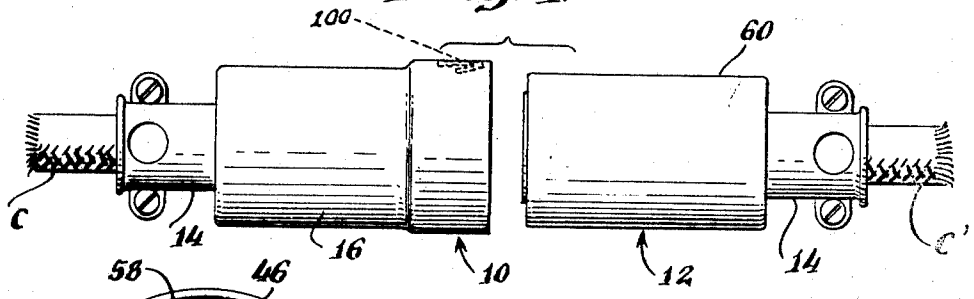
March 10, 1970 E. R. CARLSON ET AL 3,500,286

GROUNDING MEANS FOR PROTECTIVE SHELLS OF ELECTRICAL CONNECTOR DEVICES

Filed March 14, 1967 2 Sheets-Sheet 1

Fig. 1.



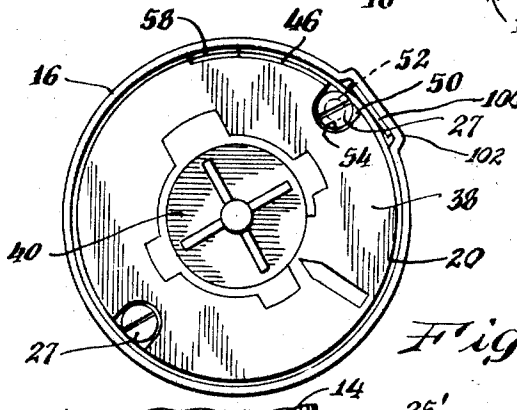


Fig. 4.

Fig. 2.

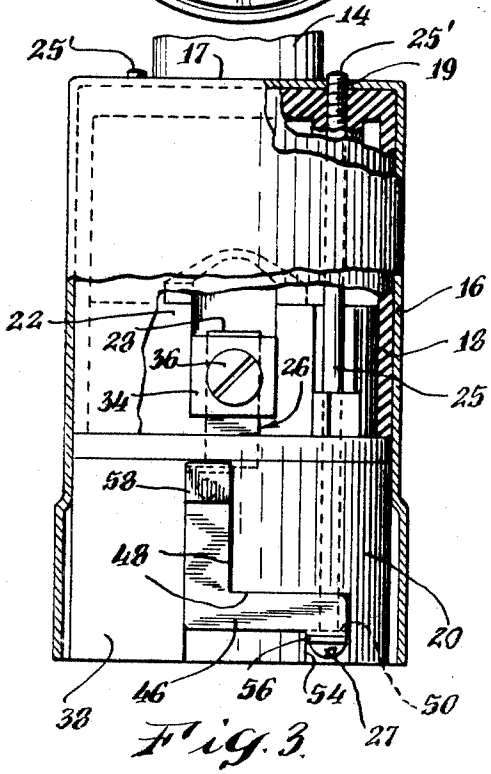
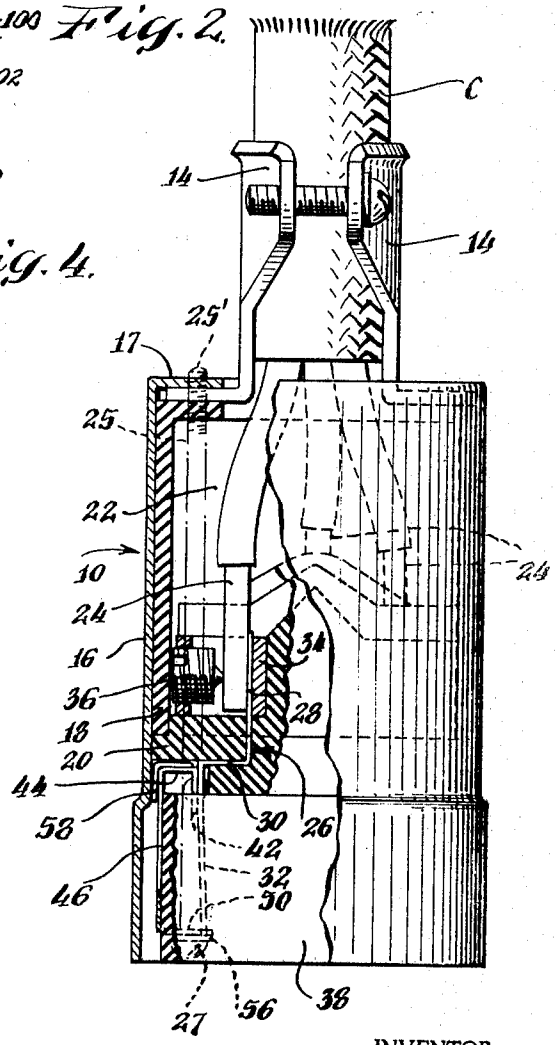


Fig. 3.



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Filed March 14, 1967 2 Sheets-Sheet 2

Fig. 8.

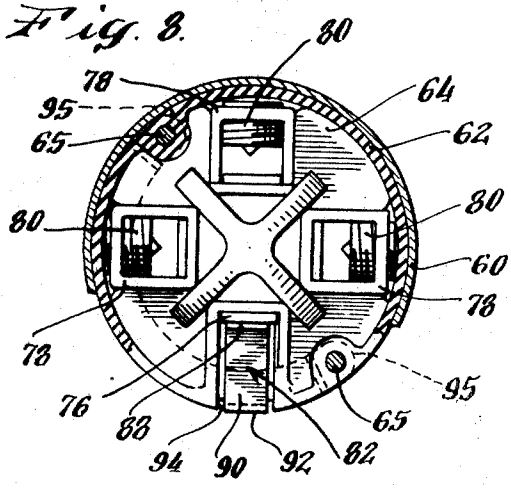


Fig. 5.

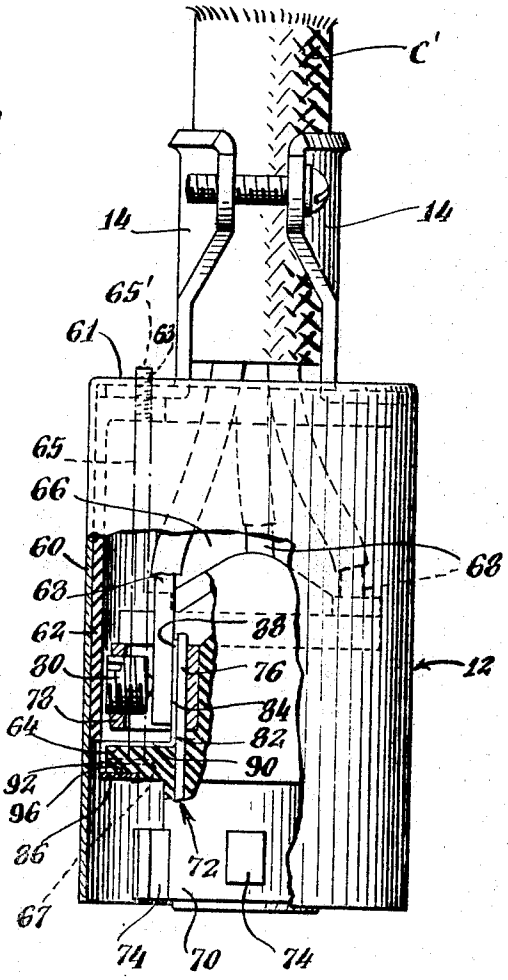
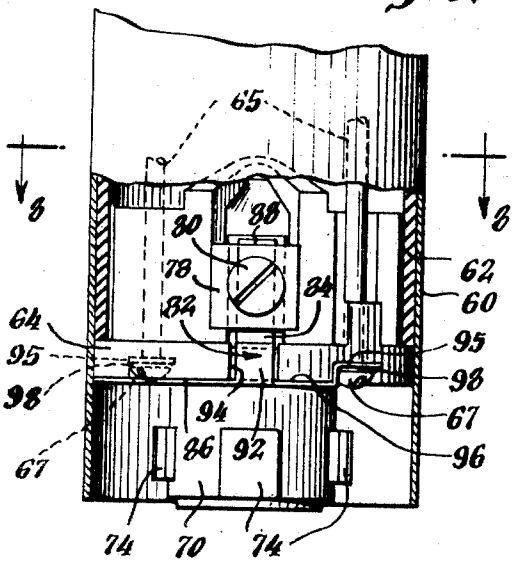


Fig. 6.



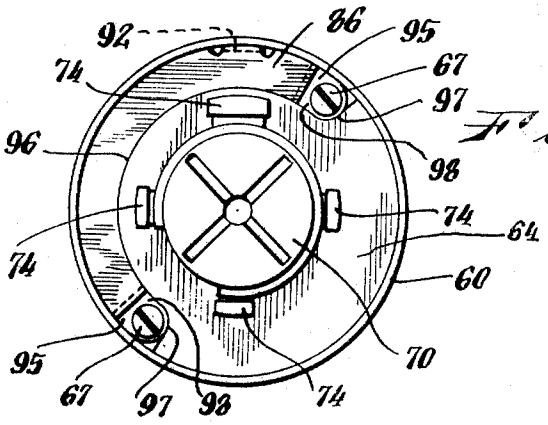


Fig. 7.

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3,500,286

GROUNDING MEANS FOR PROTECTIVE SHELLS OF ELECTRICAL CONNECTOR DEVICES

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Int. Cl. H04r 3/06
U.S. Cl. 339—14 7 Claims

ABSTRACT OF THE DISCLOSURE

A multi-wire electrical connector device having a metal shell housing for an insulator body which carries several contact-terminal elements one of which is a ground contact-terminal, securing screws for maintaining the insulator body in the metal shell and shell grounding shunts for connecting the ground contact-terminal to the metal shell through two paths, one of the paths being through one of the securing screws.

This invention relates to improved grounding means for protective shells of electrical connector devices and, more particularly, to providing in electrical connector devices improved means for obtaining and insuring grounding continuity from the usual internal grounding contacts to the usual protective metal shells comprising at least two separate grounding shunt paths.

In multi-wire electrical connector devices of high rating and capacity, wherein there is provided an equipment grounding system, it is often required to extend the usual internal wired grounding path to electrically ground the usual protective metal shells of the devices to satisfy rigorous safety standards. A grounding shunt to and through the metal shells parallel to the internal wired equipment grounding path is often provided in the usual connector bodies and caps by employing an electrically conductive flexible metal shunt strip, often of bronze, which is secured at one end to the internal grounding terminal, as by riveting or welding, and is formed at its opposite end so as to be biased into firm rubbing contact with the interior of the metal shell. Thus, each metal shell is grounded, and when the connector body and cap are coupled, there is an equipment grounding path through the internal wired grounding path of the device, and a shell grounding path parallel thereto, through the metal shells which are in electrical contact with each other when connected.

These known grounding shunt means have been found in practice to be objectionable, because it is possible to lose or reduce the grounding continuity at the point where the shunt strip is biased against the metal shell. It has been found in practice, for example, that the localized heat build-up at the shunt strip-shell point of rubbing contact, may cause the spring loaded shunt to corrode and lose its springiness, thereby significantly reducing the contact pressure which often prevents adequate grounding of the metal shell and may result in hazardous current flow through the metal shell.

Accordingly, it is the primary object of this invention to provide improved grounding means having more than one positive grounding shunt path from the internal wired equipment ground path to the usual metal shells.

A further object is to provide such improved grounding means which insures grounding continuity by providing at least one grounding path through the usual assembly screws of the device directly to the metal shell to insure positive electrical contacting of the shunt strip to the metal shell.

These objects are achieved in one form by providing a

multi-wire electrical connector device having improved shell grounding means comprising a metal shell; an insulator member disposed within the metal shell; means for securing the insulator member to the metal shell; electrical contact-terminal means carried by the insulator member, the contact-terminal means being arranged to receive the bared wire lead ends of conductors of an electrically conductive cable, one of said contact-terminal means being grounded; and grounding shunt means for electrically connecting the grounded contact-terminal means to the metal shell through at least two separate paths, at least one of the paths being through the securing means to the metal shell.

Other objects and further details of that which we believe to be novel and our invention will be clear from the following description and claims taken with the accompanying drawings wherein:

FIG. 1 is a side elevational view of a separated connector body and connector cap constructed in accordance with the present invention;

FIG. 2 is an enlarged side elevational view of the connector body of FIG. 1, which has been partially broken away to show the internal electrical contact-terminal wiring and the dual path shell grounding shunt:

FIG. 3 is a side elevational view of the electrical connector body looking from the left to right relative to FIG. 2, partially broken away to show the internal elements, such as the shell grounding shunt;

FIG. 4 is an end elevational view of the connector or body showing its connector face;

FIG. 5 is a side elevational view of the connector cap of FIG. 1 which has been partially broken away to show the grounding terminal and the grounding shunt;

FIG. 6 is a side elevational view of the connector cap looking from the left to right in FIG. 5, partially broken away to show the grounding shunt;

FIG. 7 is an end elevational view of the connector cap showing its connector face; and

FIG. 8 is a sectional view taken substantially along line 8—8 of FIG. 6 showing the electrical terminals and the seated shunt strip.

In the drawings, there is illustrated in FIG. 1 a separated connector comprising a connector body **10** and a connector cap **12**, to which are appropriately wired and secured electrical cables C and C' which are held in place by the usual cable clamps **14** which also serve to strain relieve the secured lead ends of the wired cable conductors. When connected, the electrical connector devices **10** and **12** allow an electrical current to pass from a power source to a powered equipment. In order to protect the equipment and those who handle these connector devices from hazardous current flow through the usual protective metal shells of the connector devices, there is provided an internal wired equipment grounding path and the metal shells of both the connector body and cap are grounded by being electrically connected to the equipment ground path through a plurality of separate shunt paths.

With particular reference to FIGS. 2 through 4, there is illustrated the connector body **10** of the present invention with a dual path grounding means for its metal shell. The connector body **10** includes a usual metal shell **16** within which are positioned a first insulator portion **18** and a second insulator portion **20**. The second insulator portion **20** is spaced from the closed end **17** of the metal shell **16** by the first insulator portion **18**. The insulator portions are formed to provide a wiring area **22** within which the lead ends of electrical conductor wires **24** of the electrical cable C are wired to contact-terminal means. The insulator portions **18** and **20** are secured in the metal shell **16** by the elongated securing screws **25** which extend through them and have their ends **25'** threadedly engaged in tapped openings **19** in the end wall **17** of the metal shell.

The insulator portion **20** carries a contact-terminal strip element **26** which is mounted therein and is of substantially Z-shape including an upper terminal portion **28**, an intermediate offset portion **30** and a lower contact portion **32**. The terminal portion **28** extends upwardly from the insulator portion **20** and secures a clamp-type terminal **34** in place upon a suitable seat formed in the insulator portion **20**. The terminal **34** is provided with a clamping screw **36** which urges the lead end of one of the electrical conductor wires **24** against the terminal portion **28** to insure a good electrical connection. The contact portion **32** extends into a contact chamber **38** formed in the insulator portion **20**. The insulator **20** is further provided with a spring biased shutter plate **40** which presents a dead front to the device. See copending application of Vincent F. Lipinski, assigned to the assignee of the instant application, Ser. No. 547,475, filed May 4, 1966, now Patent No. 3,392,362 issued July 9, 1968, for Electrical Connector, for a detailed disclosure of the contact-terminal arrangement.

The connector body **10** include a plurality of contact-terminal means; illustrated in FIG. 4. The body is a four contact device, but any desired number may be employed, as long as one is part of an internal wired equipment grounding system.

The electrical terminal which receives the terminal portion **28** shown in FIG. 2 is the equipment ground terminal. A grounding shunt **42**, made of bronze or a like material, is secured, as by riveting, to the contact portion **32** of the contact-terminal element **26**. The shunt **42** has a portion **44** which extends radially outwardly of the insulator portion **20** from the contact portion **32** to the outer surface of the insulator portion. Extending axially from the portion **44** is a generally L-shaped portion **46**, extending along the surface of the insulator portion **20** from the vicinity of portion **44** to the vicinity of the head **27** of one of the securing screws **25**. The L-shaped portion **46** is seated in an L-shaped recess **48** formed in the surface of insulator portion **20** so as to maintain the outer surface of the L-shaped portion flush with the outer surface of the insulator portion. At the free end of the L-shaped portion **46** there is provided a normal end portion **50** having an opening **52** formed therein. The end portion **50** is seated in a cavity **54** in the insulator portion **20** which is provided to receive the head **27** of one of the elongated securing screws **25**. The shank of this one securing screw **25** passes through the opening in the end portion **50** and is spaced therefrom by a lock washer **56**. This one screw extends through the insulator portions **18**, **20** and has its end **19** threaded into the wall **17** of the metal shell, insuring that a direct, positive ground path extends from the ground terminal-contact element **26** to the metal shell.

An auxiliary grounding shunt **58** is secured, as by welding, to the portion **44** of the ground shunt **42** at one end, and its other end is biased outwardly from the surface of insulator portion **20** so as to be in firm rubbing contact with the inner surface of the metal shell **16** when the insulator portion is mounted in assembled position within the metal shell.

Therefore, in the FIGS. 2 through 4 modifications, there are two separate grounding path from the grounding contact-terminal means: (1) one from the ground shunt **42**, through its L-shaped portion **46** and end portion **50** and through one of the securing screws **25** to the end wall **17** of the metal shell **16**, and (2) the other from the ground shunt **42**, through auxiliary shunt **58** to the inner surface of metal sheel **16**.

In FIGS. 5 through 8 there is illustrated a connector cap **12** comprising a usual protective metal shell **60** having an end wall **61**. A first insulator portion **62** and a second insulator portion **64** are disposed within the metal shell **60**, the first insulator portion **62** spacing the second insulator portion **64** from the end wall **61** to form a wiring area **66** therebetween within which the conductor wires **68** of cable C' may be secured to the respective contact-

terminals of the connector cap. The insulator portions **62** and **64** are secured within the metal shell **60** by elongated securing screws **65**, the ends **65'** of which are threadedly anchored in the tapped openings **63** in the end wall **61** of the metal shell. The insulator portion **64** includes a post **70** having contact-terminals **72** molded therein with radially extending contacts **74** and axially extending terminal elements **76**. The end of the terminal element **76** secures in position a clamp-type terminal **78**, within the seat provided therefor in the insulator portion **64**. The lead ends of the conductor wires **68** are individually secured to the terminal elements **76** by the clamping screws **80** of the terminals **78**. As the illustrated connector cap is a four-wire device, there are four contact terminals **72**.

The terminal element **76** shown in FIGS. 5 and 6 is an equipment ground terminal. A flexible metal shunt member **82**, made of bronze or a like material, is provided to form a grounding path from the equipment ground terminal to the metal shell **60**. The shunt **82** is generally an inverted T-shape, as viewed in FIG. 6, having a generally vertically disposed strip portion **84** and a lower generally horizontally disposed, first, arcuate portion **86**. The portion **84** comprises (see FIG. 5): a terminal portion **88** which is arranged to be continguous with the terminal element **76** and to be contacted directly by the lead end of the conductor wire **68** which is the grounding wire; a radially outwardly extending portion **90** which underlies the terminal clamp **78**, and an axial connecting portion **92** which is maintained flush with the circumferential surface of the insulator portion **64** by being disposed within a groove **94** provided in the surface of the portion. The generally horizontal portion **86** comprises a semi-circular, arcuate portion extending from the connecting portion **92** in two circumferential directions, the remote ends **95** of which are formed axially offset to be seated within the recesses **97** provided for the heads **67** of the securing screws **65**, and having openings therethrough for passage of the shanks of the securing screws. The horizontal portion **86** is maintained flush with the flat surface of the insulator portion **62** by being seated within a similar arcuate recess **96**. The securing screws **65** pass: through the openings in the remote ends **95** of the shunt member **82** and are spaced therefrom by lock washers **98**; through the insulator portions **60** and **62**, and their ends **65'** are threadedly anchored in tapped openings **63** in the end wall **61** of metal shell **60**. Thus, it is readily apparent that two ground shunt paths have been provided, one through each securing screw **65**.

Having described our invention of improved grounding means for electrical connector shells, it will be readily apparent that when the connector body and the connector cap are connected there will be an equipment ground path through the grounding contact-terminals of the devices, and separate parallel shunt grounding paths to the metal shells. The metal shells are in electrical contact with each other when the connector cap and body are connected, and are in grounding continuity as well. We have provided a safer and improved means for providing grounding continuity to each metal shell, as we have devised plural, separate grounding paths to the metal shells.

It will be noted that in both the connector body and connector cap, at least one of the grounding shunt paths passes through one of the elongated securing screws, directly into the metal shell, so as to provide a positive grounding path. In the connector cap device both securing screws are utilized to provide two separate grounding paths to the metal shell.

Although the metal shells **16** and **60** are grounded by means of the plural grounding shunt paths, it may optionally be desired to continue the grounding path through the metal shells. This may be achieved by means of the usual spring contact strip **100**, located in the usual outwardly deformed skirt portion **102** of the metal shell of

the connector body, which is biased against the outer surface of the shell of the connector cap.

It should be understood that the present disclosure has been made by way of example, and that numerous changes in details of construction and the combination and arrangement of parts may be resorted to without departing from the true spirit and scope of the invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A multi-wire electrical connector device having improved shell grounding means comprising: an insulator member; a plurality of electrical contacts carried by said insulator member; a plurality of electrical terminals, each connected to a different one of said electrical contacts, and forming contact-terminal means therewith; an electrical cable including a plurality of electrical conductor wires, each connected to a different one of said terminals, one of said wires being a grounding wire; a metal shell surrounding said insulator member normally electrically isolated from said contact-terminal means; means for clamping said cable to said shell; securing screws extending through said insulator member having head portions engaging said member and shank portions engaging said metal shell for maintaining said insulator member in said metal shell; and shell grounding means for electrically connecting the electrical contact-terminal means connected to said grounding wire to said metal shell through at least two conductive paths, at least one of the paths being through a securing screw from its head portion to said shell.

2. The multi-wire electrical connector device defined in claim 1 wherein said grounding means comprises: a generally T-shaped metal strip one end of which is mounted contiguous with the electrical terminal connected to said grounding wire, the other ends of which are formed so as to be in engagement with said securing screws.

3. A multi-wire electrical connector device having improved shell grounding means comprising: an insulator member; electrical contacts carried by said insulator member; electrical terminals connected to said electrical contacts and forming contact-terminal means therewith, said terminals arranged to receive the lead ends of electrical conductor wires; one of said contact-terminal means being grounded; a metal shell surrounding said insulator member; securing means engaging said metal shell for maintaining said insulator member in said metal shell; and shell grounding means for electrically connecting said one of said electrical contact-terminal means to said metal shell through at least two conductive paths, at least one of the paths being through said securing means, comprising a first metal strip being formed so as to extend from said one contact-terminal means to said securing means in contact therewith, and a second metal strip secured at one of its ends to said first strip and formed so as to have its free end biased against said metal shell.

4. The multi-wire electrical connector device defined in claim 3 wherein: said first strip is secured to said one contact-terminal means; said securing means comprises at least two securing screws; and said first strip is in contact with one of said securing screws so as to afford a positive grounding path.

5. A multi-wire electrical connector device having improved shell grounding means comprising: an insulator member; electrical contacts carried by said insulator member; clamp-type electrical terminals connected to said electrical contacts, and forming contact-terminal means therewith, said terminals arranged to receive the leads ends of electrical conductor wires; one of said contact-terminal means being grounded; a metal shell surrounding said insulator member; electrically conductive securing means engaging said metal shell for maintaining said insulator member in said metal shell; and shell grounding means comprising a generally T-shaped metal strip one end of which is located in the clamp-type terminal of said one contact-terminal means and is interposed between the lead end of the clamped wire and the terminal, and the other ends are formed at the remote ends of a substantially semi-circular arcuate portion of said metal strip to be in engagement with said securing means.

6. The multi-wire electrical connector device defined in claim 5 wherein said securing means comprises at least two elongated securing screws and said other ends of said metal strip, formed at the remote ends of the substantially semi-circular portion, are secured beneath the heads of said securing screws so as to afford two positive ground paths to said metal shell.

7. A multi-wire connector body and connector cap suitable for connection with one another for providing an electrical path from a power source to a powered equipment and an equipment grounding path when coupled, having improved shell grounding means, wherein:

(A) said body comprises: an insulator member; electrical contacts carried by said insulator member; electrical terminals connected to said electrical contacts, forming contact-terminal means therewith, said terminals arranged to receive the lead ends of electrical wires; one of said contact-terminal means being grounded; a metal shell surrounding said insulator member; electrically conductive securing means engaging said metal shell for maintaing said insulator member in said metal shell; a first metal strip secured to said one contact-terminal means and being formed to extend from said contact-terminal means to said securing means and a second metal strip secured to said first strip and being formed so as to have its free end biased against said metal shell; and

(B) said cap comprises: an insulator member; electrical contacts carried by said insulator member; electrical terminals connected to said electrical contacts, forming contact-terminal means therewith, said terminals arranged to receive the lead ends of electrical wires; one of said contact-terminal means being grounded; a metal shell surrounding said insulator member; electrically conductive securing means engaging said metal shell for maintaining said insulator member in said metal shell; a generally T-shaped metal strip one end of which is mounted upon said insulator member contiguous with the electrical terminal of said one contact-terminal means, the other ends of which are formed at the remote ends of a substantially semi-circular arcuate portion of said metal strip so as to be in engagement with said securing means.

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U.S. Cl. X.R.

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