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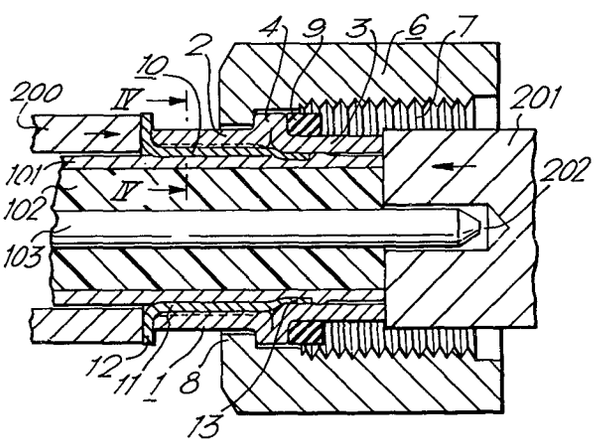
(54) Electrical connector for terminating coaxial electrical cable.

(57) An electrical connector for terminating semi-rigid coaxial cable includes a ferrule (10) having a plurality of axially extending peripheral fingers (13) at one end, which fingers (13) are deflected inwardly into intimate contact with the outer conductor (101) of a cable (100) when the ferrule (10) is urged axially into a body member (1) having two portions (2, 3) of mutually different internal diameter with the cable (100) passing through the ferrule (10) and body member (1).



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Electrical Connector for Terminating Coaxial Electrical Cable

This invention relates to an electrical connector for terminating coaxial electrical cable, and particularly cable of the type having a semi-rigid tubular solid outer conductor, for example of copper, surrounding a dielectric member which in turn surrounds a centre conductor.

Known methods of terminating such cable, and in particular of establishing an electrical connection to the outer conductor thereof, include the use of solder, or the use of an electrical connector including a back-up member which is inserted between the outer conductor and the dielectric layer and a crimping sleeve which is then crimped on to the outer conductor over the back-up member.

Such known methods are relatively difficult to carry out and do not always provide acceptable connections, since with the use of solder the necessary heat can damage the dielectric layer of the cable, and with the crimping method the necessary flaring of the outer conductor for insertion of the back-up member is particularly difficult with small cables, and can also introduce undesirable changes in characteristic impedance across the connection.

In U.S. Patent Specification No. 3,533,051 there is described an electrical connector in which these difficulties are overcome.

This known electrical connector comprises a tubular conductive body member having two axially aligned portions of mutually different internal diameter, through both of which portions the cable can pass, and a ferrule locatable within the larger internal diameter portion of the body member with the cable passing through the ferrule, the ferrule being deformable under forces applied thereto axially of the cable thereby to secure the cable within the body with the outer conductor of the cable electrically connected to the body member.

In this known connector the ferrule is of ductile material and is contained wholly within the larger internal diameter portion of the body member, the axial forces applied to the ferrule causing inelastic deformation thereof and also slight deformation of the body member and the outer conductor of the cable, the deformation being such as to provide residual stress in the body member and in the cable sufficient to lock the body member to the cable and thus provide the required electrical and mechanical connection.

A difficulty which arises with this known connector is that in order to compress the ferrule axially as required a tool must be used, which has a part which can enter the larger internal diameter portion of the body member while surrounding the cable, and this can cause difficulties with connectors of relatively small size. Further, the tooling used must comprise a plurality of parts which must be assembled about a connector and cable to be connected and which must be disassembled and removed after use.

According to this invention a known connector as set out above is characterised in that

the ferrule comprises a tubular body portion having an outwardly directed annular flange at one end, and a plurality of axially extending fingers extending from the periphery at the other end, the arrangement being such that with the body member and ferrule mounted on a cable with the fingers on the ferrule directed towards the smaller internal diameter portion of the body member, movement of the ferrule axially along the cable with the body member held fixed relative to the cable, causes the fingers on the ferrule to be deflected inwardly on entry into the smaller diameter end portion of the body member, the fingers becoming compressed between the cable and the wall of the smaller diameter end portion of the body member and causing deformation of the outer conductor of the cable whereby an electrical connection is established between the outer conductor of the cable and the body member.

The connector of this invention has the advantages that the ferrule extends beyond the limits of the body member and is thus readily accessible to simple tooling which can be used to move the ferrule axially of the body member as required.

This invention will now be described by way of example with reference to the drawings, in which:-

Figure 1 is an exploded perspective view of a connector according to this invention;

Figure 2 is a longitudinal sectional view of the connector of Figure 1 in a partly assembled state;

Figure 3 is a view similar to Figure 2 but showing the connector fully assembled, and also

showing part of the tooling used for assembly;

Figure 4 is a view on the line IV - IV in Figure 3;

Figure 5 is a perspective view of a centre contact member for use in another connector according to this invention; and

Figure 6 is a longitudinal sectional view of the other connector in the assembled state.

The connector shown in Figures 1 to 4 is for terminating a coaxial electrical cable 100 having a semi-rigid tubular solid outer conductor 101 which surrounds a dielectric material layer 102 which in turn surrounds a solid centre conductor 103, and comprises a tubular conductive metal body member 1 having two axially aligned portions 2 and 3 of mutually different internal diameter, through both of which portions 2 and 3 the cable 100 can pass, as shown in Figure 2. At the junction between its portions 2 and 3 the body member 1 is formed with an outwardly directed annular rib 4. The larger internal diameter portion 2 of the body member 1 is formed with a plurality of axially extending splines 5, best seen in Figure 1.

The connector also comprises a coupling ring 6 having a hexagonal external cross-section for cooperation with a spanner and being internally threaded, as shown at 7, from one end, and having an inwardly directed annular lip 8 at the other end. The lip 8 defines an aperture which will receive the portion 2 of the body member 1 but will not pass the rib 4 thereof.

Completing the connector are an annnular resilient sealing member 9 having an external diameter substantially equal to that of the rib 4 on the body member 1, and an internal diameter to

receive the portion 3 of the body member 1 and be retained thereon, and a metal ferrule 10.

The ferrule 10 comprises a tubular body portion 11 having an outwardly directed annular flange 12 at one end, and a plurality of axially extending pointed fingers 13 extending from the periphery at the other end, the fingers 13 being thinner than the remainder of the ferrule 10.

For use of the connector described above, the end of the cable 100 is prepared by removal of portions of the outer conductor 101 and dielectric layer 102 to leave a portion of the centre conductor 103 exposed as shown in the drawings, to constitute a centre contact for the connector.

The sealing member 9 is mounted on the portion 3 of the body member 1 abutting the rib 4, and the coupling ring 6 is mounted on the portion 2 of the body member 1 with the lip 8 abutting the rib 4 and the coupling ring 6 extending over and beyond the portion 3 of the body member 1.

The ferrule 10 is positioned on the cable 100 with the fingers 13 of the ferrule 10 directed towards the free end of the cable 100, and the free end of the cable 100 is then inserted into the body member 1 through the free end of portion 2 thereof until the end of the outer conductor 101 and dielectric layer 102 are flush with the free end of the portion 3 of the body member 1, as shown in Figure 2.

The ferrule 10 is then urged axially of and along the cable 100 until the fingers 13 and body portion 11 of the ferrule 10 enter the portion 2 of the body member 1. The assembly is then engaged by a tool (not shown in detail) having a pair of dies one 200 of which (see Figure 3) embraces the

cable 100 and engages the flange 12 of the ferrule 10 and the other 201 of which engages the free end of the cable 100 within the coupling ring 6, as shown in Figure 3. The die 201 is formed with a blind hole 202 to freely receive the centre contact portion of the centre conductor 103 of the cable 100.

The dies 200, 201 are then moved axially of the cable 100 towards each other, as indicated by arrows in Figure 3, thereby to urge the ferrule 10 further into the body member 1. On such movement of the ferrule 10 the fingers 13 thereof are deflected inwardly on entry into the smaller internal diameter portion 3 of the body member 1, the fingers 13 becoming compressed between the outer conductor 101 of the cable 100 and the wall of the portion 3 of the body member 1, causing slight deformation of the outer conductor 101 of the cable 100, whereby the required electrical connection is established between the outer conductor 101 and the body member 1. As the ferrule 10 is urged into the portion 2 of the body member 1 the splines 5 bite into the ferrule body portion 11, as shown in Figure 4, thereby to lock the ferrule 10 to the body member 1 and prevent relative rotary movement therebetween.

The ferrule 10 is urged into the body member 1 until the flange 12 on the ferrule 10 abuts the free end of the portion 2 of the body member 1, as shown in Figure 3, whereafter the tooling dies 200, 201 are removed leaving the completed connector terminating the cable 100 and ready for mating with an appropriate other connector (not shown) and coupling thereto by means of the coupling ring 6. From Figure 3 it can be seen

that the lip 8 on the coupling ring 6 is positioned between the rib 4 on the body member 1 and the flange 12 on the ferrule 10 whereby the coupling ring 6 is secured to the body member 1 in relatively rotatable manner.

Referring now to Figures 5 and 6, the connector here shown is similar to that of Figures 1 to 4 and corresponding parts have the same reference numbers.

The essential difference is that this other connector uses a separate centre contact member 300 which is crimped to the centre conductor 103 of the cable 100 rather than using the centre conductor 103 itself as the centre contact. The contact member 300 is supported, in known manner, within the portion 3 of the body member 1, by a dielectric material insert 301 located at the free end of the portion 2.

Claims:-

1. An electrical connector for terminating coaxial electrical cable of the type having a semi-rigid tubular solid outer conductor, comprising a tubular conductive body member having two axially aligned portions of mutually different internal diameter, through both of which portions the cable can pass, and a ferrule locatable within the larger internal diameter portion of the body member with the cable passing through the ferrule, the ferrule being deformable under forces applied thereto axially of the cable thereby to secure the cable within the body member with the outer conductor of the cable electrically connected to the body member, characterised in that the ferrule (10) comprises a tubular body portion (11) having an outwardly directed annular flange (12) at one end, and a plurality of axially extending fingers (13) extending from the periphery at the other end, the arrangement being such that with the body member (1) and ferrule (10) mounted on a cable (100) with the fingers (13) on the ferrule (10) directed towards the smaller internal diameter portion (3) of the body member (1), movement of the ferrule (10) axially along the cable (100) with the body member (1) held fixed relative to the cable (100), causes the fingers (13) on the ferrule (10) to be deflected inwardly on entry into the smaller diameter end portion (3) of the body member (1), the fingers (13) becoming compressed between the cable (100) and the wall of the smaller diameter end portion (3) of the body member (1) and causing deformation of the outer conductor (101) of the cable (100) whereby an electrical connection is established between the outer conductor (101) of

the cable (100) and the body member (1).

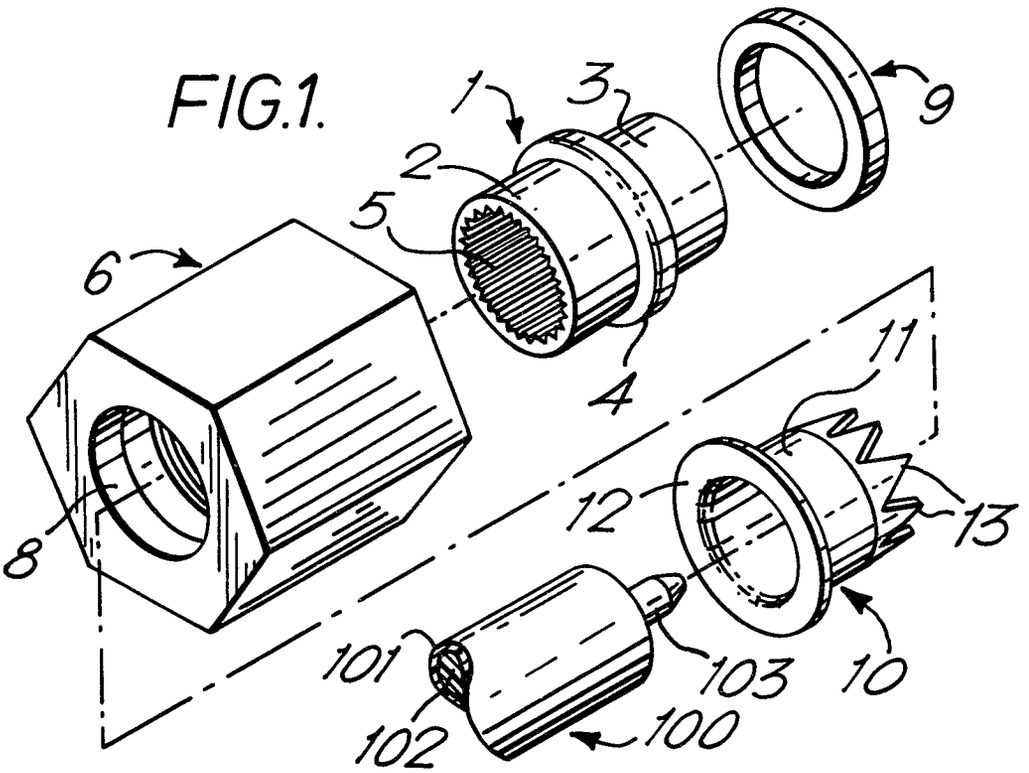
2. A connector as claimed in Claim 1, characterised in that the larger internal diameter end portion (2) of the body member (1) is formed with a plurality of axially extending internal splines (5) which bite into the tubular body portion (11) of the ferrule (10) on axial movement of the tubular body portion (11) of the ferrule (10) into the larger diameter end portion (2) of the body member (1) thereby to prevent relative rotary movement between the ferrule (10) and the body member (1).

3. A connector as claimed in Claim 1 or Claim 2, characterised in that the body member (1) has an outwardly directed annular rib (4) intermediate its ends, and carries a coupling ring (6) into which the body member (1) extends, the coupling ring (6) having an inwardly directed annular lip (8) which is positioned between the rib (4) on the body member (1) and the flange (12) on the ferrule (10) whereby the coupling ring (6) is secured to the body member (10) in relatively rotatable manner.

4. A connector as claimed in any preceding claim, characterised in that an end portion of the centre conductor (103) of the cable (100) is exposed to form a centre contact for the connector.

5. A connector as claimed in Claim 1, Claim 2 or Claim 3, characterised by a centre contact member (300) for crimping connecting to the centre conductor (103) of the cable (100), and a dielectric insert (301) locatable within the smaller internal diameter portion (3) of the body member (1) through which insert (301) the centre contact member (300) can pass.

FIG.1.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13
8
101
103
10
102
100

FIG.2.

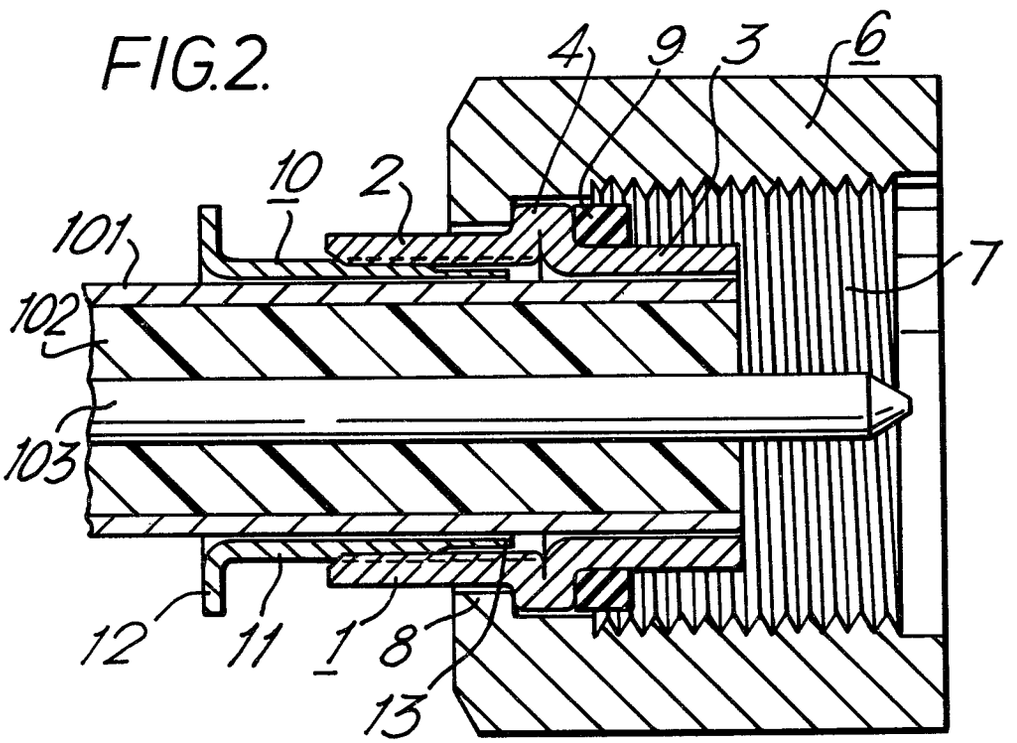
4
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FIG.3.

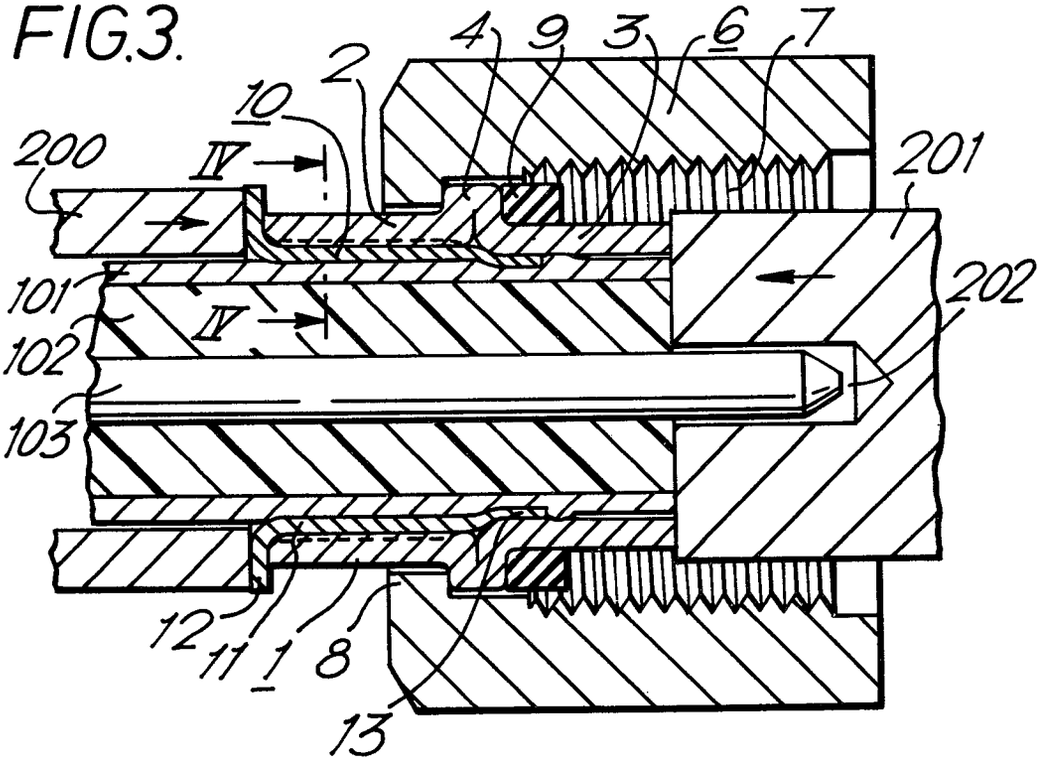


FIG.4.

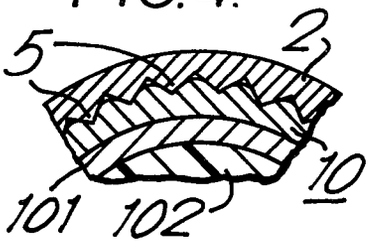
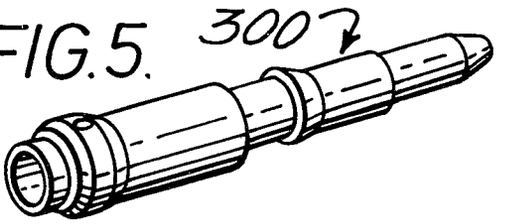


FIG.5.



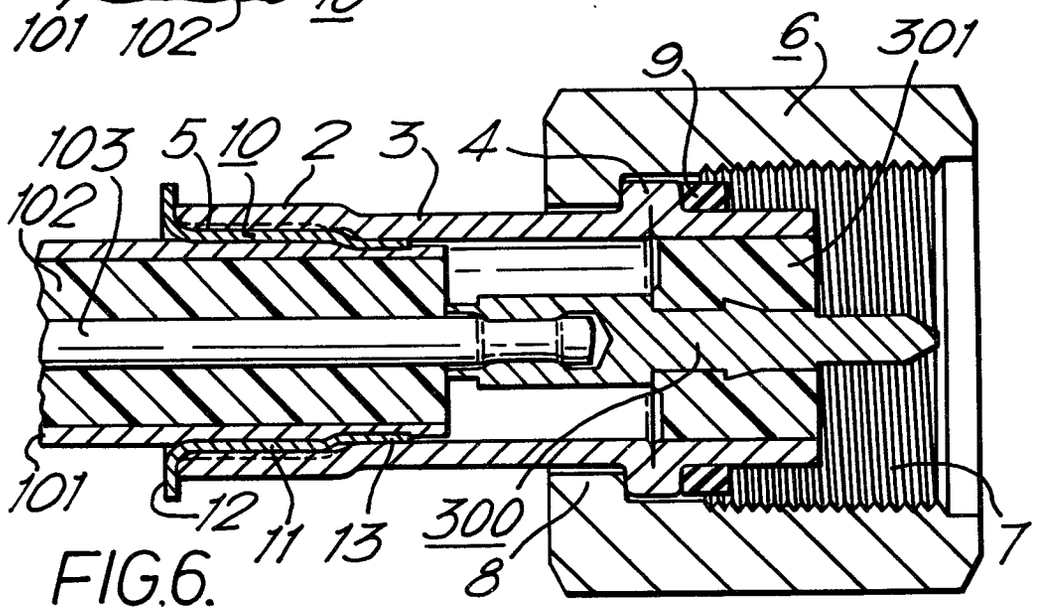


FIG.6.

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EUROPEAN SEARCH REPORT

Application number 0022627

EP 80 30 2052

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
A	US - A - 3 879 102 (GAMCO) * Column 2, line 55 - column 3, line 10; figures *	1,2
A	FR - A - 2 234 680 (SPINNER) * Page 4, lines 24-31; figures *	1,3
A	US - A - 3 537 065 (JERROLD) * Abstract; figures *	1
A	DE - B - 1 117 687 (SPINNER) * Figures 4-7 *	1
A	US - A - 3 544 705 (JERROLD) * Figures *	3
A	US - A - 3 448 430 (THOMAS & BETTS) * Figures *	1

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

H 01 R 9/05

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

H 01 R 9/05
17/12

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23-09-1980	RAMBOER

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