This invention relates generally to electrical connectors, and pertains more particularly to a connector for use with coaxial cable.

Coaxial cables are widely used. Such cables generally comprise an inner conductor, an outer conductor and an intermediate layer of dielectric material, the outer conductor being in the form of a braided shield. Usually, a protective cover, also of insulating material, encompasses the braided conductor. Inasmuch as the braided conductor is grounded, connectors employed in conjunction with this type of cable make provision for establishing or continuing the grounded path through the connector components when the components are engaged or mated. This is done by means of what is called a "grounding crown contact" incorporated into one of the connector components and which fractionally encircles a cylindrical shell contact on the mating connector component.

One object of the invention is to provide a connector component having an improved grounding crown contact.

Another object of the invention is to provide a grounding crown contact that will be firmly retained in place within the other parts constituting the connector component in which it is mounted. In this latter regard, it is planned that the grounding crown contact be of generally cylindrical configuration and that it be split along one side so that it can be snapped into an annular groove formed on the supporting sleeve. Hence, an aim of the invention is to provide a simplified arrangement for locking the grounding crown contact in place and doing so with a minimum of parts.

Another object of the invention resides in the compatibility of the assembled construction has with respect to a connector that is shock and vibration resistant. More specifically, the present invention will find especial utility when incorporated into the coaxial cable connector construction described and claimed in U.S. Patent No. 3,170,748 issued Feb. 23, 1965 to Arden D. Van Horsen.

A further object is to provide a connector component having a grounding crown contact therein that allows the component to be of miniature proportions.

Yet another object of the invention is to provide a grounding crown contact of the above-mentioned-to configuration that can be readily assembled into an operative relationship with the parts it is to connect with, it already having been stated above that once installed the grounding crown contact will be firmly retained in place. Consequently, not only will the grounding crown contact of the present invention be firmly retained, but it can be quickly and easily installed as well.

A still further object of the invention is to provide a grounding crown contact that will be exceedingly simple to fabricate and which can be manufactured at a relatively low cost.

These and other objects and advantages of my invention will more fully appear from the following description, made in connection with the accompanying illustrative drawings, wherein like reference characters refer to the same or similar parts throughout the several views and in which:

FIGURE 1 is an exploded perspective view of a connector component having a grounding crown contact constructed in accordance with the teachings of the present invention, a small fragment of the grounding crown contact being broken away to show a better advantage its configuration and the remaining parts constituting the illustrative connector being shown in section, and

FIGURE 2 is a longitudinal sectional view, much the same as FIGURE 1 but with the grounding crown contact also shown in section, the parts constituting the exemplary connector being assembled to form the female connector component, the male component of the connector being depicted in a spaced relationship with respect thereto.

Referring now in detail to the drawing, the male connector component, although not being directly concerned with the teachings of the present invention, has been designated in its entirety by the reference numeral 10. This connector component 10 includes a straight pin 12 concentrically arranged in an insulating sleeve 14 which is contained within a metallic sleeve 16 formed with a beveled end 18. The sleeve 16 has a pair of radially issuing bayonet pins 20 that serve to lock the connector component 10 to the female connector component described below.

The female connector, which embodies the feature constituting the present invention, has been designated generally by the reference numeral 22. The connector component 22 is designed to accommodate a coaxial cable 24 having a centrally disposed stranded conductor 26, a layer of insulating material 28, a braided conductor 30, and an outer layer or covering of insulating material 32 serving as the cover for the cable 24.

A socket contact 34 is employed, which can be of the type shown and described in my co-pending application now abandoned Ser. No. 424,618, filed Jan. 11, 1965, for "Contact Having Convergent Tines and Methods of Making Same." The socket contact 34 includes a metallic body 36 having a radially extending flange 38. The body is drilled to form an axial passage 40 into which extends the conductor 26, a suitable radial passage through the body 36 allowing the conductor 26 to be soldered in place. A cylindrical portion 42 is integral with the body 36 and it is to this cylindrical portion 42 that the spring fingers or resilient tines 44 are integrally attached.

Surrounding the cylindrical portion 42 is a metallic protective shroud 48 having an access opening 50 at one end thereof. In other words, the metallic shroud 48, which is of a generally cylindrical construction, has the end opposite the end with the opening 50 therein pressed over or otherwise secured to the cylindrical portion 42 of the socket contact 34.

Next to be described is a clamping sleeve 52 having a first cylindrical portion 54 received between the inner layer of insulation 26 and the braided conductor 30 as shown in FIGURE 2. The clamping sleeve 52 further includes a radial flange 56 interconnecting the cylindrical portion 54 and a larger diameter cylindrical portion 58 formed with a rounded lip 60 thereon.
Contained within the confines of the cylindrical portion 58 is a sealing gasket 62. Having one end abutting the gasket 62 is a bushing or sleeve 64 which has its other end abutting the radial flange 38. At this time, attention is directed to a stepped insulating bushing 121 having a cylindrical body 68 formed with a rounded lip 70 which can be pressed into engagement with the previously-mentioned rounded lip 60. Preferably, the bushing 66 is constructed of polytetrafluoroethylene (DuPont plastic called Kel-F) but may be of other resilient plastic material, such as Teflon. Additionally, the stepped insulating bushing 66 includes an internal shoulder 72 and an external shoulder at 74. Still further, it will be noticed that there is an annular groove 76 formed in an integral sleeve portion 78 which circumscribes the protective metallic shroud 48. The annular groove 76 has a readily deformable gasket 80 of compressible elastomeric material held therein.

Toward the left in FIGURE 2, it will be discerned that a retaining nut 82 is provided, the nut 82 having a cylindrical body 84, an internal shoulder 86 and external threads 88. A gasket 90 is received in the confines of the retaining nut 82, the cylindrical body 84 having a bore of sufficient diameter to accommodate said gasket 90. Having an end abutting the gasket 90 and the shoulder 86 is a clamping sleeve 92 which can be crimped or otherwise pressed against the braded conductor 30, more specifically, that portion of the braded conductor 30 which surrounds the cylindrical portion 54 of the clamping sleeve 52.

An outer metallic sleeve 94 has internal threads 96 which engage the external threads 88 on the retaining nut 82. The outer sleeve 94 is formed with a first bore portion 98 of relatively large diameter, a somewhat smaller diameter bore portion 100 and a still smaller bore portion 102. It is the outside of the sleeve 94 in the vicinity of the bore thereof circumjacent the bore portion 102 that is formed with an annular groove 104 which plays a relatively important role as far as the present invention is concerned.

The present invention is concerned with a grounding crown contact 106 that is generally cylindrical as can be readily perceived from FIGURE 1. It will be observed that the grounding crown contact 106 is longitudinally slit along one side at 108. In this way, the contact 106 can be expanded for a purpose presently to be explained. It will be further discerned, however, that the crown contact 106 has a relatively short cylindrical body 110 at one end of the body 110 is an inturned flange 112, whereas longitudinally directed resilient fingers 114 project from the other end of the body 110. Due to the slit 108, the grounding crown contact 106 can be expanded radially in order to allow the flange 112 to be snapped or received into the groove 104 formed on the outer sleeve 94.

For the purpose of providing a locking action which retains the connector components 10, 22 assembled, a biasing coil spring 116 encircles a portion of the outer sleeve 94, the spring 116 bearing at one end against an enlarged or shouldered section 117 of the sleeve 94 and bearing at its other end against a washer 118. The washer 118 in turn presses against a ring 120 having a plurality of locking fingers 122 integral therewith, the fingers 122 each having a beveled end 124 thereon. Stated somewhat differently, the coil spring 116 is responsible for normally urging the ring 120 to the right as viewed in FIGURES 1 and 2 through the intermediary washer 118.

A coupler member 126 is also employed, the coupler member 126 having a body 128 and a pair of longitudinally directed slots 130 therein. The slots 130 slidably accommodate the fingers 122. One side of each slot contains a semicircular notch 132. Still further, as far as the interior of the coupler 126 is concerned, it is to be appreciated that there is a shoulder 134 formed therein which provides a bore portion 136 of one diameter; a further bore portion 138 which is somewhat larger in diameter than the portion 136 is provided and it can be mentioned that still another bore portion 140 is provided having the same diameter as the portion 136.

A slidable actuating sleeve 142 is provided, the sleeve 142 having an internally extending radial flange 144 which is engageable with the ring 120 intermediate the fingers 122 thereon. The flange 144, in this instance, is formed with a pair of slots at 146 which are registerable with the slots 130 provided in the coupler member 126. From the preceding several paragraphs, it should be evident that the coil spring 116 normally urges or biases the fingers 122 toward the right as viewed in FIGURES 1 and 2, doing so by acting against the washer 118 which in turn bears against the ring 120 to which the fingers 122 are attached. By reason of the beveled ends 124 on the fingers 122, the pins 20 on the component 10 are automatically urged into the notches 132. This locking action is more fully described in Patent No. 3,170,748, supra.

While it is believed obvious that an electrical path is established through the connector component 22 from the braded conductor 30 via the members 54, 84, 92 and 94 to the crown contact 106 and from this contact 106 to the sleeve 16 of the connector component 10 due to the frictional engagement of the fingers 114 with the exterior of said sleeve 16, it is not so obvious how this component 22 is assembled. This is accomplished by first preparing the cable 24 by stripping off some of the insulating covering 22 so as to expose a longitudinal portion of the braded conductor 30. The braded conductor 30 is cut back sufficiently so that an end portion of the insulation 28 is exposed and some of this insulation 28 is cut back so as to bare the conductor 26. Before or after doing the above, the retaining nut 82 is placed in an encircling relationship with the cable 24 with the gasket 90 and clamping sleeve 92 contained therein.

Having performed the foregoing, the cylindrical portion 54 of the clamping sleeve 82 can be inserted between the layer of insulation 28 and the braded conductor 30. Then the gasket 92 is pressed into the cylindrical portion 58 of the sleeve 82, followed by the placing of the bushing 64 about the projecting section of insulation 28. It is then that the top of the conductor 26 is soldered in the passage 40 of the socket contact 34, utilizing the intersecting radial passage (not shown) to effect a good solder joint.

The insulating bushing 66 can now be brought into juxtaposition with the clamping sleeve 52 and its lip 70 snapped into engagement with the lip 60 on said sleeve 52, the resiliency of the plastic material forming the bushing 66 allowing this to occur when sufficient force is applied.

The sleeve 94 can be placed in an encircling relation and the threads 88 of the retaining nut 82 engaged with the threads 96 of said sleeve 94. The nut 82 may be tightened to whatever extent proves necessary.

The coupler member 126 should now be inserted into the actuating sleeve 142 and by rotating the actuating sleeve 142, its slots 146 can be moved into angular alignment with the slots 130 formed in the coupler member 126. Such slot alignment or registry permits the fingers 122 to be inserted so that the ring 120 abuts the end of the body 128 of the coupler member 126. The washer 118 can at this time be placed against the ring 120.

The final stage of assembly involves the sub-assembly composed of the parts 110, 120, 126 and 142 and the telescoping thereof over the sub-assembly composed of the parts 94, 116, etc. Obviously, the coil spring 116 yields or compresses when sufficient force is applied to the actuating sleeve 142. Enough force can be applied so as to move the coupler member 126 to a position such that the bore portion 136 thereof is moved farther to the left than the position in which it appears in FIGURE 2. Such a position results in the somewhat larger bore portion 138 overlying the annular groove 104 formed in
the outer sleeve 94. When so positioned, the crown contact 106, owing to the slit 108, can be expanded to allow its flange 112 to pass over sleeve 94 and then snap into the groove 104. Release of the actuating sleeve 142 will allow the spring 116 to expand which forces the coupler member 126 to the right but the shoulder 134 will strike the crown ring 106 to stop further movement. It will be appreciated that the crown ring 106 is now fixedly anchored relative the sleeve 94 by virtue of the engagement of the flange 112 in the groove 104. Consequently, it will be appreciated that the crown ring 106 serves the dual purpose of retaining the component 22 in an assembled state, as well as providing an excellent electrical contact path with the sleeve 94.

The gasket 89 is sufficiently deformable so that it can be flexed or radially expanded as it is forced to the left over the sleeve portion 78 of the bushing 66. When moved into longitudinal alignment with the groove 76, it can be permitted to contact with the consequence that it remains in the position pictured in FIGURE 2.

When the components 10 and 22 are connected together, a primary electrical path is provided via the pin 12 and the fingers 44 on the socket contact 34 and hence to the conductor 26 of the cable 24. At the same time, a secondary electrical path is provided via the sleeve 16, the fingers 114 of the grounding crown contact through the sleeve 94 to the braided conductor 30 of the cable 24. It is important to appreciate that excellent contact is provided between the crown contact and the sleeve 94 through the agency of the flange 112 which is received in the groove 104, as well as with the sleeve 16 on the male connector component 10. At the same time, the construction prevents any chance of dislodgment of the crown contact 106. Hence, a connector of the envisaged type not only functions superbly but can be made quite small which is very important in a number of situations where extreme miniaturization is demanded.

It will, of course, be understood that various changes may be made in the form, details, arrangements and proportions of the parts without departing from the scope of my invention as set forth in the appended claims.

What is claimed is:

1. An electrical connector component comprising a metallic sleeve member having an annular groove in its outer surface near one end thereof, a grounding crown contact having an inturned flange at one end received in said groove and a plurality of resilient fingers projecting from its other end, the outer diameter of said crown contact being slightly greater than that of the surface of said sleeve member, and a coupler member slidably encircling said sleeve member having an internal shoulder engageable with said crown contact to limit slidable movement of said coupler member in the direction of said crown contact.

2. An electrical connector component in accordance with claim 1 in which said internal shoulder is formed by a relatively small diameter bore portion and a larger diameter bore portion, said larger diameter bore portion corresponding in size to the outer diameter of said crown contact.

3. An electrical connector component in accordance with claim 2 in which said coupler member has a still larger diameter bore portion adjacent said second-mentioned bore portion and said crown contact has a longitudinal slit so that said crown contact can be expanded when said coupler member is positioned with its said largest diameter bore portion overlying said groove in order to permit said flange to be snapped thereinto.

4. An electrical connector component comprising a metallic sleeve member, means for electrically connecting said metallic sleeve member to the braided conductor of a coaxial cable, a coupler member slidably along a longitudinal portion of said sleeve member, said sleeve member having an annular groove disposed near one end thereof, a grounding crown contact having a flange thereon projecting into said groove to anchor said crown contact to said sleeve member, said coupler member having an internal shoulder engageable with said crown contact to limit movement thereof in one direction, and locking means movable with said coupler member for maintaining engagement of said crown contact with a contact on a mating connector component.

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