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[54] CONNECTION OF COAXIAL CABLE ENDS

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[52] **U.S. Cl.** ..... **174/88 C,** 174/92

[51] **Int. Cl.** **H02g 15/08**

[58] **Field of Search** ..... 174/88 R, 88 C, 91–93, 174/75 C, 89, 21 C; 339/176 R, 177 R, 177 E, 103 R, 103 M, 89 R

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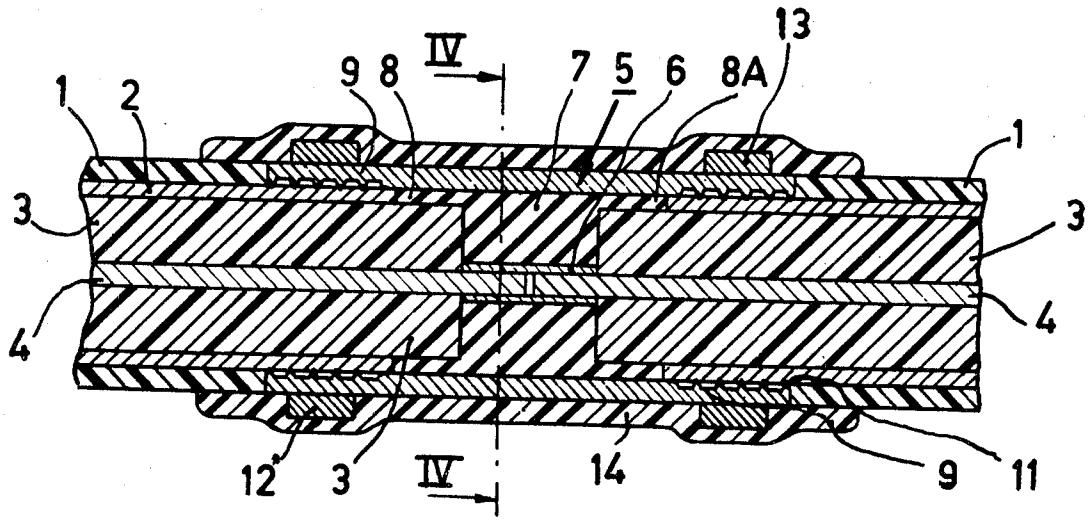
[57] **ABSTRACT**

A water resistant electrical connection of two coaxial cable ends in which metal shells having ridges on the inside and overlapping the outer conductors and being in electrical contact therewith are provided in a clamping manner on the cable dielectrics.

2 Claims, 5 Drawing Figures



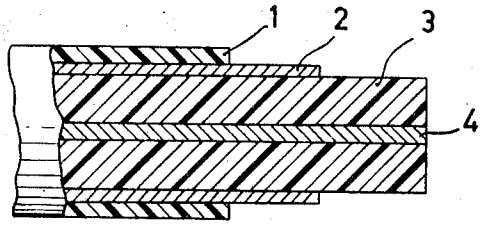


Fig.1

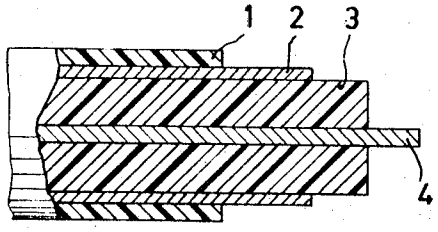


Fig.2

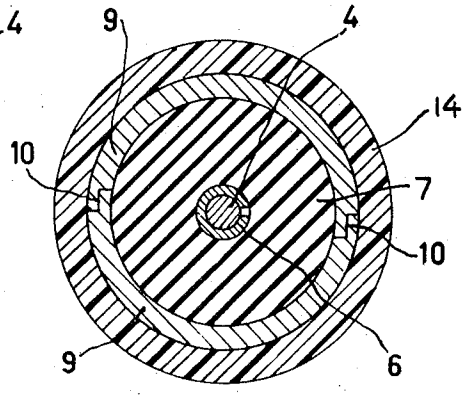


Fig.4

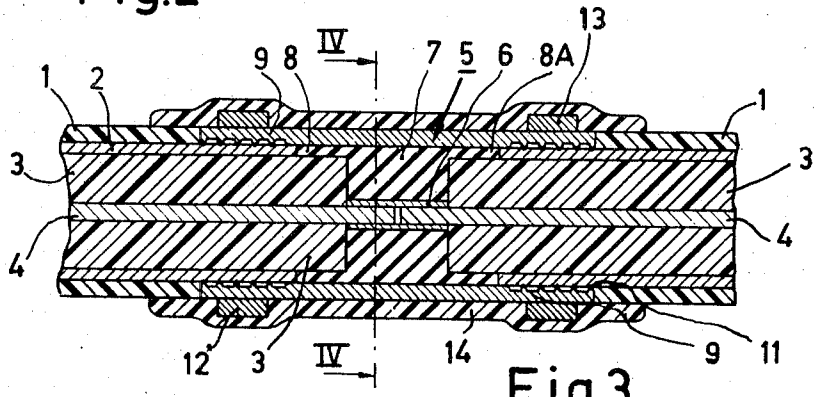


Fig.3

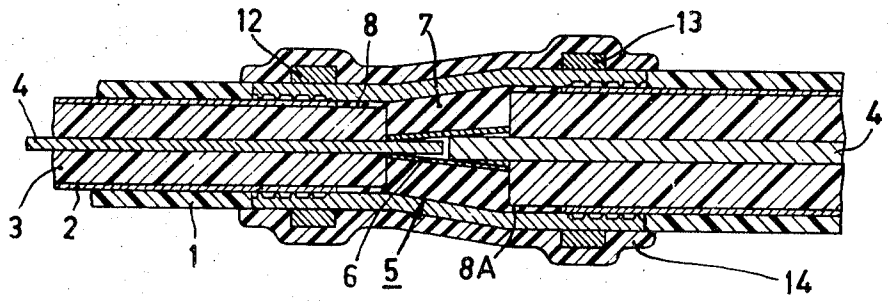


Fig.5

CONNECTION OF COAXIAL CABLE ENDS

The invention relates to a water resistant electrical connection of two coaxial cable ends each consisting of a central conductor, a solid dielectric surrounding the central conductor, a cylindrical outer conductor and a sheath, the central conductors and the outer conductors being electrically connected together in a conventional manner, for example, by means of clamping connections. The invention further relates to a method of manufacturing a moisture-tight connection of two coaxial cable ends. As a result of the increasing use of communal aerial systems particularly also for television reception there is a great need of reliable connections between coaxial cable ends which may have an equal or an unequal diameter.

The most important requirement imposed on such connections is that no reflections which deteriate the signal distributed through the cable must be produced. In addition the connection must be waterresistant and must be able to withstand pulling forces occuring during normal handling of the cable. In general, the existing connections are of a complicated nature and are expensive and easily give rise to errors. They can only be applied by specially trained people and generally require time-consuming operations.

An object of the invention is to provide a connection which can be applied quickly and without errors and with as few tools as possible by untrained personnel after some instructions, and which connection is relatively inexpensive

A connection between two coaxial cable ends which satisfies this condition is characterized in that the cable ends are mechanically connected together by means of shell-shaped connection pieces of electrically conducting material provided with parts projecting in the direction of the central conductor, said connection pieces overlapping the outer conductors of the two cable ends and electrically connecting them together while they are provided in a clamping manner by means of clamping devices on the dielectrics with the outer conductor of the two cable ends.

A preferred embodiment of the connection according to the invention is characterized in that the connection pieces consist of shells of electrically conducting material having a ridged inner surface for at least the part overlapping the outer conductors.

A connection according to the invention may be obtained as follows: the sheath is removed radially over a given distance from the two cable ends and subsequently a part is radially removed from the bared part of the outer conductor.

To realize a satisfactory electrical connection between the central conductors, the central conductors are bared over a given distance and these bared ends are slid in a metal bush provided with an envelope of insulating material. The insulating material is preferably the same material as that used for the cable dielectric. The metal bush may be provided with one or more axial slots and may have a slightly smaller inner diameter than the diameter of the central conductor so that a clamping connection is obtained. In order to bring at that area the ratio between the internal diameter (D) of the outer conductor and the diameter (d) of the inner conductor, which determines the impedance, to the same value as in the cable ends it is necessary, due to the slightly larger diameter of the inner conductor, to give the insulating envelope of the metal bush a

slightly larger thickness than the dielectric of the cable ends and this in such a manner that the ratio D/d is equal to that in the cable ends. If the diameters of the cable ends differ, the diameter at each end of the insulating envelope is slightly larger than the diameter of the adjacent cable dielectric. The diameter between the two ends then varies, for example, regularly with the distance so that a conical shape is obtained, while it must of course be ensured that the impedance in the conical part is adapted to that of the cable ends. A further adaptation may also be obtained by providing the envelope of insulating material with ducts. In a preferred embodiment of the invention the insulating envelope at both ends and in alignment therewith supports hollow cylinders having a slight length and being made of the same material with a wall thickness which is equal to the difference in thickness of the ends of the insulating envelope and the adjacent cable dielectric. When providing the connection, the dielectrics of the cable ends are slid into these hollow cylinders. The described cylinders have for their object to lengthen the creeping-path for moisture. Polythene wax or another viscous moisture-repellent material may be provided on the inner walls of the cylinders so that the water resistance is still better ensured. When using this embodiment the length of the cylinders is preferably chosen to be such that the part of the dielectric not coated with the outer conductor is enveloped thereby. It was found that a satisfactory moisture-tight connection can be obtained in this manner while the reflections caused at that area by the extra quantity of insulation material are still very small and can be maintained within the admissible limits. Thhe electrical connection between the cylindrical outer conductors is obtained by means of the shell-shaped connection pieces of electrically conducting material, for example, copper, nickel-plated copper or brass. The shell-shaped connection pieces may be clamped with the aid of clamping rings on the outer conductors and on the dielectric located underneath. In order to obtain a satisfactory electrical and mechanical connection between the two cable ends, the connection pieces, at least as regards the parts overlapping the outer conductors, are provided on their inner sides with elevations, such as internal varying ridges. These elevations may have another form, provided that a satisfactory electrical and mechanical connection can be obtained therewith. The shell-shaped connection pieces are preferably provided at least at the area of the connection of the central conductors with adjoining profiled edges so as to prevent outward radiation. Subsequently an outer sheath may be provided, for example, by sliding a heat-shrinkable tube of electrically insulating material, for example, polyethylene on the assembly or by providing vulcanizing sealing tape.

A preferred embodiment of the invention and a method of manufacturing such a connection will now be described in greater detail with reference to the accompanying drawing.

FIGS. 1 and 2 are longitudinal cross sections of a cable and at different preparatory stages for the provision of a connection according to the invention.

FIG. 3 shows a connection of two cable ends of the same diameter in a longitudinal cross section.

FIG. 4 shows a cross section taken on the line IV–IV in FIG. 3.

FIG. 5 shows a longitudinal cross section of a connection between two cable ends of unequal diameter.

FIG. 1 shows partly in a cross section a coaxial cable end part of whose sheath 1 and the outer conductor 2 consisting of a copper foil and a copper stranded wire provided thereacross has been removed so as to prepare the provision of the connection. Subsequently (FIG. 2) part of the dielectric 3 is removed so that the central conductor 4 projects outside the dielectric 3. The parts of the central conductors 4 projecting outside the dielectric 3 of two cable ends are then slid into the connection piece 5. The connection piece 5 consists of a metal bush 6 which may have a slightly smaller diameter than the central conductors 4 and may be provided with one or more slots running parallel to the axis so as to obtain a clamping fit, and an envelope of insulating material 7. Since the provision of the metal bush 6 causes the diameter (d) of the central conductors in the connection piece to be larger than that of the central conductors 4, the thickness of the insulating envelope 7, which consists preferably of the same material as the cable dielectrics 3, for example, polyethylene, is chosen to be such that the ratio D/d is equal to that in the cable ends (D is the inner diameter of the outer conductor). The insulating envelope 7 extends at both ends in the form of thin walled hollow cylinders 8 and 8A having a wall thickness which is equal to the said thickness difference between the envelope 7 and the cable dielectric 3 and which surround the cable dielectrics over the part from which the outer conductors 2 have been removed. Subsequently the metal shells 9 are provided (FIGS. 3 and 4). As is shown in FIG. 4 two shells may constitute a cylinder sheath. It is of course alternatively possible to form the shells in such a manner that three or more shells constitute a closed cylinder sheath. Generally it is, however, preferred to limit the number of shells so that also the number of seams through which moisture might penetrate is limited. In order to obtain a protection from radiation, the mutual tangent planes of the shell 9 are profiled at least for the part surrounding the connection piece 5, for example, in the manner as shown at 10 in FIG. 4. This profile has the advantage that for a given connection only one type of shell part, dependent on the cable diameter, is to be kept in stock. The shells 9 are provided on their inner sides with radially varying ridges. The shells 9 are secured with clamping rings 12 and 13. Subsequently a shrinkable tube of polyethylene is provided on the sheath 14. The connection of two cable ends having an unequal diameter and being shown in a longitudinal cross section in FIG. 5 does not principally differ from that of FIG. 4. The reference numerals have the same significance as those in FIG. 5. It is evident that the shape of the then conical envelope 7 of insulating material is to be chosen to be such that the impedance in the connection does not differ from that in the cable ends. In order to obtain a satisfactory sealing from moisture penetration a thin layer of water-repellent mass, for example, polyethylene wax or silicon grease may be provided between all parts of the connection.

A connection as shown in FIGS. 3 and 5 can withstand not too large pulling forces so that there is no risk of variation of the electrical properties connection between the cable ends or of the impedance at that area.

A connection according to the invention may be used, for example, for the assembly of networks for communal aerial systems, for coupling all kinds of cables used for this purpose with a solid dielectric and mutually equal or different diameters may be coupled using the connection according to the invention.

The connections may be used for buried and overhead cables and the use of cable muffs is generally not necessary.

What is claimed is:

1. A connection between adjacent ends of coaxial cables electrically connecting conductors thereof, each of said cable ends having a central conductor, a dielectric surrounding said central conductor, a cylindrical outer conductor surrounding said dielectric and coaxial with said central conductor, said connection comprising an electrical conducting bush connecting the ends of the central conductors, an envelope of electrically insulating material enveloping said bush, hollow cylinders supported at both ends of said envelope made of the same material as said envelope receiving said cable dielectrics, said envelope having a wall thickness equal to the difference in thickness of the ends of the insulating envelope and the adjacent cable dielectric, shell shaped connection pieces of electrically conducting material having inwardly projecting parts connected between said cylindrical outer conductors of said cable ends and overlapping the ends of said outer conductors, and clamping means for securely connecting said shell-shaped pieces to the cylindrical outer conductors of each cable so as to insure secure electrical and mechanical connection.

2. The connection according to claim 1 further comprising a viscous moisture repellent material between the hollow cylinders and the cable dielectric enveloped thereby.

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