

[54] **SOLDERLESS CONNECTORS OF THE T TYPE**

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[22] Filed: **Sept. 20, 1971**

[21] Appl. No.: **182,078**

[52] **U.S. Cl.** 339/177 R, 339/244 R

[51] **Int. Cl.** H01r 17/04

[58] **Field of Search**.....339/60 C, 89 C, 80 C, 339/91 P, 94 C, 177 R, 177 E, 244; 174/75 C, 88 C, 89

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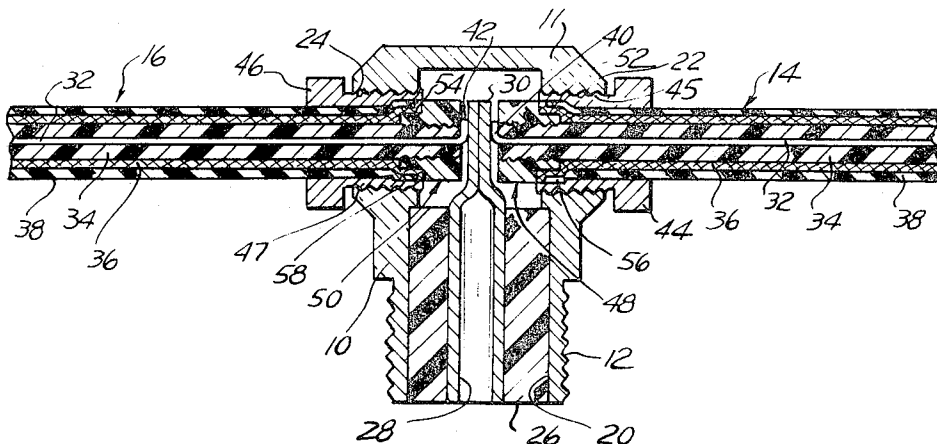
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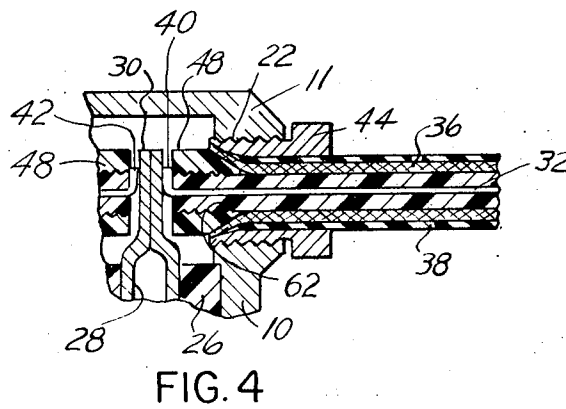
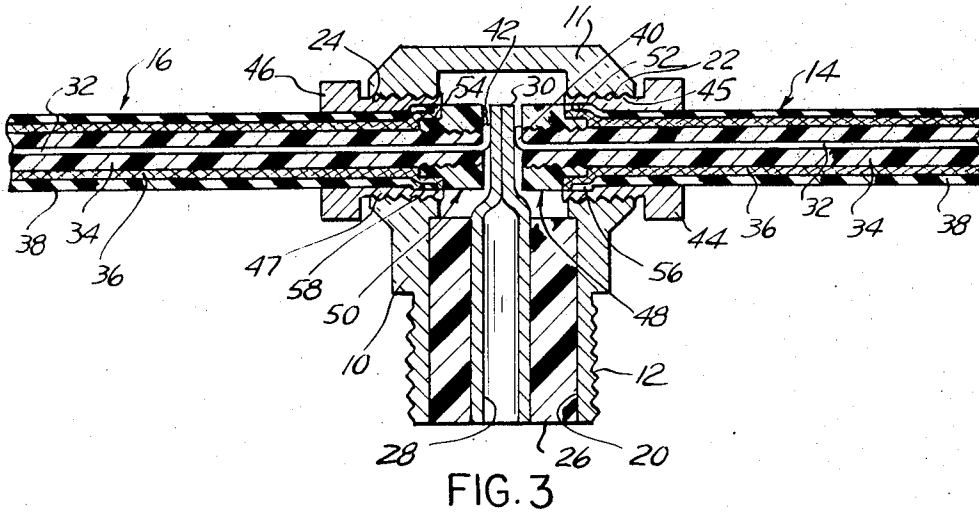
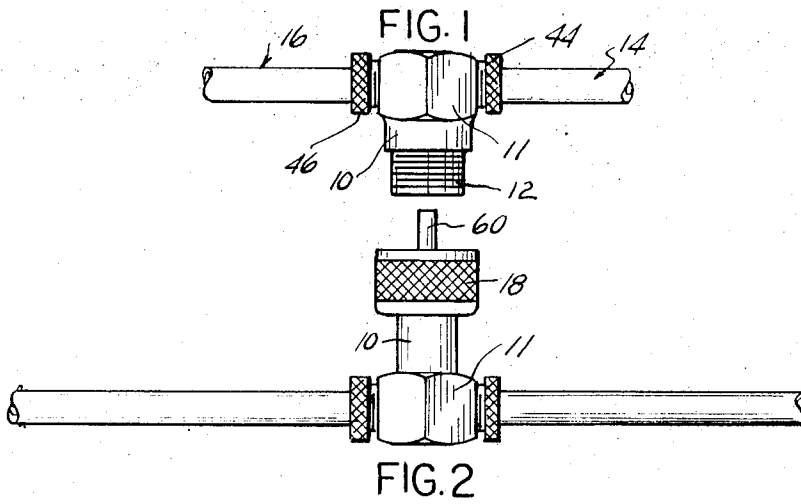
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[57] **ABSTRACT**

Solderless plug and union connectors for a pair of coaxial shielded cables having a "T" type body provided with pin bearings or socket bearing junctions for contacting the exposed end of an inner conductor from each of a pair of cables disposed in a transverse plane to the body of the connector. The connector body includes a pair of dielectric material washers, each disposed about the dielectric material sleeve surrounding the inner conductor of one of the cables and having a mating step portion formed thereon for engagement with a similar step portion formed on an abutting metallic sleeve member similarly extending through the connector body. The connector assembly includes a threaded cup member slidably fixed to a second connector member for coupling the "T" connector and for drawing the "T" connector and the second connector into tight sealing engagement through the operation of the cup member.

11 Claims, 4 Drawing Figures





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SOLDERLESS CONNECTORS OF THE T TYPE

BACKGROUND OF THE INVENTION

The present invention relates to the broad field of electrical connectors of the solderless type and more particularly to improved connectors of the "T" type for use with flexible coaxial cables of the type which includes an inner central conductor, a dielectric material sleeve mounted on the inner conductor, an outer tubular electrical conductor mounted on the sleeve and a final outer dielectric material sheath. The outer sheath is usually made of a material having good mechanical and weather resistant properties in addition to its electrically insulating qualities. This type of coaxial cable connector is used extensively for connection between aerials for propagation or reception of high frequency radio waves, the inputs of radio receivers or the outputs of radio transmitters. Connectors such as these which are the subject of the present invention are required for connecting coaxial cables in "T" type junctions. The prior art discloses a great number of soldered or crimped connectors in which the connectors include a body portion having a hollow prong in which the inner conductor of the coaxial cable is introduced and there locked in place by crimping or soldering. The outer tubular conductor is similarly provided with means for either crimping it in electrical contact with the connector or soldering it to the body of the connector. It will be seen that the soldered connections are difficult to make and require the availability of soldering irons and of operators with somewhat specialized skill. Because of the elevated temperature required for soldering the inner conductor to the hollow prong and the outer tubular conductor to the connector, heat damage may affect the subsequent insulating quality of the dielectric materials in the cable end and the connector. Such soldered connections additionally lack good mechanical strength. Problems also arise when crimping is used to effectuate the electrical and mechanical connections. Special tools and skills are required and the crimping operation has the tendency to reduce the mechanical strength of the connection particularly by giving rise to stresses in the materials thus reducing their normal tensile strength.

SUMMARY OF THE INVENTION

The principal object and goal of the present invention is to provide a coaxial cable connector of the "T" type which connector offers substantial advances over the prior art connectors with respect to secure electrical and mechanical clamping of the tubular conductor. At the same time, there is provided a means whereby the inner conductor is firmly clamped and anchored in an appropriate axial position and in secure electrical contact with the central pin or socket of the connector.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevation of a female type "T" connector incorporating the present invention;

FIG. 2 is a front elevation of a male type "T" connector also incorporating the present invention;

FIG. 3 is a cross-sectional view of the connector of FIG. 1 showing the details of its internal construction and the internal structure of the coaxial cables; and

FIG. 4 is a partial cross-sectional view with parts broken away showing a connector substantially similar to the connector of FIG. 3, but including an alternate embodiment of the present invention.

DETAILED DESCRIPTION OF THE SEVERAL EMBODIMENTS

Referring now to the drawings and more particularly with reference to FIGS. 1 and 2 thereof, the external parts of the connector assembly comprise an electrically conductive connector body 10 which may preferably include a hexagonal head 11 to facilitate assembly and tightening of the parts. The connector body 10 further includes an external threaded portion 12 in the case of the female type connector of FIG. 1. The coaxial conductors shown at either side of the connector body 10 are identified by the numerals 14 and 16 and each includes conventional coaxial cable construction with successive layers and parts which will be shown in full detail in FIG. 3 hereinafter. The male type connector of FIG. 2 differs from the female type connector of FIG. 1 principally in having an internally threaded cup 18, which cup is slidably mounted on the body 10 and limited in its upward movement by a suitable flange thereon. During tightening of the assembly, the threads of the cup 18 are threadably engageable with the threaded peripheral portion of a female type connector or outlet terminal, such as the threaded portion 12 of the female type connector of FIG. 1, a metallic prong or pin such as pin 60 being engaged in an appropriate socket.

With reference to FIG. 3, it will be seen that the connector body 10 further includes a central bore 20 extending through the greater length of the body. The connector body 10 additionally has a pair of transverse bore portions 22, 24 which are internally threaded and extend through the sides of the body in opposing relationship. The central bore 20 additionally retains at its lower open end a dielectric material plug 26 and a central conductor 28 embedded therein. In the embodiment of FIG. 3, the central conductor 28 is of a tubular form and has a flattened upper end portion 30. The central tubular conductor 28 in the assembled connector position is adapted to receive a mating prong or pin of a male type connector, such as the prong 60 of the male type connector of FIG. 2. The two coaxial cables 14, 16 are each of the same construction and include the following elements: an inner electrical conductor 32 which in the present embodiment is shown as a conductive wire centered coaxially in a dielectric material sleeve 34 and a second electrical conductor embodied as a tubular member 36 mounted about the dielectric sleeve 34. Tubular conductor 36 in the present instance is embodied in braided wire form. The final layer of the coaxial cable comprises a protective dielectric material sheath 38 which sheath preferably is formed of a weather resistant material such as rubber or polyvinyl. Preparatory to making the cable connections, the cables 14 and 16 are dressed by removing the outer protective coating 38 from their inner ends. The tubular conductor 36 and the inner dielectric sleeve 34 are also cut off but closer to the cable ends such that end portions 40, 42 of the inner conductor wires 32 are left exposed as shown. An additional extended portion of the braided tubular conductor 36 is left attached as in-

licated. The actual devices for connecting the cables to the connector body 10 include a pair of metallic sleeves 44 and 46 which sleeves are slidably mounted upon the cables 14, 16, respectively. The sleeves 44, 46 have a knurled periphery formed at their respective outer ends to facilitate turning. This feature is shown in FIGS. 1 and 2. The sleeves 44, 46 further have a pair of externally threaded inner ends 45, 47 for respective threaded engagement with the internally threaded bores 22, 24 of the connector body 10. In addition, a pair of internally threaded dielectric material washers 48, 50 are mounted at the ends of the cables 14, 16, respectively. The insulating washers 48, 50 are made of a suitable insulating material such as Teflon or Delrin. The insulating washers 48, 50 have a step portion formed at their outer ends with the step portions being indicated by the numerals 52 and 54, respectively. It will be seen that these step portions are juxtaposed to a pair of mating step portions 56, 58 formed on the internal diameters of the sleeves 44, 46, respectively. In the assembled position of the connector and cables, it will become evident that the braided tubular conductor 36 from each cable extends and is solidly gripped between the mating step portions formed in the insulating washers 48, 50 and the sleeves 44, 46 as described above. It is further of importance that the braided tubular conductor 36 has been pre-cut so that it extends in length somewhat beyond the connection afforded between the mating steps. The connection between the ends of the inner electrical conductors 32 and the upper flattened end of the socket 28 are achieved by bending over the exposed ends 40, 42 of the inner conductors 32. In the assembled position of the connectors and cables, it will be seen that the lower male connector, as it is shown in FIG. 2, carries the cup 18 which is internally threaded to draw the lower threaded portion 12 of the upper connector body 10 downwardly during the tightening of cup 18. There is contained in the male connector body an insulator plug substantially the same as the plug 26 carried in the upper female connector. The male connector pin 60 is centrally mounted in alignment with the socket 28. The two insulating plugs will thus be drawn into secure sealing relationship as the threaded connection is tightened.

FIG. 4 shows an alternate embodiment in which the major difference resides in the construction of the mating portions of the two insulating washers 48, 50 where they match with the internal diameters of sleeves 44, 46 so as to retain therebetween the braided tubular conductors 36. In the FIG. 4 embodiment, the washers 48, 50 are as shown at 62 with respect to washer 48 tapered rather than stepped at their outer ends. The opposing internal diameter surfaces of sleeves 44 and 46 are correspondingly tapered in the manner illustrated. In either case, the electrical coupling and mechanical connection are superior and represent a substantial advance over prior art connectors.

It will be seen that I have provided by my invention a solderless connector of the "T" type in which a minimum of manual preparation for the parts is required and in which, by reason of the shape and construction of the parts, a waterproof sealing electrical connection is achieved.

It will now become obvious that the structure described in the foregoing description and in the ac-

companying drawings is provided by way of illustration only and that various changes in construction and various different modifications and embodiments may be made by those skilled in the art without departing from the spirit of the invention.

I claim:

1. A "T" type connector for coaxial shielded cables of the type having an inner electrical conductor, a dielectric material sleeve mounted on said inner conductor, an outer tubular electrical conductor mounted on said sleeve and a dielectric material sheath covering said outer tubular conductor, said connector comprising:

a connector body having a central longitudinal bore open at one end and a pair of opposed threaded bores extending through the sides of said body into said central bore;

a pair of sleeves, each having a longitudinal bore adapted to accept one of said cables and having an externally threaded end portion threadably engageable with one of said threaded bores of said body, each of said sleeves having an internal step portion at its threaded end;

a pair of dielectric material washers, each disposed about the dielectric material sleeve surrounding the inner conductor of one of said cables in gripping engagement with said dielectric material sleeve at the end of each cable and having a mating step portion at its end proximate said step of said associated sleeve for retaining therebetween an extended end of said tubular conductor, said inner conductor projecting from the end of the dielectric material sleeve and being bent over;

and a central conductor in a dielectric plug disposed in the open end of said longitudinal bore of the connector body, said central conductor having exposed sides for direct electrical engagement with the ends of each inner conductor projecting from said dielectric material sleeve at the end of each of said cables.

2. The combination as set forth in claim 1 wherein said sleeves are provided with a knurled surface on at least a portion of the outer surface thereof.

3. The combination as set forth in claim 1 wherein said central conductor of said connector body comprises a tubular socket having flattened sides at one end thereof between said opposed bores for engagement with said inner conductors of said cables.

4. The combination as set forth in claim 1 wherein said outer tubular conductor comprises a conductor of braided metallic material, extending between and slightly beyond said step portions.

5. The combination as set forth in claim 1 wherein said central conductor of said connector body comprises a pin having flattened sides at one end thereof between said opposed bores for engagement with said inner conductors of said cable, the other end of said pin projecting from said connector body.

6. A "T" type connector for coaxial shielded cable of the type having an inner conductor, a dielectric material sleeve mounted on said inner conductor, an outer tubular conductor mounted on said sleeve and a dielectric material sheath covering said outer tubular conductor, said connector comprising:

a connector body having a central longitudinal bore open at one end and a pair of opposed threaded bores extending through the sides of said body into said central bore;

a pair of sleeves, each having a longitudinal bore adapted to accept one of said cables and having an externally threaded end portion threadably engageable with one of said threaded bores of said body, each of said sleeves further having a tapered internal portion proximate its threaded end; and

a pair of dielectric material washers, each disposed about the dielectric material sleeve surrounding the inner conductor of one of said cables in gripping engagement with said dielectric material sleeve at the end of each cable and having a mating tapered peripheral portion at its end proximate said tapered portion of said associated sleeve for retaining an extended end of said tubular conductor therebetween, said inner conductor projecting from the end of the dielectric material sleeve and being bent over;

and a central conductor in a dielectric plug disposed in the open end of said longitudinal bore of the connector body, said central conductor having exposed sides for direct electrical engagement with the ends of each inner conductor projecting from said dielectric material sleeve at the end of each of said cables.

7. The combination as set forth in claim 6 wherein said sleeves are provided with a knurled surface on at least a portion of the outer surface thereof.

8. The combination as set forth in claim 6 wherein said central conductor of said connector body comprises a tubular socket having flattened sides at one end thereof between said opposed bores for engagement with said inner conductors of said cables.

9. The combination as set forth in claim 6 wherein said outer tubular conductor comprises a conductor of braided metallic material, extending between and slightly beyond said step portions.

10. The combination as set forth in claim 6 wherein

said central conductor of said connector body comprises a pin having flattened sides at one end thereof between said opposed bores for engagement with said inner conductors of said cable, the other end of said pin projecting from said connector body.

11. A "T" type connector for coaxial shielded cables of the type having an inner electrical conductor, a dielectric material sleeve surrounding said inner conductor, an outer tubular electrical conductor surrounding said sleeve and a dielectric material sheath covering said outer tubular conductor, said connector comprising:

a connector body having a central longitudinal bore open at one end and a pair of opposed threaded bores extending through the sides of said body into said central bore;

a pair of sleeves, each having a longitudinal bore adapted to accept one of said cables and having an externally threaded end portion threadably engageable with one of said threaded bores of said body, each of said sleeves having an internal gripping portion at its threaded end;

a pair of dielectric material washers, each disposed about the dielectric material sleeves surrounding the inner conductor of one of said cables in gripping engagement with said dielectric material sleeve at the end of each cable and having a mating gripping portion at its end proximate said gripping portion of said associated sleeve for retaining therebetween an extended end of said tubular conductor, said inner conductor projecting from the end of the dielectric material sleeve and being bent over;

and a central conductor in a dielectric plug disposed in the open end of said longitudinal bore of the connector body, said central conductor having exposed sides for direct electrical engagement with the ends of each inner conductor projecting from said dielectric material sleeve at the end of each of said cables.

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