present unique cable clamping arrangement is adapted to easily accommodate cables of varying diameters.

Sealing ring 58, FIG. 2, is preferably made of soft rubber or similar material and includes extending axially inward from its opposite sides, opposed pairs of annular slits 68. Thus, ring 58 may be adapted for different diameter cables 14 by peeling off one or two inner annular strips from the sealing ring body.

Although the present invention has been described in connection with a preferred embodiment, it is obvious that various modifications in structure and arrangement may be made by those skilled in the art to which the invention pertains without departing from the spirit of essential characteristics thereof; therefore, the present embodiment is to be considered in all respects as illustrative only and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description.

I claim:

1. In an electrical cable connector assembly having a main body portion defining a cup-shaped member having a closed end and an open end, the improvement comprising in combination:

- a. a first member having a portion adapted to receive one end of said cable and having individual means to each receive a wire of said cable; said first member being adapted to be inserted into said main body portion through said open end thereof;
- b. a second member comprising a cable clamp disposed over said cable adjacent said first member having a resilient cable clamping means disposed for extension through said cable receiving portion of said first member towards said cable;
- c. a third member comprising a pressure ring adapted for coaxing pushover engagement over said second member and said cable-receiving portion of said first member to thereby depress said resilient cable clamping means into clamping engagement with said cable; and
- d. a fourth member defining an end clamp disposed over said cable having means for attachment to said main body portion over said first, second and third member to thereby close said open end of said main body portion and securely confine said members within said main body portion and said end cap.

2. In the assembly as defined in claim 1, said first member being constructed of a cable receiving hub portion and an enlarged radial flange portion integral therewith having an axial bore extending through both said hub portion and said flange portion for extension of said cable therethrough; said hub portion being provided with radially spaced longitudinal slots and having a reduced diameter end section adjacent said slots; said second member comprising a cylindrical body portion for

seating engagement on said reduced diameter end section of said hub portion and having resilient cable clamping means comprising resilient fingers extending axially from said body portion in radially spaced relationship corresponding to said radial spacing between said slots in said hub portion of said first member for extension of said resilient fingers into said slots, the free ends of said fingers extending normally upwardly from the radial surface of said hub portion.

3. In the assembly as defined in claim 2, each of said resilient fingers being provided with gripping means at the underside of said fingers extending into said slots; said third member comprising said pressure ring having a contoured inner surface defining spaced cam sections adapted to slidably engage the upwardly extending free ends of said fingers when pushed over said body portion of said second member and said hub portion of said first member in associated coaxing relationship therewith to thereby depress said fingers inwardly of said slots to provide maximum locking engagement of said clamping means with said cable when said pressure ring is moved into abutment against said flange portion of said first member.

4. In the assembly as defined in claim 3, said third member comprising said pressure ring having a circumferential flange adapted to be clamped in assembly between said flange portion of said first member and the inner end of said end cap when said end cap is attached to said main body portion to thereby retain said pressure ring in position over said resilient fingers.

5. In the assembly as defined in claim 2, said individual wire receiving means of said first member being disposed in said flange portion and comprising radially spaced apertures provided therein for extension of a wire from said cable into each of said apertures.

6. In the assembly as defined in claim 5, said main body portion and said first, second, third and fourth members all being made of a nonconducting material; said wire receiving apertures and said flange portion each retaining a metal conductor for electrical contact with said wires; said main body portion having a plurality of electrically conducting prongs each having a first portion extending from the closed end thereof outwardly, and a second portion extending inwardly of said main body portion; said second inwardly extending portions of said prongs being radially spaced in correspondence with the radial spacing of said apertures in said flange portion of said first member for extension into said apertures when said first member is inserted within said main body portion to thereby establish electrical contact with said wires and said metal conductors retained in said apertures.

7. In the assembly as defined in claim 1, the further provision of an insulated sealing member disposed around said cable between said third member and said end cap to be clamped therebetween when said end cap is attached to said main body portion to thereby prevent entrance of moisture into said main body portion.

8. In the assembly as defined in claim 1, the open end of said main body portion being provided with internal threads and said end cap being provided with external threads to permit said end cap to be screwed into said main body portion for confinement of said first, second and third member in between said main body portion and said end cap.

9. In the assembly as defined in claim 3, said contoured inner surface of said pressure ring comprising a plurality of equally radially spaced cam surfaces each disposed on radii of varying dimensions to thereby permit selective clamping engagement with cables of different diameters.

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