

United States Patent

Nepovim

[15] 3,668,612

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[54] CABLE CONNECTOR

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[21] Appl. No.: 62,112

[52] U.S. Cl.: 339/94 C, 174/65 SS, 285/158, 285/248, 285/257, 285/322, 339/177 R

[51] Int. Cl.: H01r 13/52

[58] Field of Search: 339/89, 94, 177, 103; 174/65 SS, 75 R, 75 C, 77 R; 285/158, 248, 249, 257, 322

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Primary Examiner—Joseph H. McGlynn

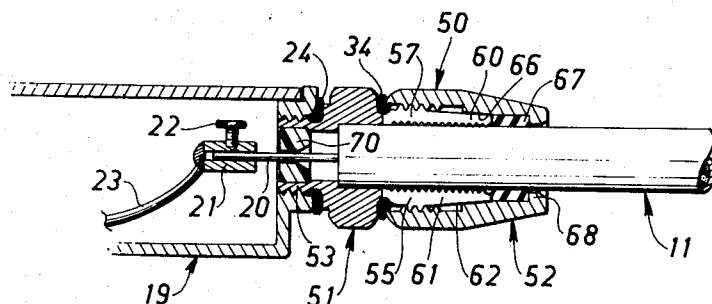
Attorney—Arne I. Fors and Frank I. Piper

[57]

ABSTRACT

A connector for attachment to the end of a coaxial cable having an axial core electrode or conductor and a conductive sheath electrode or conductor includes a housing having an integral tubular skirt formed from four rearwardly extending tongues collectively formed with a rearwardly facing external cam surface. A tubular cover sleeve formed with a forwardly facing internal cam surface for engagement with the external cam surface of the tongues screws onto the housing so that interaction of the cam surfaces causes the tongues to be flexed radially inwardly into gripping engagement with a cable disposed within the connector and into electrical contact with the conductive sheath electrode of that cable. Usefully, a radially inwardly compressible and electrically conductive collet sleeve is coaxially disposed within the tongues between their forward and rearward ends so as to receive an exposed forward end portion of the core electrode of the cable. An electrically insulating and radially inwardly compressible bushing disposed about the collet sleeve serves to transmit radially inward movement from the tongues to the collet sleeve so as to provide simultaneous gripping of the core electrode without any torsional shearing action between the sheath and core electrodes.

8 Claims, 10 Drawing Figures



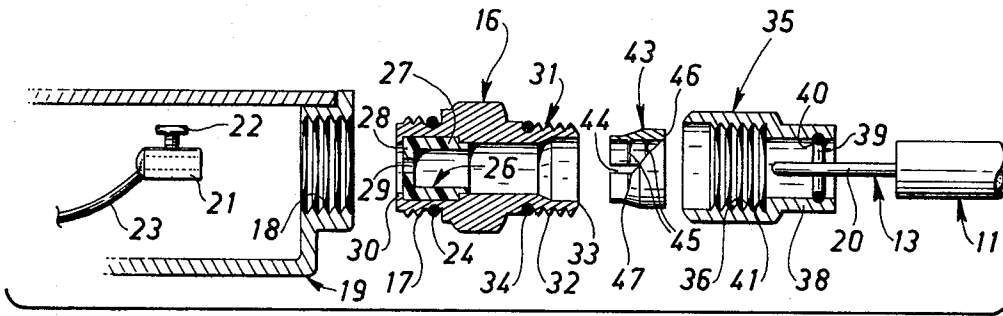


FIG. 1 PRIOR ART

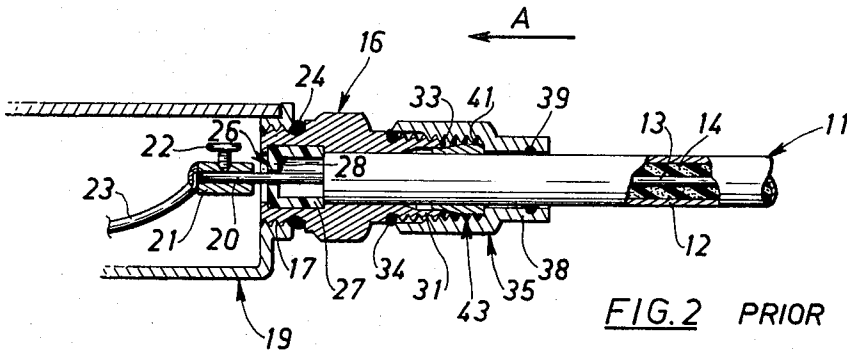


FIG. 2 PRIOR ART

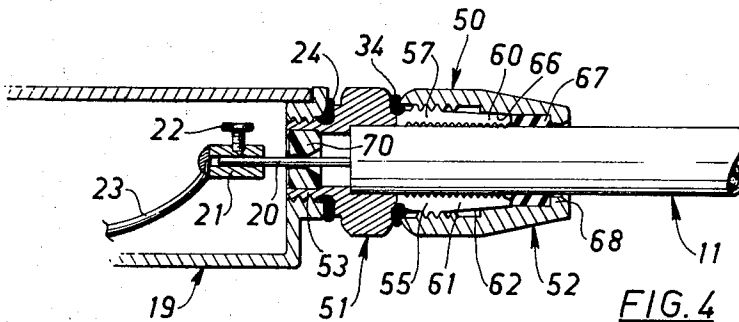


FIG. 4

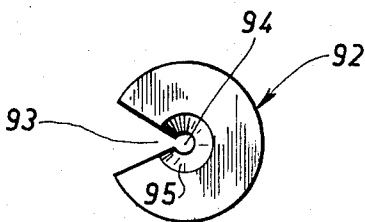


FIG. 7

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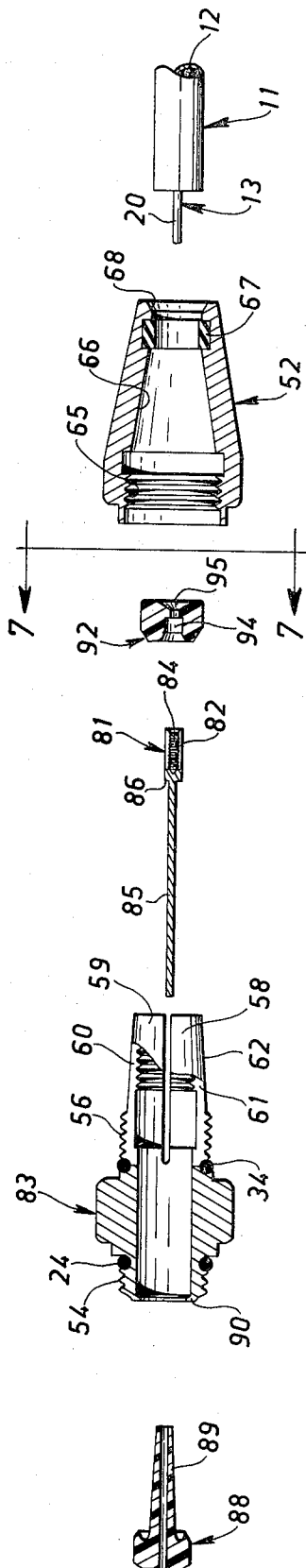


FIG. 5

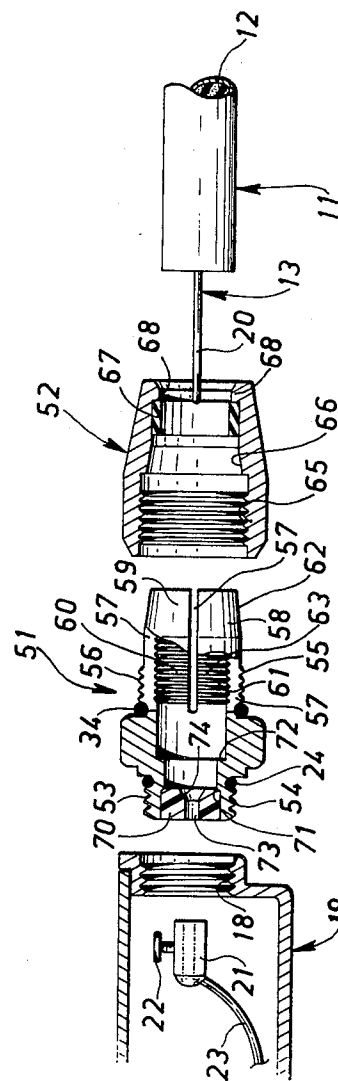


FIG. 3

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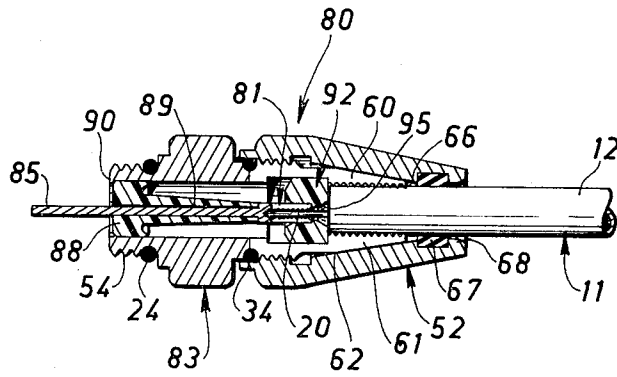


FIG. 6

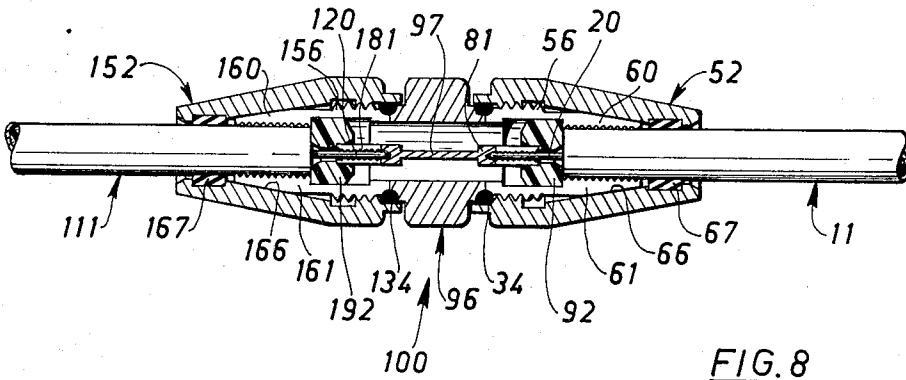


FIG. 8

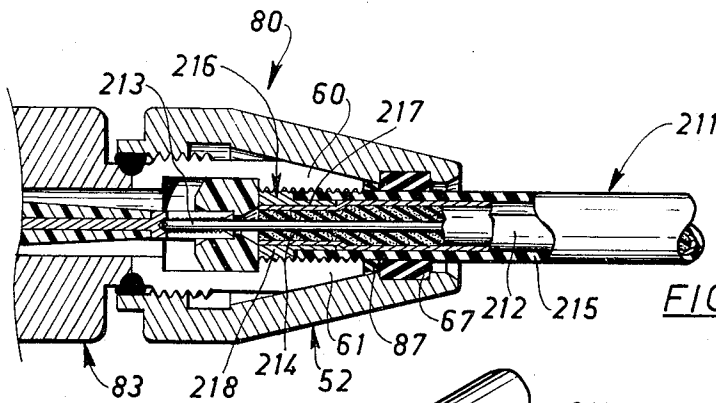


FIG. 9

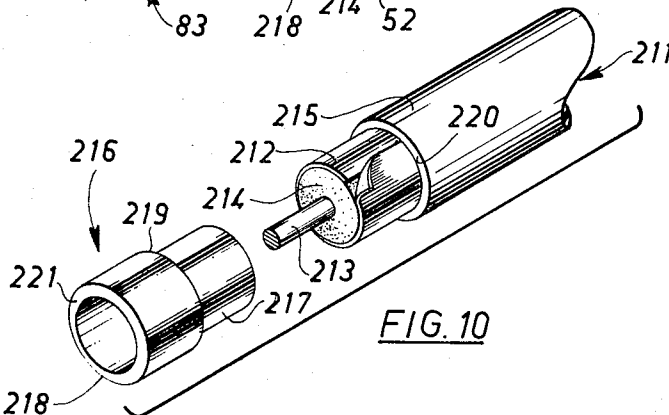


FIG. 10

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CABLE CONNECTOR

BACKGROUND OF THE INVENTION

The present invention relates to electrical connectors and more particularly to connectors intended for securement to coaxial cables of the type used in CATV distribution systems.

Many different types of electrical connectors for the aforementioned purpose are presently available but the practical requirements for a connector of this type have proved to be difficult to attain.

From a commercial point of view, it is desirable that such a connector should have the minimum possible number of component parts consistent with effective operation and that the manufacture and assembly of such a connector should involve as few manufacturing steps as possible. In this way, the cost of such a connector can be reduced to the lowest possible level. Such a connector must also present the desired electrical characteristics with particular reference to the loss of signal strength which can occur due to reflection of signals back along the coaxial cable to which such a connector is secured.

Yet another important requirement of such a connector is that it provides a positive grip on the cable as well as effective electrical connection to one or both of the core electrode and the conductive sheath electrode of the cable. In the case where the connector is designed to engage both such electrodes, failure to provide positive connection to both electrodes may, as a result of the different thermal expansion rates of the two electrodes, lead to the core electrode being pulled loose from the connector, particularly when the cable is exposed to large temperature variations.

Another important feature required in an electrical connector particularly intended for use in a CATV system is that such a connector should incorporate an adequate seal against the ingress of moisture and dirt into the connector and consequently ultimately into the electrical insulation provided between the core electrode and the outer sheath of such a coaxial cable.

A particularly serious problem which has arisen with many of the connectors heretofore known and intended for securement to both the core electrode and the sheath electrode of a coaxial cable is that the action of tightening the connector on the cable frequently causes a torsional shearing action on the insulation between the two cable electrodes with possible damage to such insulation.

It is a principal object of this invention to provide an electrical connector intended for securement to a coaxial cable and especially suited for use in CATV distribution systems.

Another object of this invention, in accordance with a particular feature thereof, is to provide a connector intended to provide mechanical gripping of both the core electrode and the sheath electrode of a coaxial cable and the use of which connector is free from all risk of applying a torsional shearing action on the insulation between the electrodes.

Yet another object of this invention is to provide connectors for the purpose specified and which connectors are of relatively simple construction and which can, consequently, be manufactured at a relatively low cost while still providing the necessary positive engagement with and electrical connection to one or both electrodes as required, of a coaxial cable.

Other objects of the invention will become apparent as the description herein proceeds.

SUMMARY OF THE INVENTION

In its broadest scope, the present invention provides a connector for securement to the end of a coaxial cable having a core electrode and a conductive sheath electrode and which connector comprises a hollow housing having integral therewith a rearwardly extending and peripherally discontinuous electrically conductive tubular skirt for radially inward compression into gripping engagement with a coaxial cable extending forwardly into said skirt and into electrical contact with the conductive sheath electrode of such a coaxial cable said tubular skirt being formed with a rearwardly facing exter-

nal cam surface; a hollow tubular cover sleeve having associated therewith a forwardly facing internal cam surface for conjoint axial movement with said cover sleeve and for engagement with said rearwardly facing external cam surface of said tubular skirt when said cover sleeve is disposed coaxially around said tubular skirt and adapted to cause radially inward compression of said tubular skirt into gripping engagement with the coaxial cable disposed within said tubular skirt and into electrical contact with the conductive sheath electrode of that coaxial cable on forward axial movement of said cover sleeve relative to said housing; and cooperating means on said housing and on said cover sleeve for retaining said cover sleeve in a fixed forward axial position on said housing in turn to maintain said tubular skirt radially inwardly compressed and in gripping engagement with the coaxial cable disposed within said tubular skirt and in electrical contact with the conductive sheath electrode of that cable.

A connector in accordance with this invention can be constructed to grip a coaxial cable to provide electrical connection to only the conductive sheath electrode of that cable but such a connector can readily be constructed, in accordance with a particularly useful feature of the invention, so as to provide connection to both the cable electrodes. In such a construction of a connector in accordance with the invention, a radially inwardly compressible and electrically conductive collet sleeve is disposed coaxially within the tubular skirt for receiving therewithin an exposed forward end portion of the coaxial cable. An electrically insulating and radially inwardly compressible bushing coaxially disposed about such a collet sleeve and within said tubular skirt then serves to transmit radially inward movement from the skirt to the collet sleeve to cause the latter to be compressed into gripping engagement and electrical contact with the exposed end portion of the core electrode, as the cover sleeve of the connector is advanced forwardly on the housing.

As will be explained in greater detail hereinafter, the connectors of this invention can also be constructed so that they can be used for providing electrical interconnection between the core and sheath electrodes respectively of two coaxial cables.

Other features and advantages of the invention will become apparent as the description herein proceeds.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described merely by way of illustration with reference to the accompanying drawings in which:

FIG. 1 is an exploded sectional view of one previously known type of coaxial cable connector and fragmentarily also showing a coaxial cable to which such a connector is intended to be connected and a connector box to which the connector can itself be secured;

FIG. 2 is a longitudinal, axial and vertical sectional view through the connector box and cable shown in FIG. 1 and illustrating the manner in which that connector functions, FIGS. 1 and 2 being included herein merely for purposes of comparison;

FIG. 3 is an exploded sectional view similar to that of FIG. 1 but showing one useful embodiment of a connector in accordance with this invention;

FIG. 4 is a longitudinal, axial and vertical sectional view similar to that of FIG. 2 but of the connector in accordance with the invention as shown in FIG. 3;

FIG. 5 is an exploded sectional view similar to that of FIG. 3 but showing a different embodiment of a connector in accordance with the invention;

FIG. 6 is a longitudinal, axial and vertical sectional view through the connector of FIG. 5 and showing that connector in its assembled form;

FIG. 7 is a vertical end elevation of a radially inwardly compressible and electrically insulating bushing forming an important component of the connector shown in FIGS. 5 and 6 when viewed as indicated by the arrows 7-7 of FIG. 5;

FIG. 8 is a longitudinal, axial and vertical sectional view through a further embodiment of a connector in accordance with the invention and illustrating the use of this particular connector for interconnecting the electrodes or conductors of two coaxial cables;

FIG. 9 is a fragmentary, longitudinal, axial and vertical sectional view through yet another embodiment of a connector in accordance with this invention and having many features in common with the connector shown in FIGS. 5 and 6 but showing the connector coupled to a coaxial cable in which the sheath electrode thereof is disposed within an electrically insulating outer cover sheath; and

FIG. 10 is an exploded perspective view showing an adaptor utilized with the connector of FIG. 9 for ensuring positive gripping of the cable and effective electrical connection to the sheath electrode of that cable.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In order to facilitate understanding of the present invention and of the advance in the art provided thereby, the previously known connector shown in FIGS. 1 and 2 of the accompanying drawings and the manner in which that connector functions will first be described herein.

For convenience the left-hand ends of all the connectors shown in the accompanying drawings will be referred to herein as the forward ends of those connectors while the right-hand ends will be referred to as the rearward ends. Similarly, the direction from the rearward end to the forward end of each such connector as indicated by the arrow "A" in FIG. 2 will be considered as being the forward direction. Identical components of the various connectors will be indicated on all the figures of the accompanying drawings by the same legends.

Referring first, therefore, to FIGS. 1 and 2 of the accompanying drawings, it will be seen that the known connector generally indicated therein at 10 is shown in FIG. 2 as being secured to the forward end of a coaxial cable generally indicated at 11. The cable 11 comprises an outer electrically conductive sheath 12 generally formed of relatively pure aluminum and an axial core wire electrode 13 generally formed of copper. A closed cell foamed plastic insulation 14 serves to maintain the core electrode 13 correctly axially positioned as well as to insulate the core electrode 13 from the outer sheath electrode 12. Although the invention will primarily be described herein with reference to the use of the connectors in accordance therewith together with cables having such outer sheath electrodes, the connectors of this invention can equally be utilized with cables in which the sheath electrodes are disposed within electrically insulating outer sheaths of such cables. An adaptor for use with the last-mentioned type of cable will be described in greater detail hereinafter with particular reference to FIGS. 9 and 10 of the accompanying drawings.

Referring now in greater detail to the known connector 10 of FIGS. 1 and 2, it will be seen that that connector includes a hollow housing generally indicated at 16 and formed at its forward end with a male threaded portion 17 by means of which the connector 10 can be secured within an internally threaded opening 18 in a connector box generally indicated at 19 and within which electrical connection can be made to an exposed forward end portion 20 of the core electrode 13 of the cable 11, for example, by a short metal sleeve 21 provided with a set screw 22 for clamping the core electrode end portion 20 within the sleeve 21. A wire 23 is shown as being connected to the sleeve 21 within the box 19. A resiliently compressible O-ring 24 is shown as being provided around the housing 16 at the rearward end of the threaded portion 17 to provide a water-tight and dust-proof seal between the connector 10 and the wall of the box 19.

It will further be noted that the known connector 10 includes an electrically insulating spacer generally indicated at 26 and disposed within the forward end of the housing 16 for

the purpose of maintaining the forward end portion 20 of the core electrode 13 of the cable 11 in its correct axial position. The spacer 26 comprises a peripheral wall 27 and an annular end wall 28 having an axial opening 29 through which the core electrode 13 extends as will readily be understood by reference to FIG. 2. An annular flange 30 formed on the forward end of the threaded portion 17 of the housing 16 serves to retain the spacer 26 in position therein.

At its rearward end, the housing 16 is formed with a tubular portion 31 provided with an external thread 32 and a rearward edge surface 33. An O-ring 34 is provided at the forward end of the threaded portion 31 to ensure a seal between the housing 16 and a tubular cover sleeve generally indicated at 35 and formed with an internal thread 36 for engaging the aforementioned thread 32 of the housing 16. The cover sleeve 35 has a rearwardly open rearward end portion 38 with an O-ring 39 mounted within an internal peripheral recess 40 for the purpose of providing a seal with the outer conductive sheath 12 of the cable 11. The tubular portion 38 of the cover sleeve 35 terminates forwardly in a forwardly facing annular shoulder 41.

Disposed between the housing 16 and the cover sleeve 35 within the connector 10, there is provided a metal ferrule 43 which is peripherally discontinuous at an axially extending slot 44 to permit resilient and radially inward compression of the ferrule 43 in a manner yet to be explained. On its internal surface, the ferrule 43 is formed with serrations 45 for gripping engagement with the outer conductive sheath 12 of the cable 11. The ferrule 43 has a rearwardly facing rear radial edge 46 and a forwardly facing external cam surface 47 adapted to be engaged externally by the rear edge surface 33 of the tubular portion 31 of the housing 16.

In the use of the known connector 10 shown in FIGS. 1 and 2 of the accompanying drawings, the outer sheath 12 and the insulation 14 of the cable 11 are first cut away to expose the forward end portion 20 of the core electrode 13. The cable 11 is then inserted into the connector in the forward direction until the forward end surface of the sheath 12 abuts the rearward edge of the peripheral wall 27 of the spacer 26, the exposed forward end portion 20 of the core electrode 13 then projecting into the box 19 as actually shown in FIG. 2. The cover sleeve 35 is then tightened onto the housing 16 and, during such tightening operation, the rear edge 46 of the ferrule 43 is abutted by the shoulder 41 of the cover sleeve 35 to cause the ferrule 43 to move forwardly. During such forward movement of the ferrule 43, abutment of the rear edge surface 33 of the housing 16 against the cam surface 47 of the ferrule 43 causes the latter to be radially inwardly compressed until the internal serrations 45 thereof firmly grip the outer conductive sheath 12 of the cable 11 disposed therewithin. In this way, electrical continuity is obtained between the outer conductive sheath 12 and the metal box 19 through the ferrule 43 and the housing 16.

Having described the previously known connector shown in FIGS. 1 and 2, one particularly useful embodiment of a connector in accordance with this invention and as generally indicated at 50 in FIG. 4 of the accompanying drawings will now be described. The connector 50 is shown in FIGS. 3 and 4 as being used for the same purpose as the connector 10 of FIGS. 1 and 2, i.e. for connecting a coaxial cable 11 to a connector box 19 within which an exposed forward end portion 20 of the core electrode 13 of the cable 11 is connected in a short sleeve 21 by a set screw 22 while the outer conductive sheath 12 of the cable 11 is electrically connected to the metal of the box 19 through the connector 50.

Referring now in greater detail to the structure of the connector 50, it will be seen that it comprises an electrically conductive hollow housing generally indicated at 51 and a hollow tubular cover sleeve generally indicated at 52. The housing 51 has a forward end portion 53 externally threaded at 54 for engagement with the internal thread 18 provided in the opening of the end wall of the connector box 19, an O-ring 24 being provided as in the connector 10 of FIGS. 1 and 2. A rearward

tubular end portion 55 of the housing 51 has an external male thread 56 formed on its forward end. The tubular end portion 55 is peripherally divided by four axially extending slots 57 into four rearwardly projecting resiliently and radially inwardly compressible tongues 58, 59, 60 and 61 which are collectively formed with a rearwardly facing external frusto-conical cam surface 62. Internally, the tongues 58, 59, 60 and 61 are threaded at 63 or formed with serrations for gripping the outer surface of the outer conductive sheath 12 of the coaxial cable disposed within the connector 50 as actually shown in FIG. 4.

Referring now to the hollow tubular cover sleeve 52, it will be seen that that cover sleeve 52 includes a forwardly disposed internal thread 65 for engagement with the external thread 56 of the housing 51. Rearwardly of the thread 65, the cover sleeve 52 is formed with a forwardly facing internal frusto-conical cam surface 66 which engages the rearwardly facing external cam surface 62 of the tongues 58, 59, 60 and 61 when the cover sleeve 52 is screwed onto the housing 51 as actually shown in FIG. 4.

Rearwardly of the cam surface 66, an axially and resiliently compressible and radially and resiliently expansible, generally cylindrical sealing member 67 is retained within the cover sleeve 52 by a radially inwardly extending annular flange 68 integrally formed in the cover sleeve 52 at the rearward end thereof.

The connector 50 also includes an annular spacer 70 of electrically insulating material and which functions in the same manner as the spacer 26 of the connector 10 of FIGS. 1 and 2 for maintaining the exposed forward end portion 20 of the core electrode 13 in its correct axial position. The rearward end of the spacer 70 abuts a forwardly facing annular shoulder 71 formed in the housing 51 while a rearwardly facing annular shoulder 72 also formed in the housing 51 provides a seating for the forward end of the outer conductive sheath 12 of the cable 11. An axial bore 73 in the spacer 70 is usefully flared as at 74 to guide the forward end of the core electrode 13 of the cable 11 thereinto.

In the use of the connector 50 as shown in FIG. 4, the outer conductive sheath 12 and the insulation 14 of the cable 11 are first cut back in the manner already explained herein with reference to FIGS. 1 and 2 of the accompanying drawings and the cable 11 is then inserted into the connector 50 so that the exposed forward end portion 20 of the core electrode 13 projects into the connector box 19 while the forward edge of the outer conductive sheath 12 seats against the shoulder 72. The cover sleeve 52 is then screwed onto the housing 51 until abutment of the internal cam surface 66 of the cover sleeve 52 against the external cam surface 62 of the tongues 58, 59, 60 and 61 causes those tongues to be flexed radially inwardly into mechanical gripping engagement and electrical contact with the outer conductive sheath 12 of the cable 11, thereby providing electrical connection between the box 19 and the sheath 12 of the cable 11 through the housing 51. During such tightening movement, the sealing member 67 is axially compressed between the flange 68 and the rearward edge surfaces of the tongues 58, 59, 60 and 61 and is consequently radially expanded to provide a seal between the sheath 12 and the cover sleeve 52 as will readily be understood by reference to FIG. 4.

It should particularly be noted that, during the tightening of the tongues 58, 59, 60 and 61 onto the sheath 12 of the cable 11, there is no way in which such tongues can rotate relative to that sheath and thereby possibly damage the cable.

Referring now to the alternative embodiment of a connector in accordance with the invention as generally indicated at 80 in FIG. 6 and as also shown in FIG. 5 of the accompanying drawings, it will be noted that that connector 80 is generally similar to the connector 50 already described herein with reference to FIGS. 3 and 4. Although the dimensions and configurations of the various component parts of the two connectors 50 and 80 are somewhat different, for convenience, however, essentially identical components have been indicated by the same legends.

The connector 80 differs from the connector 50 shown in FIGS. 3 and 4 in that it incorporates means for mechanical and electrical engagement with the exposed forward end portion 20 of the core electrode 13 of the cable 11.

For such a purpose, the connector 80 includes a slotted and electrically conductive collet sleeve generally indicated at 81 and having two peripherally spaced apart and rearwardly extending generally semi-cylindrical fingers 82 defining an elongated axial bore 84 within which the forward end portion 20 of the core electrode 13 is received. The inner surfaces of the fingers 82 are usefully serrated for a reason which will readily be understood as the description herein proceeds. Integrally formed with the collet sleeve 81, there is provided an axial connector electrode 85 which extends forwardly out of the connector 80 for the electrical connection thereto, for example, within a connector box (not shown) to which the connector 80 is secured by screwing in the manner already described herein. A shoulder 86 is provided at the forward end of the fingers 82 for a purpose yet to be explained.

The connector 80 of FIGS. 5 and 6 also differs from the connector 50 of FIGS. 3 and 4 in that the spacer generally indicated at 88 and provided for supporting the forwardly extending electrode 85 differs from the spacer 70 provided in the connector 50 in that it is integrally formed with a rearwardly extending axially bored axial stem 89 which abuts the aforementioned shoulder 86 of the collet sleeve 81 to retain that collet sleeve 81 in its correct position along the axis of the connector 80. The spacer 88 is retained in position within a housing generally indicated at 83 by an internal annular flange 90 integrally formed with the housing 83 at the forward end thereof.

Coaxially disposed around the collet sleeve 81, there is provided an electrically insulating and radially inwardly and resiliently compressible bushing generally indicated at 92 and which, when the connector is assembled as shown in FIG. 6, is disposed between the forward and rearward ends of the aforementioned tongues 58, 59, 60 and 61 so as to be inwardly compressed on radially inward movement of such tongues. Such inward compression of the bushing 92 in turn causes radially inward movement of the collet sleeve fingers 82 into gripping engagement and electrical contact with the exposed forward end portion 20 of the core electrode 13 of the cable 11. In order to facilitate the compression of the bushing 92, the latter is usefully formed with a cutaway segment 93 as is well known in cable connectors of the type considered herein and as is particularly shown in FIG. 7 of the accompanying drawings. The axial bore 94 provided in the bushing 92 for receiving the collet sleeve 81 is usefully flared at its rearward end as indicated at 95 to facilitate the entry of the forward end of the core electrode 13 thereinto.

The manner in which the connector 80 is used should be readily apparent from the foregoing description. During tightening of the cover sleeve 52 onto the housing 83, the mutual engagement of the cam surfaces 62 and 66 causes radially inward movement of the tongues 58, 59, 60 and 61 into gripping engagement and electrical contact with the outer sheath 12 of the cable 11. Such radially inward movement of the tongues 58, 59, 60 and 61 in turn causes radially inward compression of the bushing 92 which in turn leads to radially inward compression of the fingers 82 of the collet sleeve 81 into gripping engagement and electrical contact with the exposed forward end portion 20 of the core electrode 13.

Referring now to the further embodiment of a cable connector in accordance with the invention as generally indicated at 100 in FIG. 8 of the accompanying drawings, it will be noted that that connector 100 differs from those already described herein in that it is intended for interconnecting the sheath electrodes and the core electrodes of two coaxial cables 11 and 111 instead of being intended for providing electrical connection to one or both electrodes of a single such cable. Nevertheless, the connector 100 has numerous features in common with the connector 80 shown in FIGS. 5 and 6 and, for the purpose of avoiding undue repetition in the description herein, the same legends are used in FIG. 8 as were used in

FIGS. 3, 4, 5 and 6 for indicating identical component parts of the various connectors.

It will further be noted that the connector 100 has a generally symmetrical structure including two hollow cover sleeves 52 and 152 which are screwed onto opposite ends of an intermediate housing generally indicated at 96. The components on the left-hand side of the connector 100 are identified by the same legends as those used for the corresponding components on the right-hand side of the connector except that the legends for all such left-hand components are preceded by the numeral "1."

The connector 100 of FIG. 8 differs from the connector 80 of FIGS. 5 and 6 in that the former is provided with right-hand and left-hand collet sleeves 81 and 181 respectively for receiving the exposed end portions 20 and 120 of the core electrodes of the two cables 11 and 111 respectively and in that these collet sleeves 81 and 181 are carried on opposite axial ends of a center electrode 97 supported axially within the housing 96.

The housing 96 of the connector 100 is provided with right-hand and left-hand tubular skirts, each of which is formed from four peripherally separated and internally serrated tongues, tongues 60, 61 and 160, 161 being shown in FIG. 8. Bushings 92 and 192 are similarly provided around respective ones of the collet sleeves 81 and 181 for the same purpose as the bushing 92 was provided in the connector 80 of FIGS. 5 and 6. The bushings 92 and 192 also serve to support the center electrode 97 and to retain that electrode in its correct position within the housing 96.

In the use of the connector 100, the two cables 11 and 111 are prepared in the manner already described and, after such cables have been inserted into the connector 100 so as to be disposed in the positions shown in FIG. 8, the cover sleeves 52 and 152 are tightened on the housing 96 to cause the respective tongues to be radially inwardly compressed into gripping engagement and electrical contact with the outer conductive sheaths of respective ones of the cables 11 and 111.

Such compression of the tongues causes compression of the bushings 92 and 192 which in turn causes compression of the collet sleeves 81 and 181 respectively into gripping engagement and electrical contact with the exposed end portions 20 and 120 respectively of the core electrodes of the cables 11 and 111 respectively. In this way, electrical interconnection is effected between the core electrodes of the two cables 11 and 111 through the central electrode 97 as well as between the outer conductive sheath electrodes of the two cables 11 and 111 through the housing 96.

It should particularly be noted that, for the connector 80 of FIGS. 5 and 6 and for the connector 100 of FIG. 8, the tongues which serve to grip the outer conductive sheath of the cables are integrally formed with a housing which will normally be held stationary while the cover sleeves 52 and 152 are rotated relative thereto to tighten the connectors. Accordingly, there is no rotational shearing action of such tongues on the sheath electrodes. Furthermore, the collet sleeves which serve to grip the core electrodes are completely stationary since they are disposed within the stationary tongues and there is, therefore, no rotational shearing action on the core electrodes. There is in distinction to many known connectors in which the outer conductive sheath of a coaxial cable is gripped by a separate ferrule provided within the connector so as to be radially inwardly compressed into contact with the sheath of the cable when the connector is tightened. The use of such separate ferrules frequently causes slight rotation of the outer conductive sheath of the cable and, in the event that the connector is of the type that firmly clamps the core electrode of the cable against rotation, there is a dangerous risk that the sheath will be twisted relative to the core electrode. It will now be understood how this danger is completely avoided in the connectors of the present invention.

Reference will now be made to FIG. 9 which illustrates the use of the connector 80 of FIG. 6 in conjunction with a coaxial cable generally indicated at 211. The connector 80 shown in

FIG. 9 is identical to the connector 80 shown in FIG. 5 and 6, except that a washer 87 is disposed within the connector forwardly of the sealing member 67 for the purpose of reducing frictional forces during the tightening of the connector. The cable 211 differs from the cables 11 and 111 already described herein in that the conductive sheath electrode 212 of the cable 211 is in the form of a strip of aluminum wound around the foamed plastic insulation 214 in which the core electrode 213 is axially positioned. The aluminum foil sheath electrode 212 is retained in position and protected by an electrically insulating outer sheath 215.

It will be understood that, if the connector 80 were to be used with the cable 211 in the same manner as that already described herein with reference to FIG. 6 of the accompanying drawings, the tongues 58, 59, 60 and 61 would be flexed radially inwardly into mechanical gripping engagement with the electrically insulating outer sheath 215 of the cable 211. Such procedure would not, however, provide electrical connection to the conductive foil sheath electrode 212.

In order to provide such electrical connection between the connector 80 and the sheath electrode 212 of the cable 211, the cable is first prepared by removing the electrically insulating sheath 215 for a short distance rearwardly from the end of the internal insulation 214 so as to reveal the foil 212 as actually shown in FIG. 10. An electrically conductive metal adaptor generally indicated at 216 and including a thin sleeve 217 and an annular head 218 is then utilized to ensure electrical connection to the foil electrode 212. The internal diameter of the sleeve 217 and that of the head 218 are substantially equal to the external diameter of the foil electrode 212, while the external diameter of the head 218 equals the external diameter of the outer insulating sheath 215 of the cable 211. For use, the adaptor 216 is pushed over the prepared end of the cable 211 to force the sleeve 217 between the foil electrode 212 and the insulating outer sheath 215 until the rearward edge 219 of the head 218 abuts the forward edge 220 of the insulating outer sheath 215 of the cable 211. At such time, the forward edge 221 of the head 218 of the adaptor 216 will be generally coplanar with the forward edge surface of the insulating core 214 of the cable 211. When positioned on the cable, the outer peripheral surface of the head 218 forms a forward extension of the outer peripheral surface of the insulating outer sheath 215 of the cable 211, the core electrode 213 projecting forwardly as already described.

The cable 211 with the adaptor 216 so positioned thereon is then inserted into the connector 80 in exactly the same manner as already described herein with reference to FIG. 6 and the cover sleeve 52 of the connector 80 is then screwed onto the housing 83 thereof to cause radially inward flexing of the tongues 58, 59, 60 and 61. The rearward ends of such tongues are consequently moved into gripping engagement with the insulating outer sheath 215 of the cable 211 and so cause the sleeve 217 of the adaptor 216 to be pressed into positive electrical contact with the foil sheath electrode 212 disposed therewithin. At the same time, the forward ends of the tongues 58, 59, 60 and 61 are moved into positive gripping engagement and electrical contact with the head 218 of the adaptor 216. As a result, the cable 211 is firmly secured in the connector 80 while effective electrical connection is provided between the housing 83 of the connector 80 and the foil sheath electrode 212 of the cable 211.

I claim:

1. A connector for securement to the end of coaxial cable having a core electrode and a conductive sheath electrode and which connector comprises a hollow housing having integral therewith a rearwardly extending and peripherally discontinuous electrically conductive tubular skirt for radially inward compression into gripping engagement with a coaxial cable extending forwardly into said skirt and into electrical contact with the conductive sheath electrode of such a coaxial cable, said tubular skirt being formed with a rearwardly facing external surface; a hollow tubular cover sleeve having associated therewith a forwardly facing internal cam surface for conjoint

axial movement with said cover sleeve and for engagement with said rearwardly facing external surface of said tubular skirt when said cover sleeve is disposed coaxially around said tubular skirt and adapted to cause radially inward compression of said tubular skirt into gripping engagement with the coaxial cable disposed within said tubular skirt and into electrical contact with the conductive sheath electrode of that coaxial cable on forward axial movement of said cover sleeve relative to said housing; co-operating means on said housing and on said cover sleeve for retaining said cover sleeve in a fixed forward axial position on said housing in turn to maintain said tubular skirt radially inwardly compressed and in gripping engagement with the coaxial cable disposed within said tubular skirt and in electrical contact with the conductive sheath electrode of that cable; a radially inwardly compressible and electrically conductive collet sleeve mounted generally axially within said tubular skirt of said housing for receiving an exposed forward end portion of the core electrode of the coaxial cable inserted into said connector; and a radially inwardly compressible and electrically insulating bushing coaxially disposed around said collet sleeve and within said tubular skirt whereby, on said radially inward compression of said tubular skirt on forward axial movement of said cover sleeve relative to said housing, said bushing and said collet sleeve are radially inwardly compressed to move said collet sleeve into gripping engagement and electrical contact with the core electrode of the cable.

2. A connector as claimed in claim 1 in which said housing is formed on a forward end thereof with a forwardly extending second said peripherally discontinuous and electrically conductive tubular skirt for radially inward compression into gripping engagement with a second coaxial cable inserted into a forward end of said connector and into electrical contact with the conductive sheath electrode of such a second coaxial cable, said second tubular skirt being formed with a forwardly facing external cam surface, which connector additionally comprises a second said hollow tubular cover sleeve having associated therewith a rearwardly facing internal cam surface for conjoint coaxial movement with said second cover sleeve and for engagement with said forwardly facing external cam surface of said second tubular skirt when said second cover sleeve is disposed coaxially around said second tubular skirt and adapted to cause radially inward compression of said second tubular skirt into gripping engagement with said second coaxial cable and into electrical contact with the conductive sheath electrode of that second coaxial cable on rearward axial movement of said second cover sleeve relative to said housing, in which said collet sleeve is adapted to receive an exposed rearward end portion of the core electrode of the second coaxial cable inserted into said connector, which connector additionally comprises a second said radially inwardly compressible and electrically insulating bushing coaxially disposed around said collet sleeve within said second tubular skirt whereby, on radially inward compression of said second tubular skirt on rearward axial movement of said second cover

sleeve relative to said housing, said second bushing and said collet sleeve are radially inwardly compressed to move said collet sleeve into gripping engagement and electrical contact with said exposed rearward end portion of the core electrode of the second coaxial cable, and which connector additionally comprises cooperating means on said housing and on said second cover sleeve for retaining said second cover sleeve in a fixed rearward axial position on said housing in turn to maintain said second tubular skirt radially inwardly compressed and in engagement with the outer conductive sheath of the second coaxial cable disposed within said tubular skirt.

3. A connector as claimed in claim 1, in which said tubular skirt is formed with a rearwardly facing external cam surface adapted to be engaged by the forwardly facing internal cam surface of the hollow tubular cover sleeve.

4. A connector as claimed in claim 1 in which said tubular skirt is peripherally divided into a plurality of peripherally spaced apart and rearwardly extending, radially inwardly and resiliently compressible tongues having said rearwardly facing external cam surface formed collectively thereon and in which said bushing is disposed axially between forward and rearward ends of said tongues.

5. A connector as claimed in claim 4 in which said tongues are internally serrated for gripping engagement with the coaxial cable disposed therewithin.

6. A connector as claimed in claim 5 in which said tubular skirt is externally threaded for engagement with a mating internal thread formed within said cover sleeve whereby said cover sleeve is advanced forwardly on rotation of said cover sleeve relative to said housing to cause engagement of said external and internal cam surfaces and radially inward compression of said tongues of said tubular skirt and in turn radially inward compression of both of said bushing and said collet sleeve.

7. A connector as claimed in claim 6 in which said cover sleeve has an annular flange integrally formed therewith rearwardly of said internal thread and which said connector additionally includes an axially resiliently compressible and radially outwardly and resiliently expansible seal adapted to be compressed between rearward end surfaces of said tongues and a forwardly facing surface of said annular flange on forward movement of said cover sleeve relative to said housing to provide a seal between said cover sleeve and a peripheral outer surface of the coaxial cable disposed within said connector.

8. A connector as claimed in claim 7 which additionally includes an electrically conductive axially forward extension of said collet sleeve and an annular electrically insulating spacer disposed around said forward extension of said collet sleeve to maintain said forward extension of said collet sleeve in a generally axial position within said housing and a rearward tubular extension integrally formed with said spacer and adapted to abut said bushing to maintain said bushing in correct axial position within said tongues of said housing.

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