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ELECTRICAL CONNECTOR DEVICE HAVING IMPROVED GROUNDING MEANS FOR SHELL

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Fig. 1.

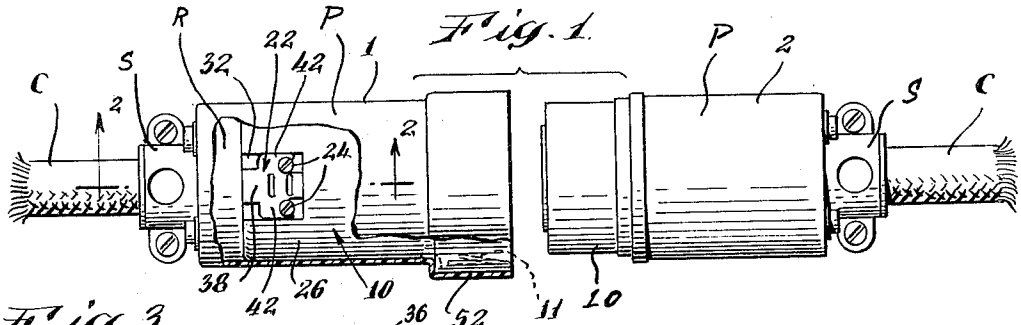


Fig. 3.

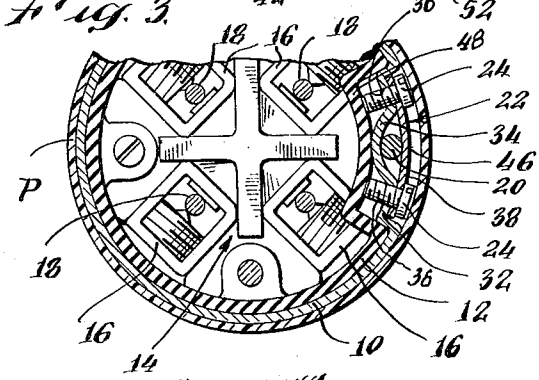


Fig. 4.

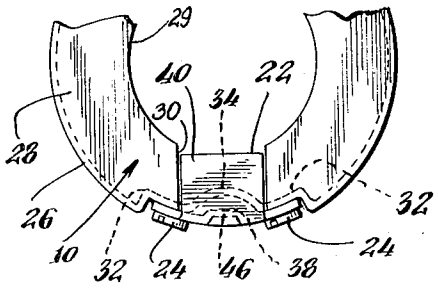


Fig. 2.

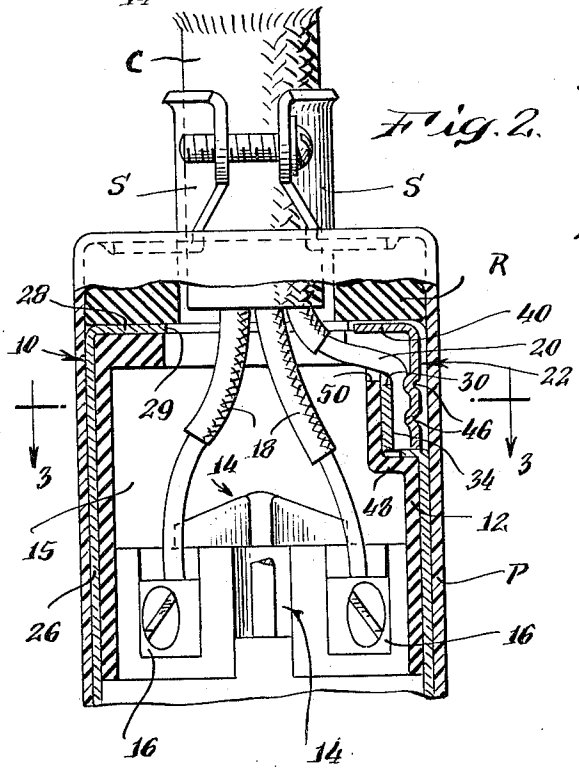


Fig. 5.

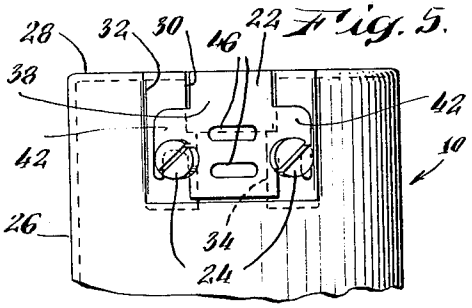
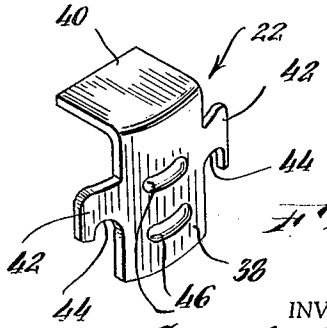


Fig. 6.



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ELECTRICAL CONNECTOR DEVICE HAVING IMPROVED GROUNDING MEANS FOR SHELL

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U.S. Cl. 339—14 8 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to an electrical connector device having improved shell grounding means. The connector includes a metal shell which houses an insulating body member therein carrying electrical contact-terminal elements arranged to receive leads of conductive wires of an electrical supply cable. A clamping member is adjustably mounted on the exterior of the metal shell to secure an externally led ground wire of the supply cable to the metal shell.

This invention relates to an electrical connector device having improved grounding means, and more particularly to an electrical connector device having a metallic protective shell and improved grounding means therefor, including improved means to secure a grounding wire directly to the shell.

To satisfy rigorous safety requirements, it is often necessary to ground the usual exposed metal shells of electrical connector devices. Grounding of the metal shells is achieved either by connecting the outer metal shells of the connector body and cap directly in a separate ground circuit, thereby completing the ground circuit through the shells, or by providing a grounding shunt or path through the metal shells extending from and being parallel to the usual internal equipment ground circuit of the electrical connectors, which passes through the usual ground contacts and terminals thereof.

A known arrangement for grounding the exposed metal shells by connecting them directly in a separate ground circuit comprises securing the ground wires to a ground wire binding screw anchored directly in the metal shell. This arrangement is limited to utilization with relatively small grounding wires. A well known prior art shell grounding shunt includes securing one end of a flexible metal conductor strip to an internal ground wire terminal, as by riveting or welding thereto, and forming the other end so that it is biased into rubbing contact with the interior of the shell. It will be readily understood by those skilled in the art that this shunt construction requires current flow to pass through at least two joints, one riveted or welded and the other one of rubbing contact. One known prior art shunting arrangement eliminates one joint by capturing one end of a flexible metal conductor strip in a clamp type equipment ground terminal while maintaining the other end biased in rubbing contact with the interior of the shell in the usual manner. In this arrangement, the ground wire is placed in direct contact with the ground shunt conductor strip and current flow must only pass through one joint, namely, the rubbing contact joint at the interior of the metal shell.

The grounding means of each of the above arrangements is objectionable because heating occurs wherever the current flow encounters resistance, for example, in the vicinity of the riveted joints and the rubbing contact joints. This objectionable heat rise occurs particularly under full load conditions. Furthermore, it has been found in practice that this localized heat build-up causes the riveted joints eventually to loosen and the spring-loaded shunt conductor strip of the rubbing contact joint to lose contact pressure or continuity due to corrosion. Thus, it is readily apparent that a minimum of joints in the grounding path is desirable.

Accordingly, it is the primary object of this invention to provide an improved electrical connector device having an improved shell grounding means that eliminates a ground terminal within the usual molded terminal section of the electrical connector device, and a rubbing shunt joint for grounding the metal shell by providing means for securing a relatively large ground wire directly to the metal shell.

A further object of the invention is to provide an improved shell grounding means in an electrical connector which minimizes the heat rise and voltage drop in the shell grounding circuit by eliminating all unnecessary joints and all spring biased joints in the grounding path by providing a ground wire of maximum size secured directly to the metal shell.

A still further object of the invention is to provide an improved grounding means for an electrical connector device wherein the grounding circuit elements are spaced from all current carrying elements and having a neat appearing ground wire clamp mounted directly on the exterior of the metal shell.

These objects are achieved in one form by providing an electrical connector device having improved grounding means for grounding the metal shell which comprises: electrical contact-terminal elements mounted on an insulating body member and arranged to receive leads of the conductive wires of an electrical supply cable; a metal shell within which the insulating body member is disposed; and shell grounding means arranged to clamp the ground wire of the electrical supply cable directly to the metal shell. The grounding means includes a clamping member arranged to be secured to the exterior of the metal shell and an inwardly extending arcuate portion of the shell which cooperates with the clamping member to clamp the ground wire therebetween.

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 drawing, wherein:

FIG. 1 is a side elevational view of an electrical connector cap and body in accordance with the present invention with portions broken away to show the shell grounding means;

FIG. 2 is a sectional view of an electrical connector device taken substantially on line 2—2 of FIG. 1;

FIG. 3 is a fragmentary sectional view taken substantially along line 3—3 of FIG. 2 showing a grounding wire secured in place by the clampling member;

FIG. 4 is a fragmentary end elevational view of the metal shell and clamping member of the FIGS. 1–3 device;

FIG. 5 is a fragmentary side elevational view showing the clamping member mounted on the metal shell; and

FIG. 6 is a perspective view of the clamping member constructed in accordance with the present invention.

With particular reference to FIG. 1 there is illustrated a connector body 1 and a connector cap 2, each of which is provided with an outer protective cover, a protective metal shell and improved shell grounding means including an overlapping clamping member 22. The ground circuit is completed through a grounding wire of the electrical cables C and through the metal shells 10, which are in electrical contact through the usual spring contact strip 11. The shells 10 are surrounded by outer protective covers P.

The structural elements to be described, which relate to the invention, are identical in their application to both the connector cap and the connector body and, therefore,

the specification shall hereinafter refer to an electrical connector device and the structure described shall apply equally to both types of electrical connector device.

With reference to FIGS. 2–6, there is illustrated a five-wire electrical connector device constructed in accordance with this invention. The device comprises a usual cup-shaped metal shell **10** disposed in an outer cup-shaped protective cover P, which may be made of a strong durable plastic material, support a cable strain relief clamp S at one end, and compress a resilient sealing cushion ring R between it and the closed end of the shell **10**. A first body portion **12** made of a rigid electrical insulation material and cup shaped is located within the shell **10**, and a second body portion **14** of similar material is located within the shell but spaced from the end of the shell by the first body portion **12**, through which the lead wires of an electrical supply cable C extend into the wiring area **15** formed therebetween. The second body portion **14** is massive and recessed, and carries the usual clamp-type terminals **16** which are arranged to receive the electrically conductive power wires **18** of the electrical supply cable C. As can be seen in FIG. 3, the illustrated device includes four electrically conductive power wires **18** each connected to one of the clamp-type terminals **16**, and a separate grounding wire **20** connected directly to a source of ground and to the shell **10** by the overlapping clamping member **22** which is secured to the shell by means of the mounting screws **24**.

The metal shell **10** comprises a substantially cylindrical wall **26** which is open at one end and has a radially inwardly extending flange **28** at its other end which defines a rear wall having a central aperture **29**. A cut-out **30** is formed through the flange **28** and the adjacent portion of the cylindrical wall **26**, and is located centrally of a radially inwardly offset wall portion **32**. The portion **32** is concentric with the cylindrical wall **26**, but has a smaller radius of curvature so as to allow the overlapping clamping member **22** to be seated flush with the outer surface of the cylindrical wall **26**. Located centrally of the portion **32** immediately adjacent the cut-out **30** is a sheared radially inwardly extending arcuate wire clamp portion **34** which is arranged to coact with the overlapping clamping member **22** to secure a ground wire **20** therebetween. Tapped holes **36** are located on each side of the sheared portion **34** and arranged to threadedly receive the mounting screws **24** which secure the overlapping clamping member **22** to the shell **10**.

The clamping member **22** comprises a formed metal plate including an arcuate main wall **38**, having the same radius of curvature as the cylindrical wall portion **26** of the metal shell, and a substantially normal wall **40** which acts to close the cut-out portion in the flange **28** when the clamping member is secured in place and further acts as a snubbing strain relief for the ground wire **20**. Extending laterally outwardly from and described on the same arc as the main wall **38** are opposed lateral mounting arms **42** having screw receiving ways **44**. Ways **44** are slightly larger than the diameter of the shanks of the mounting screws **24** and enable the overlapping clamping member **22** to rest on the shanks of the mounting screws **24** and to be firmly clamped in place by the force of the screw heads when it is desired to secure the clamping member **22** to the shell **10**. Disposed in the main wall **38** are inwardly extending indentations **46** which coact with the sheared arcuate cable clamp portion **34** to lockingly secure the ground wire **20** in place against inadvertent removal when the overlapping clamping member **22** is mounted in place.

The first body portion **12** is constructed so that it can be readily accepted in the metal shell **10**. This is accomplished by molding an inwardly offset walled seat **48** arranged to receive the offset portion **32** of the metal shell. A cut-out **50** similar to the cut-out **30** in shell **10**, is located in the seat **48**, and allows the ground wire **20** to be positioned in place. When positioned in the shell **10**, the first body portion is disposed, as shown in FIG. 2, to have the seat **48** inwardly surround clamp portion **34** of the shell **10**.

To assemble and wire the connector body **1**, the electrically conductive wires **18** are connected to the clamp-type terminals **16** in the usual manner, and the body portions **12** and **14** are secured in the metal shell **10**. The ground wire **20**, is isolated from the conductive wires **18** and moved from the wiring area **15** through the cut-outs **50** and **30**, and is positioned adjacent the exterior surface of the sheared arcuate cable clamp portion **34**. Once the ground wire **20** is so positioned, the overlapping clamping member **22** is slid axially relative to shell **10** and rested upon the shanks of the mounting scerws **24**. Finally, the screws are tightened and the overlapping clamping member **22** is urged toward the shell **10**, thereby securely clamping the ground wire **20** in place between the portion **34** and member **22**, and insuring that the wire **20** will not be inadvertently displaced, by driving the inwardly extending indentations **46** into the wire to effect a lock.

The connector cap **2** is wired and assembled in a generally similar manner. The grounding path is continued from the connector body **1** to the connector cap **2** by means of the usual spring contact strip **11**, located in the usual outwardly deformed skirt portion **52** of the metal shell of the connector body which is biased against the outer surface of the shell of the connector cap.

Having described the improved grounding means for connector device shells, it will be readily appreciated by those skilled in the art that the secure clamping of the grounding wire **20** affords a highly desirable direct grounding of the metal shell by a separate ground path, with all its attendant advantages. Further, the ground wire clamping means formed by shell clamp portion **34** and the arcuate wall **38** is configured to accommodate a variety of large diameter ground wires. Thus, it is apparent that not only has the prior existing deficiency of grounding the metal shells by means of spring biased grounding shunts been eliminated, but that the improved grounding means does not require any grounding terminals, and thereby frees one of the clamp-type terminals **16**, previously used as a ground wire terminal, for use by another electrically conductive power wire **18**. In the improved grounding means, the equipment ground path includes the shell grounding path.

It should be understood that the present disclosure has been made only 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 the scope of the invention.

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

1. An electrical connector device having improved grounding means comprising: a metal shell including a substantially cylindrical wall, and a normal end wall at one end thereof having a central aperture therein; an insulator body member disposed within said metal shell; electrical contact elements having electrical terminal means carried by said body member; said terminal means arranged to secure a plurality of current-carrying wires; and clamping means including a clamping member secured to and arranged to clamp a ground wire directly to said metal shell; wherein said clamping member is substantially L-shaped for engagement with the exterior of said metal shell including a main wall portion of said clamping member for lying adjacent said cylindrical wall for clamping the ground wire between said main wall and said cylindrical wall, and a wall portion disposed substantially normal to said main wall for acting as a strain reliever for the ground wire.

2. The improved electrical connector device defined in claim **1** wherein said main wall is arcuate and has a

curvature substantially conforming to the curvature of said cylindrical metal shell for lying adjacent thereto.

3. The improved electrical connector device defined in claim 2 wherein said clamping member includes inwardly extending indentations disposed in said main wall portion for lockingly securing the ground wire in place between said cylindrical wall and said clamping member.

4. The improved electrical connector device defined in claim 2 wherein: said clamping member further includes laterally oppositely extending arms projecting from said main wall portion which conform to the curvature of said main wall portion; and said clamping means further includes mounting means cooperating with said arms for securing said clamping member to said metal shell.

5. An electrical connector device having improved grounding means comprising: a metal shell including a substantially cylindrical wall, and a normal end wall at one end thereof having a central aperture therein; an insulator body member disposed within said metal shell; electrical contact elements having electrical terminal means carried by said body member; said terminal means arranged to secure a plurality of current-carrying wires; and clamping means including a clamping member secured to and arranged to clamp a ground wire directly to said metal shell; wherein said metal shell includes an offset portion defining a wall portion of smaller concentric curvature relative to said cylindrical wall wherein said clamping member may be seated and, further, includes a radially inwardly extending arcuate portion disposed within said offset wall portion arranged to accommodate the ground wire, so that the ground wire may be clamped between said arcuate portion and said clamping member.

6. The improved electrical connector device defined in claim 5 wherein a cut-out portion is provided in said offset wall portion of said metal shell, adjacent said arcuate portion, and further extends into said normal end wall from said offset wall portion to said central aperture, for allowing the ground wire to be disposed between said arcuate portion and said clamping member.

7. The improved electrical connector device defined in claim 6 wherein an insulating spacer is provided with a cut-out, and an offset seat arranged to receive said offset portion of said metal shell, said cut-out being disposed adjacent said cut-out in said shell when the parts are assembled.

8. An electrical connector device having improved grounding means comprising: a metal shell including a substantially cylindrical wall, and a normal end wall at one end thereof having a central aperture therein; an

insulator body member disposed within said metal shell; electrical contact elements having electrical terminal means carried by said body member; said terminal means arranged to secure a plurality of current-carrying wires; and clamping means including a clamping member secured to and arranged to clamp a ground wire directly to said metal shell; wherein: said metal shell is provided with an inwardly offset wall portion defining a smaller concentric curvature than that of said cylindrical wall, an inwardly extending arcuate portion is disposed within said offset wall portion, and a cut-out is located adjacent said arcuate portion and further extends into said normal end wall from said offset wall portion to said central aperture; said clamping means comprises a substantially L-shaped clamping member including an arcuate main wall portion having a curvature substantially conforming to the curvature of said cylindrical wall for being seated adjacent said inwardly offset wall portion and being substantially flush with the outer diameter of said cylindrical wall, laterally oppositely extending arms projecting from said main wall portion which conform to the curvature of said main wall portion, inwardly extending indentations disposed in said main wall portion for lockingly securing the ground wire in place between said inwardly extending arcuate portion and said arcuate main wall portion, and a substantially normal wall portion at one end of said arcuate main wall portion acting as a snubbing strain relief for the ground wire; and said clamping means further includes mounting means cooperating with said arms for securing said clamping member to said metal shell.

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U.S. Cl. X.R.

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