

[54] ELECTRICAL CONNECTOR

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[51] Int. Cl. H01r 3/06

[58] Field of Search... 339/14 R, 14 P, 276 R, 276 M, 339/91 R, 91 P, 75, 82, 89, 176

[56] References Cited

UNITED STATES PATENTS

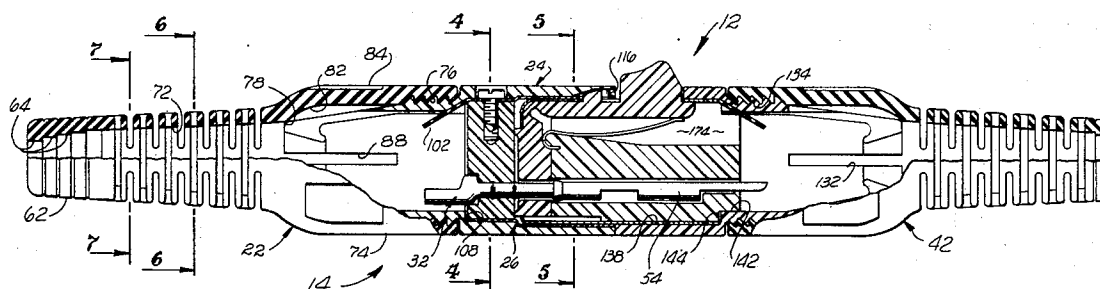
3,474,377	10/1969	Carlson et al.....	339/14 R
3,569,909	3/1971	Garver.....	339/91 R
3,609,632	9/1971	Vetter.....	339/14 R
3,467,940	9/1969	Wallo	339/14 R
3,466,590	9/1969	Sylvester.....	339/14 R

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[57] ABSTRACT

An electrical connector assembly is formed of a pair of concentric members with the outer concentric member being internally threaded at its front end and inwardly tapered towards its rear end. The inner concentric member is externally threaded for mating with the outer member. Upon threadably mating of the concentric members, the inner member is radially compressible at one end for securing the inner member to an electrical conductor. Moreover, step-sized collets, which are removable, are provided at the rear inner surface of the outer member so as to accommodate various diameter electrical conductors. Grounding shell members may be mounted in the connectors with mating of the connectors causing an electrical interconnection between the grounding shells.

2 Claims, 7 Drawing Figures



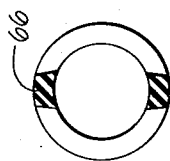
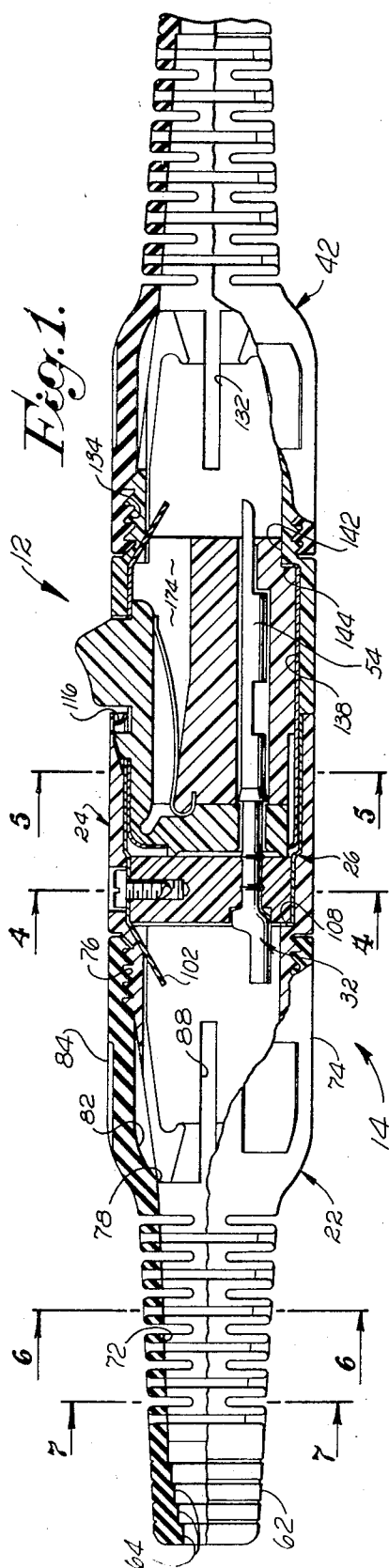


Fig. 6.

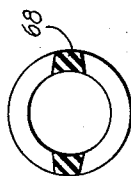


Fig. 2.

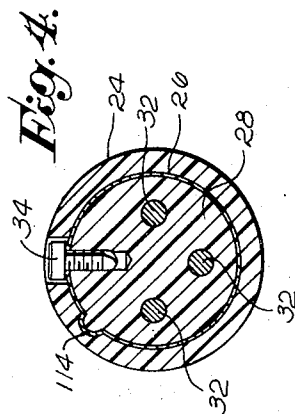


Fig. 4.

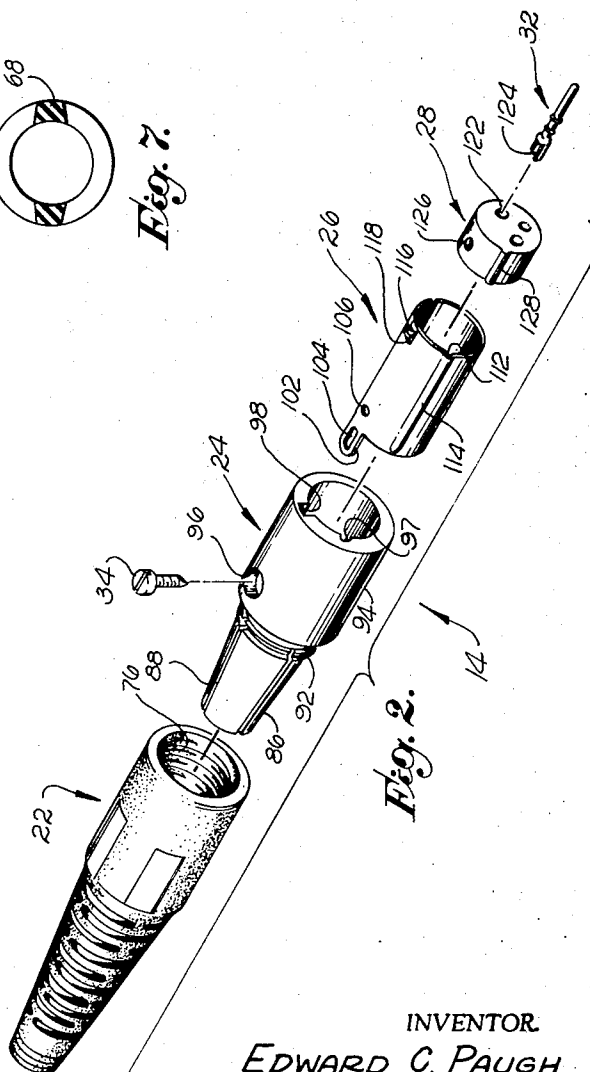
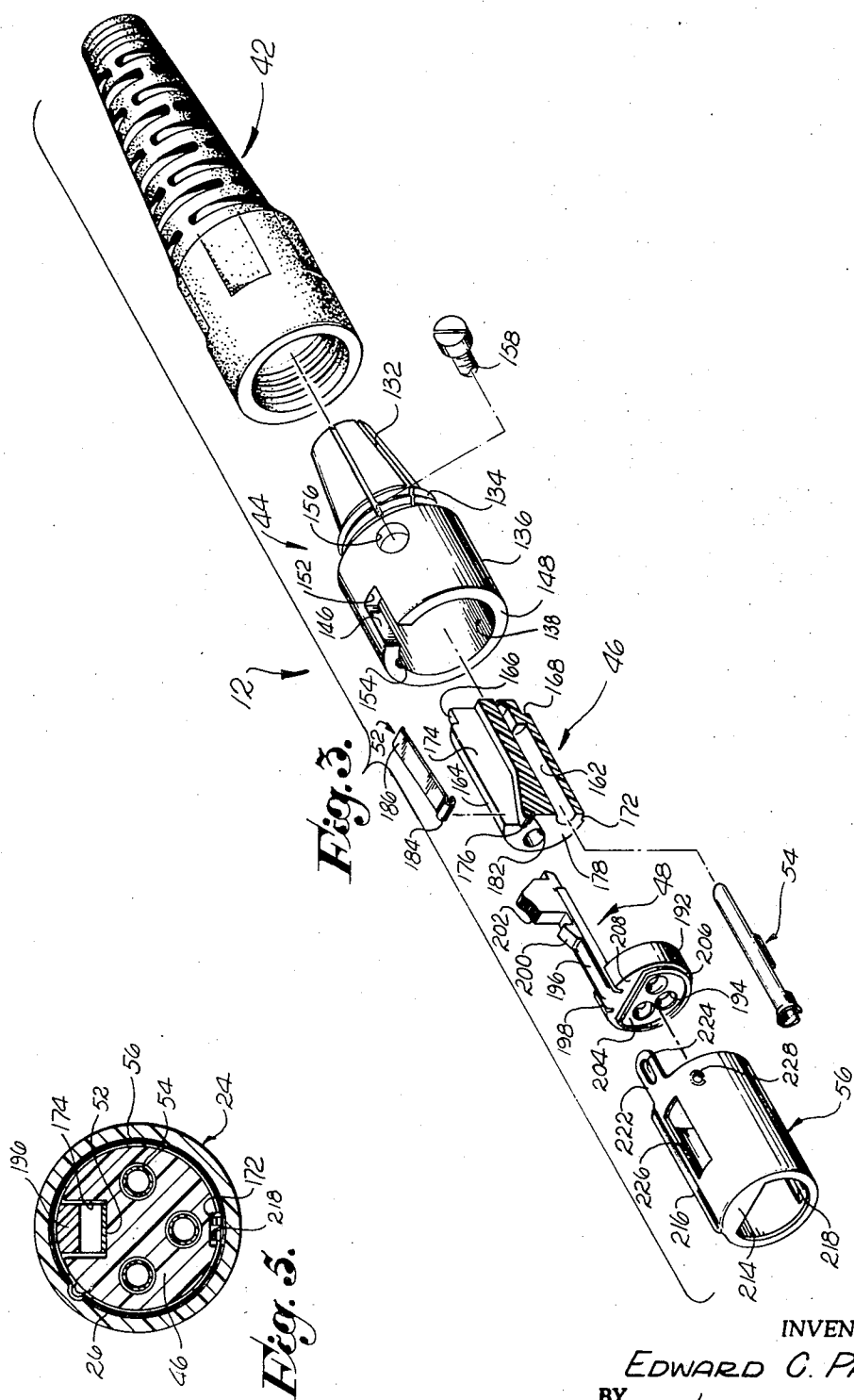


Fig. 2.

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ELECTRICAL CONNECTOR

The invention relates, in general, to electrical connectors and, more particularly, to an electrical connector for interconnecting cable connector containing an external grounding circuit.

BACKGROUND OF THE INVENTION

Conventional audio connectors which are used for interconnecting coaxial cables which have a single or multiple conductor may include a metallic braid for grounding or shielding purposes. Typically, such connectors comprise a mating plug and receptacle connector. These connectors may include a latching mechanism which allows rapid disconnect of the connectors as well as a locking device for securing the connectors together during operation. Moreover, such connectors are typically provided with clamping devices which clamp the electrical cable to provide a strain relief for the soldered or crimped conductors of the cable. Further, a flexible member at the end of the cable acts as a strain reducing member. Typically, such a flexible member is designed to restrict the conductor bend radius and consequently reduce stress concentrations. Mounted within each of the connectors are a male and female type contact which provides frictional mounting between mating contacts. The contacts are typically mounted in an insulator to isolate them from one another as well as the external housings. Finally, a means of electrically connecting the plug and socket halves to provide an external ground circuit for the conductor shield braiding must be provided.

The above-mentioned conventional audio-type cable connectors with an external ground circuit contained therein are normally difficult to manufacture due to the many interrelated components. Moreover, such connectors are subject to unmating failure if clamping screws are not completely tight. Moreover, such devices require that the shell components of the connector be electrically conductive so as to perform a path in the external ground circuit. Should the shell components be nonconductive, which is normally desirable from a weight as well as a cost standpoint, the ground circuit cannot be accomplished. Moreover, with separate individual latching and insulating members, the total number of parts required to assemble the connector rises. With such a large number of parts, assembly of the connector is complicated and assembly errors can go undetected. Moreover, the components used as flexure strain reliefs are impaired functionally because of reduced cross-sections formed at critical places. This feature causes premature failure, and due to decreased cable bend radii, increases the strain in the conductor. Typical tension strain releases are predominantly metal and as such require positive insulation from the conductor. This type of strain relief increases cost as well as the possibility of loss of components. Moreover, a major drawback is that wire accommodation is limited to a very small range of diameters.

In order to overcome the attendant disadvantages of prior art audio connectors, the present invention utilizes a minimum of components to complete the external grounding circuit. Moreover, the design is such that the device cannot fail due to improperly tightened clamping screws. Further, a nonconductive outer shell

is utilized which further insulates the conductor circuits and is not required to be conductive as in prior art connectors. By utilizing a one piece insulator and latch, which are bridged by a thin web of plastic material which acts as a live hinge, components are reduced and maximum advantage of simplified assembly is realized. Moreover, the thermoplastic hinge provides an extremely long cycle life with positive positioning of coupled components. Moreover, the flexure strain relief is tightened to provide a bend radius that does not have stress increasing discontinuities. Further, step-size collets are provided at the cable entry to provide close size matching to a number of cable diameters.

By utilizing a thermoplastic bend and plane relief, the clamping member need not be insulated from the conductor. Moreover, by using selected thermoplastic materials, a wide range of cable diameters can be firmly gripped without producing excessive stress. Also, by incorporating the tension strain relief in two major components, i.e., the shell and flexure strain relief, the overall number of parts are reduced as well as simplifying field assembly. Further, the locking times and driving collet are combined in the other major components, thus simplifying manufacture while simultaneously not detracting from performance.

The advantages of the invention, both as to its construction and mode of operation, will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like referenced numerals designate like parts throughout the figures.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 depicts a cross-sectional view of a plug and receptacle connector assembled in accordance with principles of the invention;

FIG. 2 illustrates an exploded perspective view of the receptacle half of the connector;

FIG. 3 shows an exploded perspective view of the plug half of the connector;

FIG. 4 depicts a cross-sectional view taken along the line 4—4 of FIG. 1;

FIG. 5 illustrates a cross-sectional view of the assembled connectors taken along the line 5—5 in FIG. 1;

FIG. 6 shows a cross-sectional view of the connector taken along the line 6—6 of FIG. 1; and

FIG. 7 depicts a cross-sectional view of the connector taken along the line 7—7 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, there is shown in FIG. 1 a cross-sectional view of a plug connector 12 and a receptacle connector 14 made in accordance with the preferred embodiment of the invention. The receptacle connector 14, shown in exploded view in FIG. 2, comprises a strain relief 22 having fitted therein an insulator shell 24. Within the insulator shell 24 there is positioned a grounding sleeve 26, and within the grounding sleeve there is mounted a pin insulator 28 having mounted therein contact pins 32. A screw 34 may be utilized to secure the grounding sleeve 26 and pin insulator 28 within the insulator shell 24.

The plug connector 12 is shown in greater detail in exploded view in FIG. 3 and comprises a strain relief 42 which can be made identical to the strain relief 22 of the plug connector. Positioned within the strain relief is a plug shell 44 having a socket insulator 46 positioned therein. Also mounted within the shell 44 is a plastic latching device 48 which is spring biased by means of a spring 52. Socket contacts 54 are positioned within the insulator 46 and the front end of the latch device 48. The insulator 46 and latching member 48 are positioned within a grounding sleeve 56, the grounding sleeve, in turn, being mounted in the shell 44.

The rear end 62 of the strain relief 22 contains a plurality of step-sized collets 64 which decrease in size from the front of the rear of the rear end of the strain relief. The purpose of the decreasing bores is to allow a cable to extend therethrough, and the strain relief provides a tight fit for different size cables. This is accomplished by removing the end of the strain relief whose diameter is smaller than the cable size. The central portion of the strain relief is formed of a plurality of corrugations with vertically extending corrugations 66 alternately interspaced with horizontally extending corrugations 68, as shown in FIGS. 6 and 7, respectively. The bore portion 72 in the corrugations define a forward flared portion forming a continuation of the collets 64. The front end portion 74 of the strain relief is internally threaded as at 76. The flared bore 72 terminates at a point 78 where upon a bore portion 82 is formed in the strain relief which tapers from the termination of the threaded portion 76 to the point 78. Further, a gripping surface 84 is formed on the outer surface of the portion 74 of the strain relief 22.

The shell 24 comprises a rear collapsible portion 86 which is split in quarter sections by means of slots 88. The front end of the portion 86 is threaded at its outer surface 92 so as to allow the strain relief 22 to be threaded thereon. Forwardly of the threaded portion 92, there is a cylindrical shell portion 94. The shell portion contains an opening 96 for insertion of the screw 34. Moreover, on the interior surface of the shell portion 94, there is a polarizing keyway 97 formed therein for correctly positioning the grounding sleeve 26 therein. Moreover, a rectangular slot 98 is formed on the front inner surface of the portion 94 which provides polarization for the plug connector half 12. The grounding sleeve 26 is generally cylindrically shaped and contains a grounding leg 102 which extends from the rear end thereof and has an opening 104 therein for attachment of a grounding wire thereto. An opening 106 is formed in the grounding sleeve which allows the screw 34 to pass therethrough. At the rear end of the sleeve, a lip 108 is formed and an axially extending slot 112 is formed in the grounding sleeve. The lip 108, together with the slot 112, allows correct positioning of the insulator member 28 therein. The outer surface 114 of the slot 112 may be considered to be a key for correctly positioning the grounding sleeve within the keyway 97 of the shell 24. Moreover, an upwardly protruding lip 116 is bent outwardly near the front surface of the grounding shell to form an opening 118 therein, the purpose of which will be explained hereinafter.

The insulator member 28 is formed with a plurality of axially extending bores 122 into which the pin con-

tacts 32 are mounted, as is conventional. The pin contacts may contain crimp or solder pots 124 at the rear end thereof for securing caps thereto. Moreover, a threaded opening 126 is formed in the insulator for insertion of the screw 34 therein. Formed on the outer surface of the insulator is an axially extending key 128 which allows correct positioning of the insulator in the grounding sleeve 26 with the key 128 fitting into the slot position 112.

Referring now to FIG. 3, the plug connector portion 14 contains a strain relief 42 which is normally made identical to the strain relief 22 of the receptacle connector 12 and, therefore, will not be described in greater detail. The strain relief 42 is threaded onto a plug shell 44 whose rear half is similar to the receptacle shell 24 in that its rear end is split as at 132 and forwardly of the split rear end there are threads 134 which mate with the forward internal threaded portion of the strain relief 42. The front end 136 is generally cylindrical in shape and contains an enlarged forward bore portion 138 and a reduced diameter rear bore portion 142. The junction of the bore portions 138 and 142 define a forward facing shoulder 144. Further, an axially extending slot 146 is formed in the cylindrical portion 136 and extends from the front surface 148 of the plug shell 44 rearwardly to a forward facing shoulder 152. Further, a keyway 154 extends from the front surface 148 rearwardly. An opening 156 is found in the front end for insertion of a screw 158.

The insulator 46 is formed of a plurality of conventional bore portions 162 for insertion of the socket contacts 54 therein. The outer surface of the insulator 46 contains an enlarged front diameter portion 164 and a reduced diameter rear portion 166. The junction of the portions 164 and 166 form a rearward facing shoulder 168 which abuts the forward facing shoulder 144 of the plug shell when the insulator is positioned therein. Moreover, a keyway 172 is formed axially on the outer surface of the insulator 46. An axially extending slot 174 extends the entire length of the insulator. The slot 174 has a generally constant depth at its rear end which tapers gradually toward the outer surface of the front portion of the insulator portion 164. Further, a curved lip 176 extends forwardly of the front surface 178 of the insulator and terminates in a chambered slot 182 extending from the bottom portion of the lip into the front surface 178 of the insulator.

The spring member 52 contains generally U-shaped front portion 184 whose free end is insertable into the slot 182 with the U-shaped portion abutting adjacent the lip 176 and with the free rear end 186 of the spring extending outwardly toward the outer surface of the insulator 46.

The member 48 is formed of a generally cylindrical front portion 192 having bores 194 therethrough which form a continuation of the bores 162 of the insulator 46. A latch portion 196 is formed at a live hinge junction 198 with the outer surface of the portion 192. The latch portion 196 is generally rectangular in shape and contains a locking hook portion 200 as well as a projecting portion 202. Further, the front end of the cylindrical member 192 has an outwardly extending portion 204 thereby providing a slight recess portion 206 along the bottom surface of the cylindrical member and an enlarged recess surface 208 adjacent the hinge 198.

The grounding sleeve 56 is generally cylindrical in shape and contains a lip portion 214 at the front end thereof. Further, a first key 216 is formed on its outer surface and a second key 218 formed on the inner surface of the grounding sleeve. The keys 216 and 218 are adapted to be inserted into the keyways 154 and 172, respectively. Further, a grounding lug 222, has an opening 224 therein, to which the grounding braid of a cable may be secured. Moreover, a rectangular slot 226 is formed in the surface of the grounding sleeve. Also, an opening 228 is formed in the grounding shell 52 for insertion of the screw 158.

In assembling the plug connector, the member 48 is inserted into the grounding sleeve 42 until the front recessed portion 208 abuts the lip 214. The locking hook portion 198 and portion 202 then protrudes through the slot 226. Then the insulator member 46 can be inserted into the grounding sleeve with correct orientation obtained by means of the keyway 172 and key 218. The spring 52 is mounted on the insulator prior to insertion of the insulator so that when the insulator is inserted, the rear portion 186 of the spring abuts the latch portion 196 of the member 48 directly below the portion 202. This causes the depressing portion 202 to extend through the slot 206 and outward movement is limited due to the fact that the free end of the latch portion 196 abuts the grounding sleeve to the rear of the slot 226. Then the plug shell 44 may be inserted over the grounding shell 52 with the proper mating achieved by the key 216 fitting into the keyway 154.

As can be readily seen, when the strain relief 22 is threaded onto the connector shell 24, the point 78 will tend to collapse the the split end portion 86 of the shell 24. The collapsing portion 86 would, in turn, tend to grab the cable outer surface and form a strain relief. Of course, as previously pointed out, the collets 64 form an additional strain relief.

When the connector members 12 and 14 are mated together in the position as shown in FIG. 1, the inner surface of the grounding sleeve 26 forms a friction fit with the outer surface of the grounding sleeve 56. To mate the connectors, it is necessary to depress projection portion 202 allowing hook 200 to enter the grounding sleeve 26. When the portion 202 is released, the hook projects through opening 118 and axial separation of the connectors cannot occur since the member 116 forms a barrier for the hook 200. Thus, to separate the connectors, it is necessary to once again depress the latching portion 202.

What is claimed is:

1. An electrical connector assembly comprising:
 - a plug connector and a receptacle connector;
 - said plug connector and said receptacle connector each being formed of an outer insulator shell and an inner insulator member having a plurality of contacts therein;
 - a cylindrical grounding shell surrounding the inner insulator member of one of said connectors and extending from the forward to the rear end of said member, said shell being formed with a slot therein;
 - grounding means on the other of said connector members contacting said grounding shell; and
 - said inner insulator member being provided with means movable through said slot for latching said connectors in mating engagement.
2. An electrical connector as set forth in claim 1 wherein:
 - said latching means includes an integral hinge element formed of a section of the inner insulator member of said one connector; and
 - said hinge element including a portion thereof projecting through an opening in said grounding shell operable upon actuation to release said latching means.

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