

[54] **CONNECTOR ELEMENT AND METHOD FOR ELEMENT ASSEMBLY**

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[22] Filed: **Aug. 24, 1970**

[21] Appl. No.: **66,351**

[52] U.S. Cl. **339/89 C, 339/177 E, 285/382, 29/444, 29/509, 29/629**

[51] Int. Cl. **H01r 13/54, H01r 17/04**

[58] Field of Search **339/89, 90, 177 R, 177 E, 276 R, 339/276 T; 285/382, 382.4, 386; 29/437, 444, 509**

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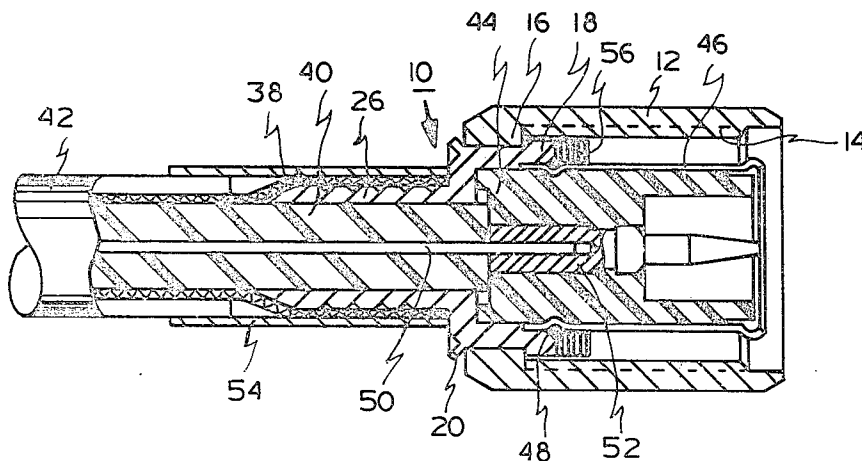
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[57] **ABSTRACT**

A body construction for a connector element which permits for easy captivation of a coupling ring on the connector body. The ring has a flange with a predetermined inner diameter while the body has an enlarged end section with a diameter larger than that of the flange inner diameter, at least one center section of diameter slightly less than the flange inner diameter, and an end section of reduced diameter. The center section includes a portion which is adapted to be bent up at an angle to the axis of the element when the flange of the coupling ring is over the center section to captivate the flange between the enlarged end section of the body and the bent-up portion of the body center section. Binding of the coupling ring as it is rotated may be eliminated by providing a slight undercut for the portion of the body section which is bent up.

4 Claims, 4 Drawing Figures



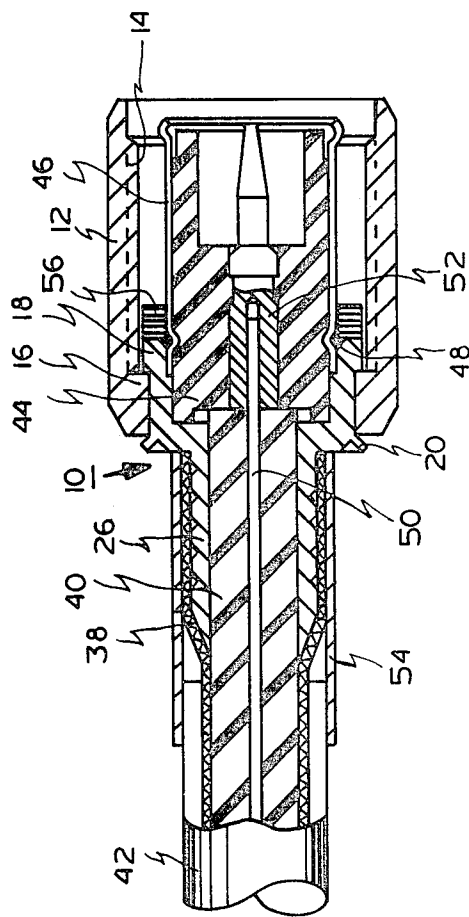


FIG. 1

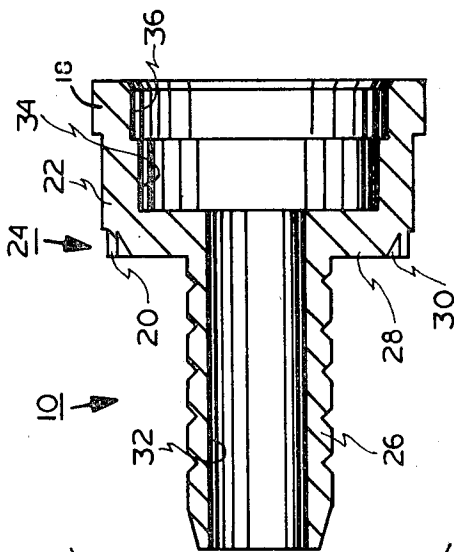


FIG. 2

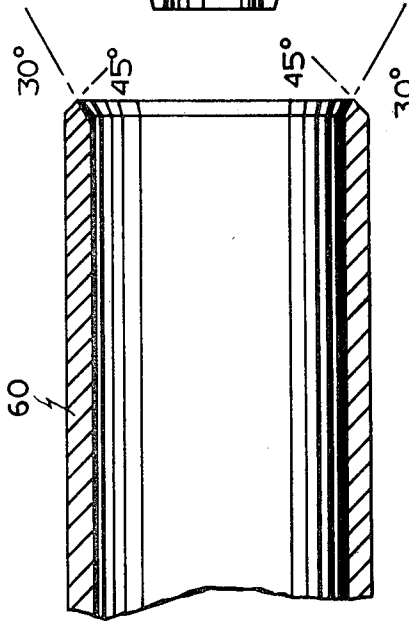


FIG. 3

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CONNECTOR ELEMENT AND METHOD FOR ELEMENT ASSEMBLY

This invention relates to a connector element having a body member with a coupling ring mounted for rotation on the body and more particularly to a body construction for such an element which permits for easy captivation of the coupling ring on the body.

Many connector elements, such as, for example, the elements of electrical connectors utilized for connecting coaxial cables, have a body member with a coupling ring mounted for rotation thereon. Additional contact and insulating elements may be fitted within the body member. Schemes utilized in the past for captivating the coupling ring on the body while permitting relative rotation between the members have generally involved the use of a retaining ring or of some other additional elements and have thus been relatively complicated and expensive both in terms of material and assembly labor. Where plating is required, the extra parts also increase the cost of this operation. These connectors have also been relatively large and bulky and thus not ideally suited for miniature and sub-miniature applications.

It is therefore a primary object of this invention to provide an improved scheme for captivating a coupling ring on the body of a connector elements.

A more specific object of this invention is to provide a scheme of the type indicated above which results in a connector element which is easier to fabricate and less expensive both in terms of material and labor.

Another object of this invention is to provide a connector element of the type indicated above which is smaller and less bulky than existing elements.

A still more specific object of this invention is to provide a scheme for reducing the number of components required to captivate a coupling ring on the body member in a connector element.

In accordance with these objects this invention provides a connector element which includes a body member and a coupling ring having a flange with a predetermined inner diameter. The body member has an enlarged end section with a diameter larger than that of the flange inner diameter, at least one center section of diameter slightly less than the flange inner diameter, and an end section of reduced diameter. The center section includes a portion which is adapted to be bent up at an angle to the axis of the element when the flange of the coupling ring is over the center section of the body and the bent-up portion of the body center section. In performing the captivation operation, a tool having a leading edge of predetermined shape is passed over the reduced end section of the body when the ring flange is properly positioned over the center section. The leading edge of the tool is then forced into a nonmating groove in a shoulder formed between the reduced end section and the portion of the center section to be bent up. The leading edge of the tool coacts with the groove in the shoulder to deform the body portion by bending it up at the desired angle to the element axis. Binding of the coupling ring as it is rotated may be eliminated by providing a slight undercut for the portion of the body center section which is bent up.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a longitudinal sectional view of a connector element constructed in accordance with a preferred embodiment of the invention.

FIG. 2 is a longitudinal sectional view of a body member suitable for use in the preferred embodiment of the invention shown in FIG. 1.

FIG. 3 is a longitudinal sectional view of a tool suitable for use in the assembly of the preferred embodiment of the invention.

FIG. 4 is a longitudinal sectional view of a connector element constructed in accordance with an alternative embodiment of the invention.

Referring now to FIG. 1, the connector shown therein is a coaxial connector of a type generally referred to as a series TNC connector. The connector element consists of two major members, a body 10 and a coupling ring 12. Coupling ring 12 is internally threaded at 14 for coupling with a mating connector element and has a flange 16 which is captivated between an enlarged end portion 18 and a bent-up portion 20 of body 10.

Referring now to FIG. 2, it is seen that body 10 is in four sections. There is a first enlarged section 18 the diameter of which is slightly larger than the internal diameter of flange 16, a second section 22 of diameter slightly less than the internal diameter of flange 16 and having a width substantially the same as that of the flange, a third section 24 which is slightly undercut (by for example, 0.01 inches) from the second section, and an elongated fourth section 26 of reduced diameter. The shoulder 28 between sections 24 and 26 of reduced diameter. The shoulder 28 between sections 24 and 26 has a cut 30 form in it slightly below the surface (for example, 0.02 inches) of the section and to a depth substantially equal to the width of the section. The outer surface of the cut is parallel to the axis of the body while the inner surface of the cut is at an angle (for example, 30°) to this axis. Cut 30 results in the formation of ring 20 which has been previously mentioned.

Body 10 has an internal bore 32 with enlarged counterbores 34 and 36. Referring again to FIG. 1, it is seen that the elongated section 26 of body 10 is forced between outer conductor 38 and insulator 40 of a coaxial cable 42 with the insulator 40 passing through bore 32 and coming to rest against a dielectric insert 44 fitted in counterbore 34. Outer contact fingers 46 are fitted in counterbore 36 and secured to body 10 by solder fillets 48. Inner conductor 50 of coaxial cable 42 is secured in a contact element 52 which is seated in dielectric insert 44. Outer conductor 38 is secured to body portion 26 by a standard crimp ferrule 54. The final member in the connector element is a sealing gasket 56 at the rear of ring 12. All of the elements 38-56 described above are of standard construction and do not form part of the present invention.

In assembling the connector of FIG. 1, body 10 is initially passed through the center of ring 12, starting with reduced portion 26. This operation terminates with enlarged portion 18 of the body butting against the flange 16 of the ring. At this time flange 16 is over section 22 of the body. A tool such as the tool 60 shown in FIG. 3 is then passed over body section 26 and the leading edge of the tool is fitted into groove 30. The inner surfaces of the groove and the tool are of the same angle so that they mate together. However, the outer surface of the tool is at an angle (for example, 45°) so that as tool 60 is forced into groove 30, it bears against the upper surface of the groove bending ring 20 up at the same angle (for example, 45°) as that of the outer surface of the tool, thus captivating ring flange 16 as shown in FIG. 1.

A connector element has therefore been provided which requires a minimum number of parts. The element is thus relatively easy and inexpensive to assemble and, because of the lesser number of parts, is substantially smaller and less bulky than existing connector elements. The slight undercut on section 24 in the embodiment of the invention shown in FIGS. 1 and 2 is a significant, but not essential, feature of the invention. Without the undercut, it has been found that when the connector element is assembled, ring 12 tends to bind when rotated. The undercutting of section 24 eliminates this binding and thus provides a connector element of superior quality. However, for connector elements where cost is a prime consideration, this undercut may be eliminated. FIG. 4 shows one such embodiment of the invention.

Referring now to FIG. 4 it is seen that the connector shown therein consists of a body 10' and a coupling ring 12' having an internal thread 14' and a flange 16'. Like numerals have been used for like elements in FIG. 1 and 4 with prime num-

bers being used to designate elements which differ slightly between the two figures. Body 10' consists of only three sections, an enlarged section 18 of diameter greater than the internal diameter of flange 16', a center section 62 of diameter slightly less than the internal diameter of the flange and of width slightly greater than the flange, and an elongated section 26' of reduced diameter. As in FIG. 1, elongated section 26' is fitted between outer conductor 38 and insulator 40 of a coaxial cable 42 with a crimp ferrule 54' being provided to secure the cable to the connector body. Body 10' initially has a cut 30' formed near the base of the shoulder between sections 26' and 62 which cut has an inner surface which is substantially parallel to the axis of the body and an outer surface which is at some slight angle (for example, 20° to 30°) to the axis of the connector.

In assembling the connector of FIG. 4, body element 10' is fitted through ring 12' in the same manner as for the embodiment of FIG. 1 until section 18 of the body butts against flange 16'. A tool similar to the tool 60 shown in FIG. 3, but having a flat rather than an angled inner surface, is then fitted over section 26' and forced into groove 30'. Since the angle of the outer surface of the tool is greater than the angle of the outer surface of the groove, this results in a portion of section 62 being bent upward as shown in FIG. 4 to captivate flange 16'.

While some dimensions have been indicated above, it is apparent that the dimensions utilized in a specific application will depend on the size of the connector element and on the material which it is constructed of. In selecting dimensions for elements such as the thickness of ring 20 and the angle at which the ring is bent up, a trade-off must be made between providing a raised portion which is strong enough to hold the ring while not splitting the ring during the assembly operation. If the ring is too thick or if it is bent up at too great an angle, it will split. The angles for the grooves 30 and the tools 60 are again given by way of example and could vary somewhat with specific applications. Other changes in the general construction of the connect element would of course occur in applying the teachings of this invention to different connector types.

Thus, while the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be apparent to those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A connector element comprising:

a coupling ring having a flange with a predetermine inner diameter; and

a body having an enlarged end section of diameter larger than said flange inner diameter, a first center section of diameter slightly less than said flange inner diameter and of width slightly greater than that of said flange, a second center section slightly undercut from said first section, and an end section of reduced diameter, said second center section including a portion adapted to be bent up at an angle to the axis of the element when said flange is over said first center section to captivate said flange between said enlarged end section and said bent-up portion.

2. A connector of the type described in claim 1 wherein said bent-up portion is bent up at approximately a 45° angle.

3. A body member adapted to have a ring mounted for rotation on it, said ring being adapted to coact with said body with a flange having a predetermined inner diameter and a predetermined width, said body comprising:

a first cylindrical section having an outer diameter greater than said flange inner diameter;

a second cylindrical section adjacent said first section, said second section having a diameter slightly less than said flange inner diameter and a width substantially equal to said flange width;

a third cylindrical section adjacent said second section, said third section having a diameter slightly less than said second section and a predetermined width;

a fourth cylindrical section adjacent said third section, said fourth section having a diameter less than said third section, a shoulder being formed between said third and fourth sections; and

a groove formed in said shoulder at a point below the surface of said third section, said groove being to a depth substantially equal to the width of said third section, said groove forming a thin circumferential ring in said third section which is adapted to be bent up at an angle to the axis of said body by a suitable tool when said ring flange is positioned over said second section to captivate said ring flange between said bent-up ring and said first section.

4. A member of the type described in claim 3 wherein said circumferential ring is adapted to be bent up at approximately a 45° angle.

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