

- [54] **ELECTRICAL CONNECTOR**
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- [51] Int. Cl. H01r 17/04
- [58] Field of Search 174/75 C, 88 C, 89; 285/149, 285/DIG. 9; 339/60 C, 89 C, 91 P, 94 C, 90 C, 126 J, 177 R, 177 E

900,393 7/1962 Great Britain339/177 E

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[57] **ABSTRACT**

A connector for use with a coaxial cable of the type including a central wire member and an outer metallic shielding member separated by an inner insulating member and additionally including an outer insulating member covering the outer metallic shield and with a first hollow truncated cone member having the smaller end thereof for insertion at a location between the inner insulating member and the outer insulating member and with the outer insulating member flared outwardly by the first cone member and with a second hollow truncated cone member having a plurality of openings placed over the outer insulating member and additionally including a locking assembly for engaging the first and second cone members to provide pressure between the cone members to have portions of the outer insulating member flow into the openings of the second cone member to lock the outer insulating member between the first and second cone members.

[56] **References Cited**

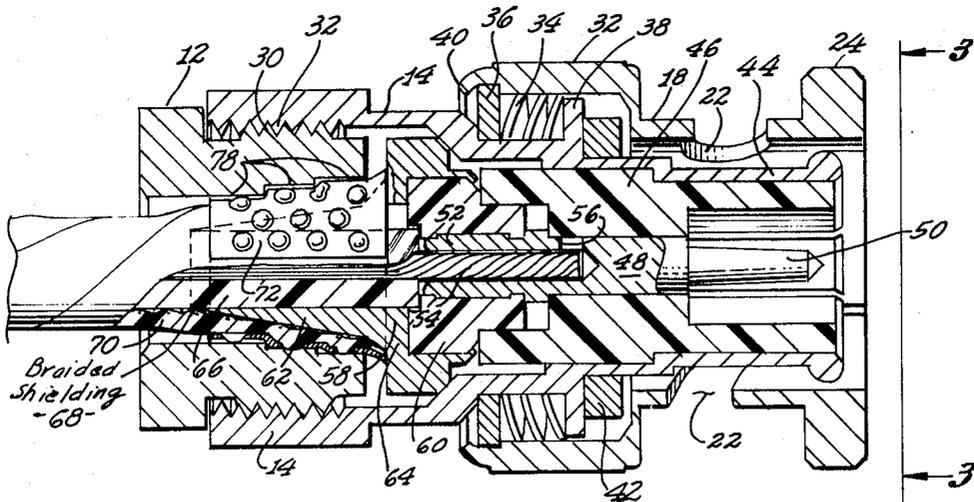
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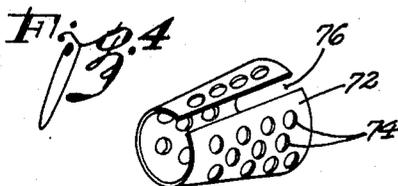
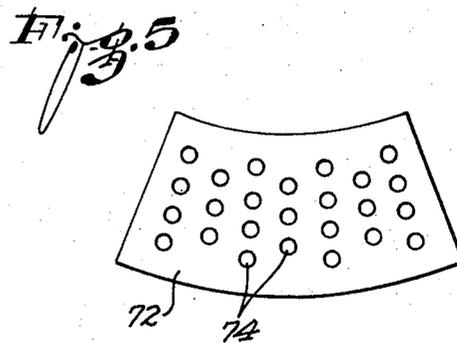
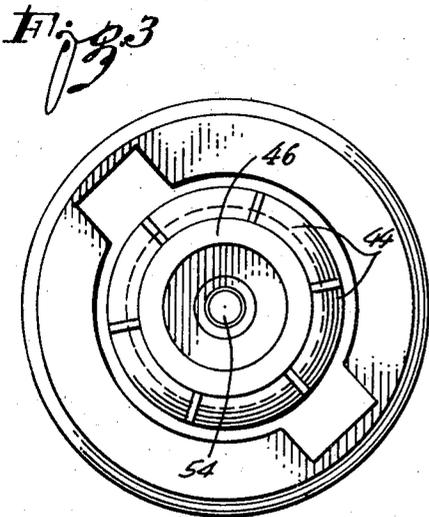
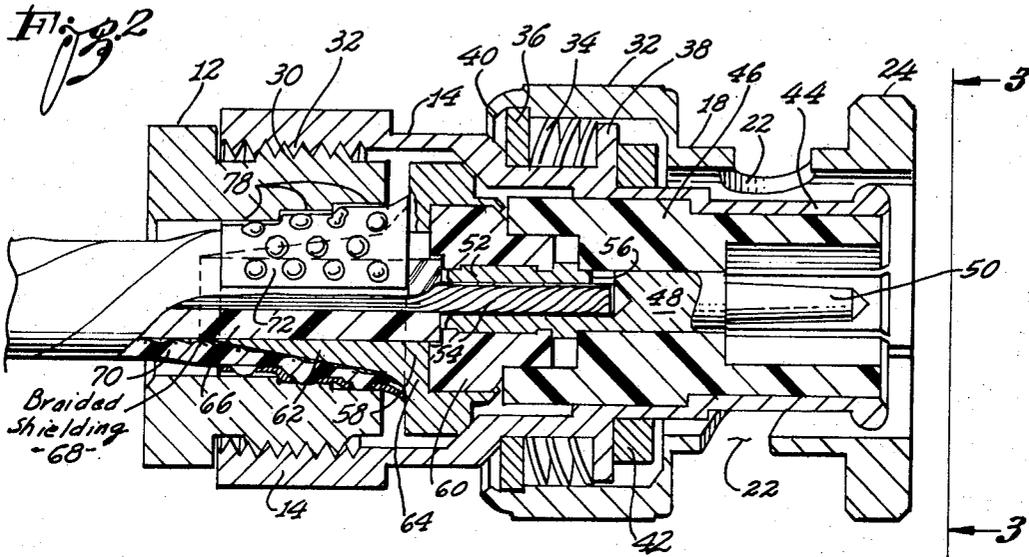
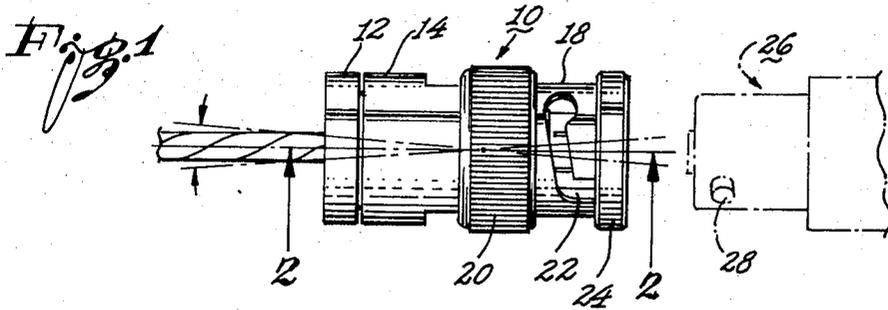
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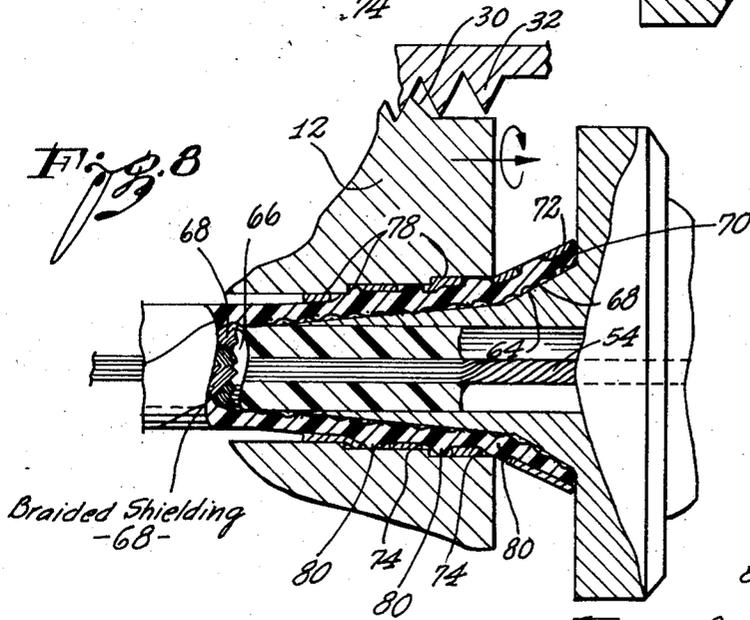
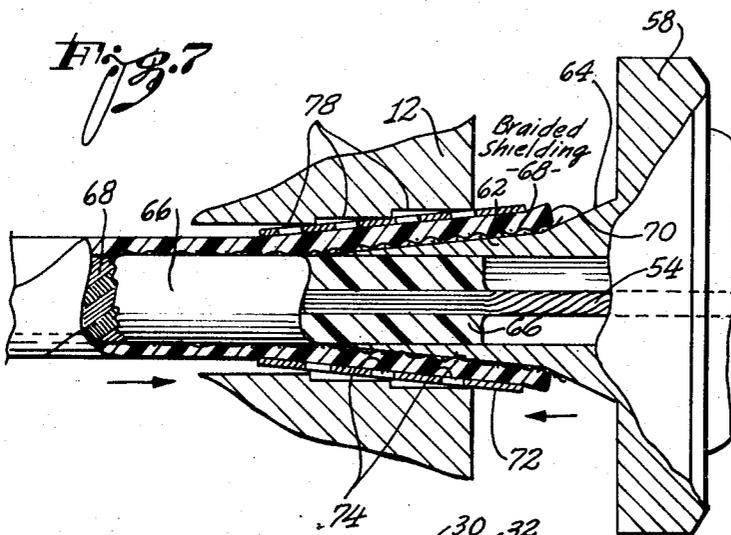
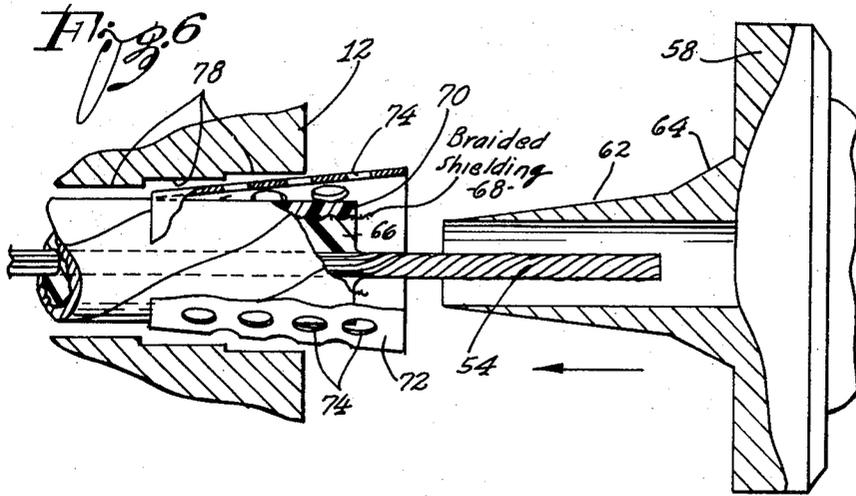
8 Claims, 8 Drawing Figures





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ELECTRICAL CONNECTOR

The present invention relates to an electrical connector for use with a coaxial cable of the type including a central wire member and an outer shield member such as a shield of metallic braid and with the central wire member and the braided member spaced by an inner insulating member and with the braided shielding member covered by an outer insulating member. Specifically, the outer insulating member may be composed of an insulating material such as Teflon which is quite slippery and which creates difficulty in locking the connector to the end of the coaxial cable. The present invention is directed to an electrical connector which provides for a reliable locking of the connector to the coaxial cable.

The present invention is designed for use in a connector of the type including a pin assembly having a pin portion for receiving the central wire member and a cone portion insulated from the pin portion which cone portion includes a hollow truncated cone member which is inserted between the inner insulating member and the shield member so as to provide for the shield member and the outer insulating member to be flared outwardly by the cone member. A locking assembly which may include an internally stepped tapered portion may be clamped down on the outer insulating material to provide pressure against the outer insulating material relative to the hollow truncated cone member.

A connector of this type may be seen with reference to U.S. Pat. No. 3,209,287 issued Sept. 28, 1965, listing Edward S. Oxner as the inventor. A difficulty that arises with the type of connector shown in the Oxner patent is that the stepped inner portion of the locking member only provides for a partial locking of the coaxial cable when the insulating material is composed of a slippery insulating material such as Teflon and the entire coaxial cable may be pulled away from the connector.

The present invention provides for a more reliable means of locking the coaxial cable to the above type of electrical connector. Specifically, the present invention includes a second hollow truncated cone member having a plurality of openings disposed between the outer insulating material of the coaxial cable and the stepped tapered portion of the locking assembly. In this way, when the locking assembly is tightened, portions of the outer insulating material are forced to flow outwardly into the openings, thereby providing for a much more secure locking between the connector and the coaxial cable. The stepped inner portion of the locking assembly also engages the second hollow truncated cone member, which can be composed of a malleable metal, to provide for a deformation of such second cone member. In this way, the stepped inner portion of the locking assembly provides for a much more secure locking than if it merely engages insulating material as with the prior art.

In addition, the first cone member which is part of the pin assembly may also include at least two different tapered sections, with one section having a steeper angle than the other. The use of a steeper section also provides for the second cone member and the outer insulating material being trapped against this second steeper section by the locking assembly to in turn pro-

vide for a more secure locking of the coaxial cable to the connector of the present invention.

The present invention, therefore, is directed to a new combination within an electrical connector and a new combination of a coaxial cable and an electrical connector so as to provide for a more secure locking of the coaxial cable to the electrical connector. A clearer understanding of the invention will be had with reference to the following description and drawings wherein:

FIG. 1 illustrates an outer view of an electrical connector of the present invention in combination with a coaxial cable and shows in a dotted portion the corresponding mating connector;

FIG. 2 illustrates a cross-sectional view of the electrical connector and coaxial cable of the present invention taken along line 2—2 of FIG. 1;

FIG. 3 shows a front view of the electrical connector taken along line 3—3 of FIG. 2;

FIG. 4 illustrates in detail a hollow truncated cone member having a plurality of openings used in the electrical connector of the present invention;

FIG. 5 illustrates the hollow truncated cone member of FIG. 4 in a flattened position; and

FIGS. 6, 7 and 8 illustrate in detail how the coaxial cable is securely locked to the electrical connector of the present invention.

Referring now to the drawings and specifically to FIG. 1, an electrical connector 10 includes a locking assembly formed from a nut member 12 and a shell member 14. An outer spring-loaded member 18 is positioned on the shell member and includes a knurled portion 20, a pair of openings 22 and a flange portion 24. The connector 10 shown in FIG. 1 is a male connector, as can be seen with more detail in FIG. 2. It is to be appreciated, however, that the internal construction of the connector which forms the inventive portion of this application may also be used with a female connector which is designed to mate with the male connector 10. For example, as shown in dotted lines, the female connector 26 may have a pair of pin members 28 which are adapted to ride within the openings 22. Although the invention will be described with reference to the male connector 10, as indicated above, the invention is not limited to such male connector.

Turning now to FIG. 2, the locking nut 12 may be seen to have external threads 30 which cooperate with an internal threaded portion 32 of the shell member 14. The spring member 34 maintains pressure between a ring member 36 and a flange portion 38 of the shell 14. The member 18 is slipped over the spring member 34 and the ring member 36 and is crimped downwardly at position 40 so as to lock the member 18 on the shell 14 and allow the member 18 to swivel and also to move in a direction away from the locking nut 12. A second ring member 42 serves as a stop.

The shell member 14 includes an end portion 44 which has been cut into a plurality of separate members, as shown in more detail in FIG. 3, so as to have the members 44 act as spring fingers to securely engage the female counterpart of the connector 10. An insulating member 46 is disposed within the shell 14 and within the spring finger portion 44 of the shell 14 and is used to provide insulation between the shell 14 and an inner pin assembly 48.

The pin assembly 48 includes a metallic pin member 50 which has a hollow portion 52 adapted to receive a central wire member 54 of a coaxial cable. The central wire member 54 may be soldered in position through an access hole 56 in the pin 50. The pin assembly 48 also includes a hollow truncated cone member 58 which is insulated from the pin member 50 using an insulating member 60. The hollow truncated cone member includes a first tapered section 62 and a second tapered section 64 having a steeper taper angle than the first section 62.

The coaxial cable in addition to the central wire member 54 also includes an inner insulating member 66, a metallic shield member 68, such as a braided shielding, and an outer insulating member 70. The cone member 58 is disposed between the inner insulating member 66 and the braided shielding 68 so as to provide for the shielding member and the outer insulating member 70 being flared outwardly in accordance with the taper of the first and second sections 62 and 64.

In order to provide for locking between the connector 10 and the coaxial cable, a second hollow truncated cone member 72, including a plurality of openings 74, is used and is positioned between the lock nut 12 and the outer insulating material 70 of the coaxial cable. As shown in more detail in FIGS. 4 and 5, the second hollow truncated cone member 72 including the openings 74 may be cut from a flat piece of flexible malleable metallic material, as shown in FIG. 5, and is then formed into the hollow truncated cone member, as shown in FIG. 4. The cone member when formed may be split as shown by the split portion 76 illustrated in FIG. 4 in order to provide for greater flexibility.

In addition to the second cone member 72, the locking between the coaxial cable and the connector is also provided by using the stepped tapered portion 78 of the lock nut 12. Also, the use of the tapered section 64 of the first cone member 58 having a steeper taper relative to the tapered section 62 provides for an additional locking of the coaxial cable to the connector 10.

A clearer understanding of the locking of the coaxial cable to the connector may be seen with reference to FIGS. 6, 7 and 8. In FIG. 6, the first hollow truncated cone member 58 is shown to receive the control wire member 54 so as to have the control wire member 54 spaced from the hollow portion of the cone member 58. The first tapered section 62 of the first cone member 58 is inserted in between the braided shielding 68 and the inner insulating member 66 and is forced so as to flare the braided shielding 68 and the outer insulating member 70 outwardly, as shown in FIG. 7. The cone member 58 is inserted so that the outer insulating member 70 and the braided shielding 68 ride up on the second tapered portion 64 of the first cone member 58.

The wire 54 should have a sufficient length so as to enter into the hollow portion 52 of the pin member 50, shown in FIG. 2, so as to be soldered through the hole 56 to the pin member 50. Normally, the soldering of the central wire member 54 to the pin member 50 as shown in FIG. 2 would occur at this point. After the soldering, the second cone member 72 would be positioned around the outer insulating member 70 so as to provide for the outer insulating member 70 and the braided shielding 68 being disposed between the first cone member 58 and the second cone member 72. In

this way, as shown in FIG. 8, when the lock nut 12 is turned so as to have the threads 30 and 32 engage each other, the lock nut 12 and specifically the tapered stepped inner portion 78 of the locking nut 12 engages the second cone member 72 so as to provide for considerable pressure between the first cone member 58 and the second cone member 72.

The pressure produces a distortion of the second cone member 72, as shown in FIG. 8. In addition, portions 80 of the outer insulating material 70 are forced to flow into the openings 74 of the second cone member 72 so as to provide for the outer insulating member 72 being securely locked in position. Also, the steeper section 64 of the first cone member 58 provides for the second cone member 72, the insulating member 70 and the braided shielding 68 being locked between the forward edge of the lock nut 12 and the steeper section 64.

The combination of the portions 80 of the outer insulating material 70 flowing into the openings 74, the distortion of the second cone member 72 by the stepped portion 78 of the lock nut 12, and the use of a double taper and specifically the steeply tapered portion 64 of the first cone member 58 all provide for the coaxial cable and specifically the insulating member 70 and the braided shielding 68 being securely locked to the connector 10.

As indicated above, the invention has been shown with reference to a male connector, but it is to be appreciated that the same construction may be used with a female connector so as to provide for a complete connector assembly.

Although the invention has been described with reference to a particular embodiment, the invention is only to be limited by the appended claims.

I claim:

1. A connector for use with a coaxial cable of the type including a central wire member and an outer metallic shielding member separated by an inner insulating member and additionally including an outer insulating member covering the outer metallic shield, including

a pin assembly including a pin member having a hollow portion for receiving the central wire member and including a hollow truncated cone member separated by insulating material from the pin member and with the largest cross-sectional portion of the hollow truncated cone member located closest to the pin member and with the smaller cross-section portion of the hollow truncated cone member for insertion between the outer metallic shielding member and the inner insulating member,

a thin-walled hollow truncated cone member having a plurality of openings therethrough for placement over the outer insulating member of the coaxial cable to capture the outer insulating member between the cone member of the pin assembly and the thin-walled cone member having the plurality of openings,

a locking assembly for engaging the pin assembly and the thin-walled hollow truncated cone member for providing pressure between the cone member of the pin assembly and the thin-walled cone member to have portions of the outer insulating member of

the coaxial cable flow into the opening of the thin-walled cone member to lock the coaxial cable to the connector, and

the cone member of the pin assembly formed with first and second sections having different taper angles and with the second section having the greater taper angle and disposed closest to the pin assembly and with the locking assembly forcing the thin-walled cone member to be flared outwardly against the second tapered section to lock the thin-walled cone member in position.

2. The connector of claim 1 wherein the locking assembly includes a tapered stepped portion located adjacent to the thin-walled cone member to provide additional locking of the coaxial cable to the connector.

3. A connector for attachment to a coaxial cable of the type including a central wire member and an outer insulating member, including

a first hollow truncated cone member having the smaller end thereof for insertion at a location between the central wire member and the outer insulating member to have the central wire member extend through the first hollow truncated cone member and to have the outer insulating member flared outwardly by the larger end of the first hollow truncated cone member,

a second hollow truncated cone member having a plurality of openings for placement over the outer insulating member of the coaxial cable and with the larger and smaller ends of the first and second hollow truncated cone member positioned adjacent to each other to have the outer insulating member captured between the first and second hollow truncated cone members,

a locking assembly for engaging the first and second hollow truncated cone members to provide pressure between the cone members to have portions of the outer insulating member flow into the openings of the second cone member to lock the outer insulating member between the first and second cone members, and

the first hollow truncated cone member formed with a first tapered section adjacent to the smaller end of the second cone member and a second tapered section having a steeper angle than the first tapered section adjacent to the larger end of the second cone member to provide a distortion of the second cone member upon engagement of the locking assembly.

4. The connector of claim 3 wherein the locking assembly includes a tapered stepped portion located adjacent to the second hollow truncated cone member to provide distortion of the second cone member to produce additional locking.

5. An electrical connector in attachment with a coaxial cable including

a coaxial cable including a central wire member and an outer metallic shielding member separated by an inner insulating member and additionally including an outer insulating member covering the outer metallic shield,

a pin assembly including a pin member having a hollow portion receiving the central wire member and including a hollow truncated cone member separated by insulating material from the pin

member and with the largest cross-sectional portion of the hollow truncated cone member located closest to the pin member and with the smaller cross-sectional portion of the hollow truncated cone member inserted between the outer metallic shielding member and the inner insulating member,

a thin-walled hollow truncated cone member having a plurality of openings therethrough placed over the outer insulating member of the coaxial cable and capturing the outer insulating member between the cone member of the pin assembly and the thin-walled cone member having the plurality of openings,

a locking assembly engaging the pin assembly and the thin-walled hollow truncated cone member and providing pressure between the cone member of the pin assembly and the thin-walled cone member and having portions of the outer insulating member of the coaxial cable flowing into the openings of the thin-walled cone member to lock the coaxial cable to the connector, and

the cone member of the pin assembly formed with first and second sections having different taper angles and with the second section having the greater taper angle and disposed closest to the pin assembly and with the locking assembly forcing the thin-walled cone member to flare outwardly against the second tapered section and lock the thin-walled cone member in position.

6. The connector of claim 5 wherein the locking assembly includes a tapered stepped portion located adjacent to the thin-walled cone member for providing additional locking of the coaxial cable to the connector.

7. A connector in attachment to a coaxial cable, including

a coaxial cable including a central wire member and an outer insulating member,

a first hollow truncated cone member having the smaller end thereof inserted at a location between the central wire member and the outer insulating member and having the central wire member extending through the first hollow truncated cone member and having the outer insulating member flared outwardly by the larger end of the first hollow truncated cone member.

a second hollow truncated cone member having a plurality of openings placed over the outer insulating member of the coaxial cable and with the larger and smaller ends of the first and second hollow truncated cone member positioned adjacent to each other and having the outer insulating member captured between the first and second hollow truncated cone members,

a locking assembly engaging the first and second hollow truncated cone members and providing pressure between the cone members and with portions of the outer insulating member flowing into the openings of the second cone member and locking the outer insulating member between the first and second cone members, and

the first hollow truncated cone member formed with a first tapered section adjacent to the smaller end of the second cone member and a second tapered

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section having a steeper angle than the first tapered section adjacent to the larger end of the second cone member for providing a distortion of the second cone member with engagement of the locking assembly.

8. The connector of claim 7 wherein the locking as-

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sembly includes a tapered stepped portion located adjacent to the second hollow truncated cone member providing distortion of the second cone member for producing additional locking.

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