

June 14, 1960

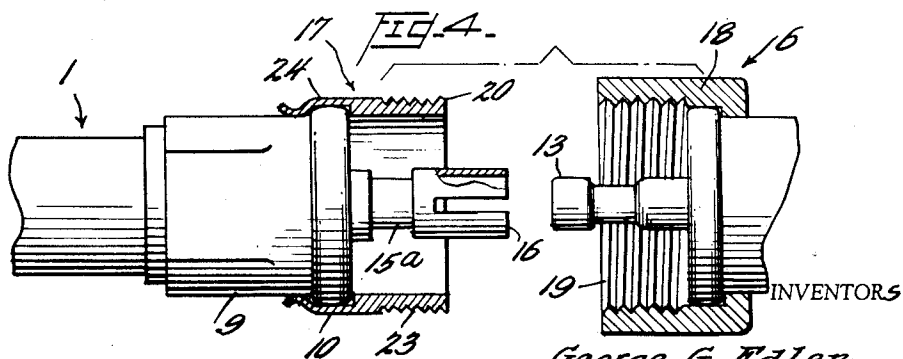
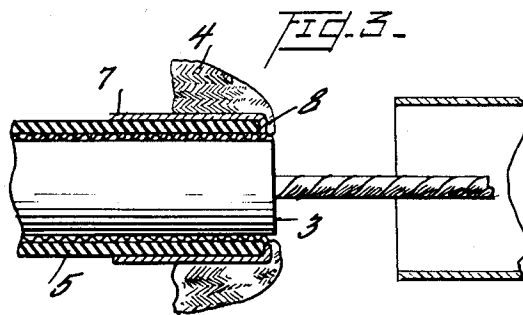
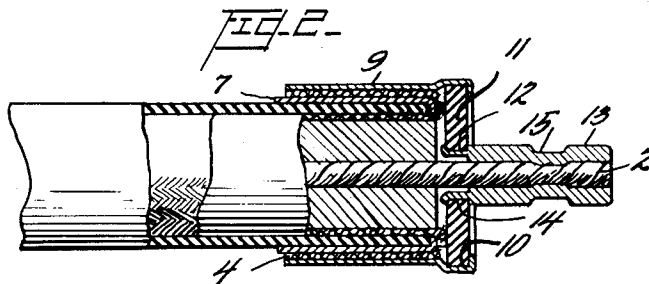
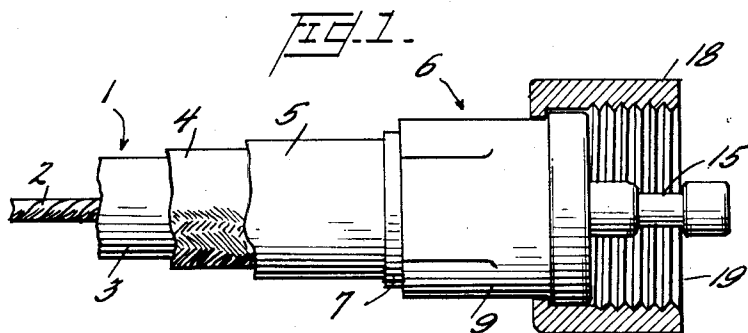
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2,941,028

SOLDERLESS COAXIAL CABLE FITTING

Filed Aug. 10, 1956

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 5.

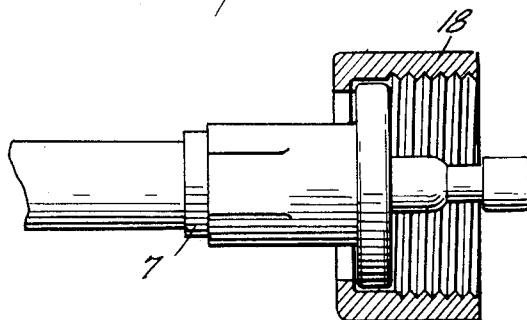


FIG. 6A

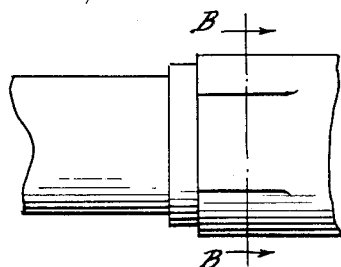


FIG. 6B

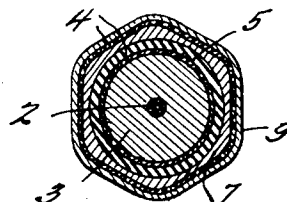


FIG. 7A

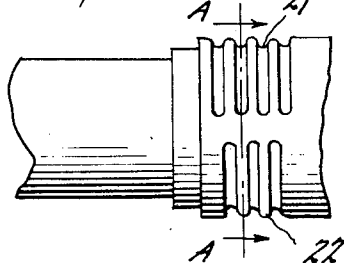
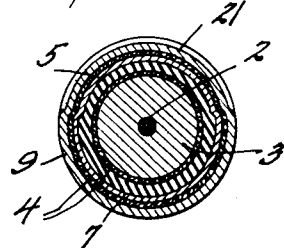


FIG. 7B



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SOLDERLESS COAXIAL CABLE FITTING

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7 Claims. (Cl. 174—75)

The present invention relates to terminal devices or end connectors for coaxial cable and in particular to a terminal device or end connector which mates with existing standard types of coaxial cable terminals or end connectors.

It is an object of the present invention to provide a readily and economically fabricated end connector for coaxial cables which may be quickly and easily applied thereto by unskilled personnel.

It is another object of the present invention to provide a coaxial cable terminal device or end connector which may be securely and firmly attached to the cable both mechanically and electrically by crimping.

It is another object of the present invention to provide a coaxial cable connector comprising essentially two hollow cylinders which may be slipped over the coaxial cable and crimped into operative engagement with each other, and a hollow central terminal member supported by but insulated from one of the hollow cylinders for receiving the central conductor of the cable and which is electrically connected thereto by crimping.

It is still another object of the present invention to provide a coaxial cable terminal device either of the female or male connector type which may be readily applied to the coaxial cable by unskilled personnel in a minimum of time.

It is yet another object of the present invention to provide a male or female terminal device for coaxial cables having a threaded element for securing a terminal device of one type to a terminal device of a mating type.

It is another object of the present invention to provide male and female connectors for coaxial cable which are substantially identical in structure except for the structure of the central terminal and the threaded and mating elements for securing the male and female connectors together.

It is still another object of the present invention to provide a terminal device or end connector for coaxial cables having a small number of parts of simple configuration and large tolerances which consequently may be fabricated by inexpensive stamping and drawing techniques and which do not require costly finishing operations such as machining, grinding, etc.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings, in which:

Fig. 1 is a side view of a male connector of the present invention applied to a coaxial cable;

Fig. 2 is a side view partially in longitudinal section of a male connector of the present invention applied to a coaxial cable;

Fig. 3 is a longitudinal cross section of a coaxial cable with one element of a connector of the present invention applied thereto;

Fig. 4 is a side view partially in section of a female connector of the present invention illustrated juxtaposed to a male connector of the present invention;

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Fig. 5 is a side view of a male connector of the present invention adapted to cooperate with a cable of smaller diameter than the cables of Figs. 1-4;

Figs. 6A and 6B are respectively a side view and a transverse cross section taken on line B—B of the connector of the present invention illustrating a preferred form of crimped configuration employed to secure a terminal of the present invention to an associated cable; and

Figs. 7A and 7B are respectively a side view and a transverse cross section taken on line A—A of another preferred form of crimped configuration.

Referring specifically to Figs. 1-3 of the accompanying drawings a coaxial cable 1 has a central conductor 2, preferably although not necessarily stranded, a concentric layer 3 of insulating material, such as polyethylene, disposed about the inner conductor 2, a concentric stranded and preferably braided outer conductor 4 encircling the insulation 3 and an outer sheath 5 of insulating material. The insulation material 3 is shown in Figs. 1, 2, 3, 6A and B, and 7A and B as being uniformly distributed between the two conductors and filling the space therebetween. A male connector or terminal generally designated by the reference numeral 6 includes an inner, conductive, thin-walled, hollow cylinder or sleeve 7 which may be slipped over the sheath 5. The conductor 1 is initially prepared as illustrated in Fig. 3 of the accompanying drawings by removing predetermined portions of the insulation 3 and the sheath 5 to provide a section of each of the outer conductor 4 and the central conductor 2 projecting beyond the insulating members 3 and 5. The inner hollow cylinder 7 has an inwardly projecting flange 8 at its forward end which engages the end of the sheath 5 and positively positions the cylinder 7 on the cable 1; the terms "forward" and "rearward" and the various forms thereof being employed herein-after to designate respectively the ends of the various elements directed toward the illustrated end of the cable 1 and the main body of the cable 1. The braided conductor 4 may be unraveled or cut longitudinally so that it may be folded back over the cylinder 7. The connector 6 further includes an outer conductive, thin-walled, hollow cylinder or sleeve 9 of such a diameter that it may be slipped over the inner cylinder 7 with the outer conductor 4 folded thereover. As shown in Fig. 2, the assembled cylinders or sleeves 7 and 9 and the portion of the outer conductor 4 sandwiched therebetween are located over the forward end of the insulation sheath 5. The forward end of the outer cylinder 9 (that is, the end adjacent the end of the cable 1) is enlarged radially outwardly to provide an inner annular recess at 10. Disposed within this recess and encircled by the outer cylinder 9 is a flat circular disc 11 of high quality insulating material such as polyethylene which is retained in the recess 10 by an inwardly directed flange of the cylinder 9. The disc 11 is provided with an aperture 12 axially aligned with the central conductor 2 of the cable 1 which passes therethrough. An elongated hollow pin 13 has an axially extending rear section 14 of reduced diameter which is disposed in the aperture 12 of the disc 11; a portion of section 14 protruding through the rear of the disc 11 and being flared outwardly to fasten the pin 13 securely to the disc 11. The pin 13 is made tubular to freely receive the central conductor 2 of the cable 1. Near the tip of the pin 13, is a section 15 of reduced diameter which provides a thin-walled portion which can be readily deformed by any suitable tool to provide a good crimped connection both electrical and mechanical between the pin 13 and the conductor 2. The thin walled construction of the reduced portion 15 is such that the deformation illustrated in Fig. 2 of the accompanying drawings produces a bulge illustrated in Fig. 1 which does

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not extend out beyond the greatest external diameter of the pin 13. Thus the pin 13 can mate with a bored and split central pin 16 of a female connector 17 illustrated in Fig. 4, without the deformed portion 15 interfering with the connection even though the portion 15 has been deformed sufficiently to insure good electrical and mechanical contact between pin 13 and conductor 2.

A hollow cylindrical nut 18 has internal threads 19 for engagement with a threaded sleeve 20 of the female conductor 17. The nut 18 extends rearwardly of the flared section 10 of the outer cylinder 9, the section extending behind flared section 10 having an internal diameter greater than the outer cylinder 9 but of smaller diameter than the section 10. In consequence the nut 18 may be slid back along the cable 1 but may not be removed therefrom without first removing the cylinder 9.

After the male connector or terminal 6 has been assembled on the cable 1 as described above, a crimping tool of any suitable design may be disposed about the cylinder 9 rearwardly of the section 10 and employed to deform or crimp the cylinders 7 and 9 to secure the connector 6 to the cable 1. The force applied to the cylinder 9 produces deformation thereof which clamps the folded over portion of the braided conductor 4 securely between the cylinders 7 and 9. The deforming force is transmitted through conductor 4 resulting in deformation of the cylinder 7 which is crimped into engagement with the cable 1, as illustrated in Figs. 6A and B and 7A and B. The deforming force should be applied relatively slowly and should be sustained for at least a short interval so as to produce cold flow of the metal in cylinders 7 and 9 thereby to insure a strong and permanent mechanical connection of the terminal 6 to the cable 1 and further to insure a good electrical contact between the cylinder 9 and the braided conductor 4. The mechanical strength of the connection obtained between the cable 1 and the connector 6 of the present invention is such that it is impossible to pull the connector from the cable by any force which the cable itself can withstand. The form of the crimps developed in the cylinders 7 and 9 may be of various shapes and conventionally may conform to the configurations illustrated in Figs. 6A and B and 7A and B of the accompanying drawings. Referring specifically to Figs. 6A and B, approximately the rear halves of the cylinders 7 and 9 are deformed into a hexagonal shape. This form of crimping has the advantage that the tool required to produce the deformation is relatively uncomplicated.

Another crimped configuration is illustrated in Figs. 7A and B wherein equally spaced approximately semi-circular circumferential grooves 21 are provided about half the circumference of the cylinders 7 and 9 while a second set of such grooves 22 are provided about the other half of the circumference of cylinders 7 and 9 and are staggered with respect to the grooves 21.

It is apparent from the above that the present invention provides a coaxial cable connector which may be quickly and readily applied to a cable with a minimum of effort even by unskilled personnel. The components of the connector are few in number and may be rapidly and economically fabricated. Specifically inasmuch as the cylinders 7 and 9 have extremely simple shapes they may be rapidly fabricated by punching, stamping or employing conventional metal drawing techniques and do not require machining or other expensive finishing operations.

The present invention is not limited to the provision of a male connector but relates to female coaxial connectors. Referring specifically to Fig. 4 of the accompanying drawings there is illustrated a male connector 6 and a female connector 17 which is engageable with the male connector 6. The construction of the female connector 17 is the same as that of the male connector 6 except for the structure of the central terminal 13 and the nut 19. In the female connector 17 the central terminal 16 is a hollow-slotted cylinder fabricated from

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resilient material so that the male pin 13 is resiliently grasped thereby. The terminal 16 engages the central conductor of its associated length of cable 1 and is secured thereto by a reduced portion 15a similar to portion 15 of Fig. 2. The hollow sleeve 20 of the female connector 17 is provided with external threads 23 which engage with the internal threads 19 of the nut 18. The internal diameter of the forward portion of the sleeve 20 is smaller than the diameter of the flared section. The sleeve 20 has a rearwardly extending thin walled skirt of larger diameter than the section 10 of cylinder 9 and terminates at its rearward end in an inwardly flared portion of smaller diameter than the section 10 but of larger diameter than the main body of the cylinder 9. In consequence the sleeve 20 has a fixed longitudinal position with respect to the cylinder 9 but may be rotated with respect thereto to facilitate screwing the nut 18 and the sleeve 20 together. As the nut 18 and sleeve 20 are progressively rotated the pin 13 is drawn into the cylinder 16 and connection is completed between the two conductors.

The male connector 6 and female connector 17 of the present invention are not restricted to use with one another but are of such a configuration that they may be mated with conventional connectors now on the market and in current use. Thus the male connector 6 is suitable for use with a female connector such as is represented by U.S. military designation SO-239 while the female connector 17 may be employed with the corresponding male connector.

The connectors of the present invention are not limited to utilization with a cable of particular size or diameter but may be employed with coaxial cables of all sizes. Referring specifically to Fig. 5 of the accompanying drawings, the connector 6 is illustrated as applied to a cable of approximately two-third the diameter of the cable illustrated in Figs. 1-4. All that is required for adapting the connectors to this smaller size cable is to reduce the diameter of the cylinder 7 to approximately that of the cable and to reduce the diameter of the main body of the cylinder 9 to that of the folded over portion of the braided conductor 4; the flared section 10 of the cylinder 9 may be of the same diameter regardless of the diameter of the cable, and similarly for the nut 18. Since coaxial cables come in only a few standard sizes, i.e., diameters, only a few standard sizes of cylinders 7 and 9 are required to provide a full stock of connectors adapted for utilization with coaxial cables now in use.

It will be apparent that the embodiments shown are only exemplary and that various modifications can be made in construction and arrangement within the scope of the invention as defined in the appended claims.

We claim:

1. In combination, a coaxial cable and a connector secured to an end thereof; said cable comprising an inner conductor, a flexible outer conductor coaxially surrounding the inner conductor, insulation material uniformly distributed between the two conductors and filling the space therebetween, and an insulation sheath surrounding said outer conductor; said connector comprising a first hollow conductive sleeve positioned over said sheath adjacent said end of said cable, a second hollow conductive sleeve telescoped over said first sleeve, a length of said outer conductor adjacent said end of said cable and stripped of said insulation sheath being reversely folded and sandwiched between said two telescoped sleeves, said assembled sleeves and sandwiched outer conductor being crimped over said sheath clamping said sandwiched outer conductor between said sleeves and clamping said assembled sleeves and sandwiched outer conductor to said sheath, whereby said sheath functions to protect said uniformly distributed insulation material against deformation forces resulting from crimping of said assembled sleeves and sandwiched outer conductor, and mechanical and electrical coupling means carried by

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said second sleeve adapted to cooperate with a mating connector structure.

2. In a combination as set forth in claim 1, said coupling means carried by said sleeve comprising an insulation button supported in that end of said second sleeve immediately adjacent said end of said cable, and an elongate hollow conductive pin mounted centrally in said button and receiving therein an extending end of said inner conductor.

3. In a combination as set forth in claim 2, said pin having a reduced diameter portion crimped to said extending end of said inner conductor.

4. In a combination as set forth in claim 2, said coupling means further comprising a mechanical coupling element carried by said end of said second sleeve and extending substantially coaxially over at least a portion of said pin.

5. In a combination as set forth in claim 1, the crimp of said assembled sleeves and sandwiched outer conductor being circumambient thereof and being formed in a fashion to provide at least one sinuous curvature axially of the cable in the crimped portion of said assembled sleeves and sandwiched outer conductor.

6. In a combination as set forth in claim 1, said coupling means including a mechanical coupling element carried by that end of said second sleeve immediately adjacent said end of said cable.

7. In combination, a coaxial cable and a connector secured to an end thereof; said cable comprising an inner conductor, a flexible outer conductor coaxially surrounding said inner conductor, insulation material uniformly distributed between the two conductors and filling the space therebetween, and an insulation sheath surrounding said outer conductor; said connector comprising a first

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hollow conductive sleeve positioned over said sheath adjacent said end of said cable, a second hollow conductive sleeve telescoped over said first sleeve, a length of said outer conductor adjacent said end of said cable and stripped of said insulation sheath being reversely folded and sandwiched between said two telescoped sleeves, the assembled sleeves and sandwiched outer conductor being circumambiently crimped over said sheath to clamp said sandwiched outer conductor between said sleeves circumambiently, and to clamp said assembled sleeves and sandwiched conductor to said cable, at least one sinuous curvature axially of the cable being formed in the crimped portion of said sleeves and sandwiched conductor, whereby said sheath functions to protect said uniformly distributed insulation material against deformation forces resulting from crimping of said assembled sleeves and sandwiched outer conductor, an insulation button supported in that end of said second sleeve immediately adjacent the end of said cable, an elongate hollow conductive pin mounted centrally in said button and receiving therein an extending end of said inner conductor, and a mechanical coupling element carried by said end of said second sleeve and extending substantially coaxially over at least a portion of said pin.

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