

[54] **GROUNDING CONNECTORS FOR SHIELDED CABLE**

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[51] Int. Cl. **H01r 11/20**

[58] Field of Search **339/95, 97-99, 339/14, 263; 174/78**

[56] **References Cited**

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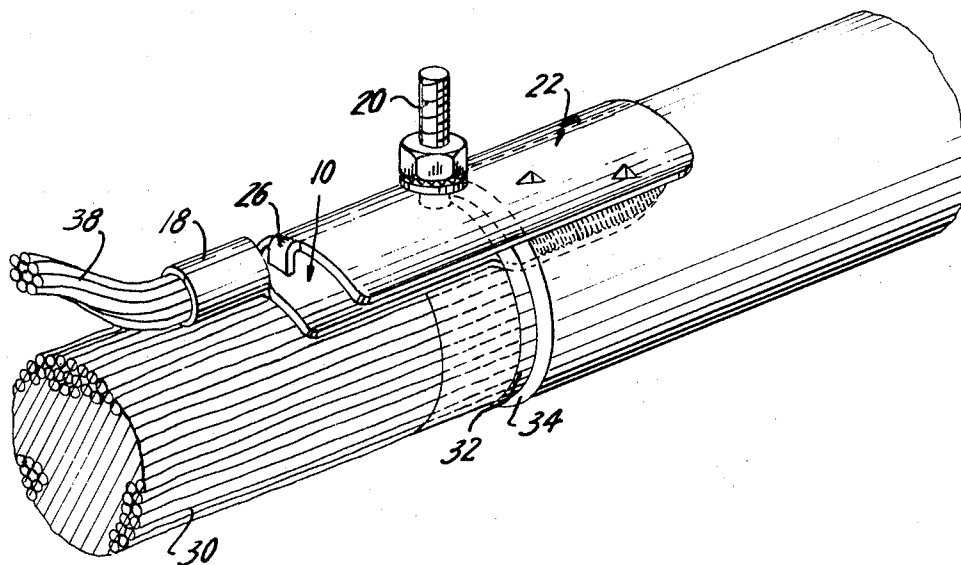
[57] **ABSTRACT**

A grounding connector for shielded and insulation-sheathed cable includes upper and lower plates cylindrically curved about the axis of the cable. The lower

plate is divided by an off-set into a contact portion that is slipped underneath the shield and bears against the bundle of cable conductors, and a clamp portion that is spaced out of potentially damaging contact with the cable wires. A stud projects from the clamp portion of the lower plate adjacent the off-set through the upper plate and bears a nut for drawing the plates toward each other. The clamp portion of the lower plate has an integral solderless connector for a grounding conductor, providing a solid metallic path from the shield to the grounding conductor. Differing from other connectors of this class, there is no tendency for stresses applied to the grounding conductor to loosen the disclosed connector.

Special ridges are formed by grooves in the cylindrical outward-facing surface of the contact portion, one side of each ridge being in a plane perpendicular to the cylindrical axis and the other surface of each ridge sloping from the bottom of the groove toward the stud. There is a narrow crest between each groove and the next. The ridges facilitate insertion of the contact portion of the lower plate inside the cable shield, and yet the ridges resist mechanical pull-out stresses and provide stable electrical contact to the inside surface of the shield without cutting the shield.

7 Claims, 5 Drawing Figures



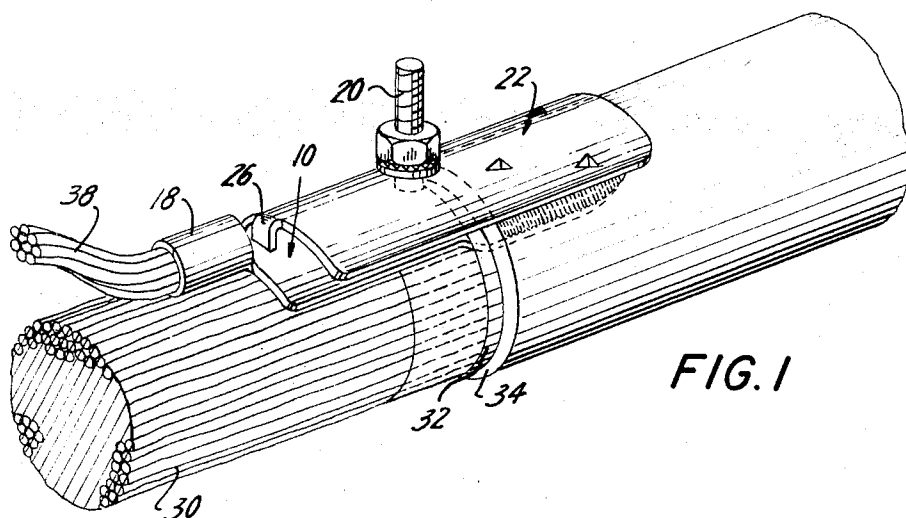


FIG. 1

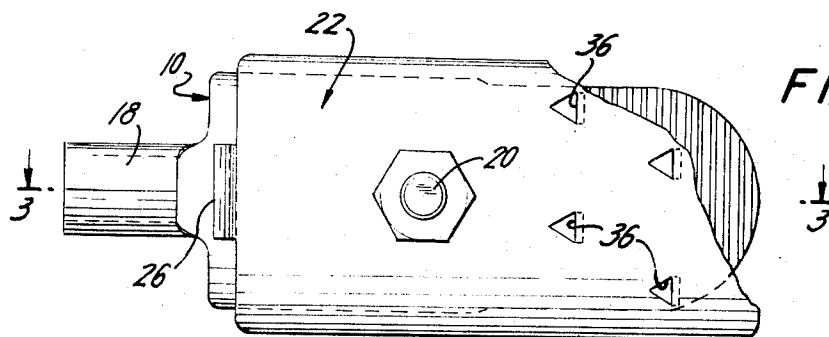


FIG. 2

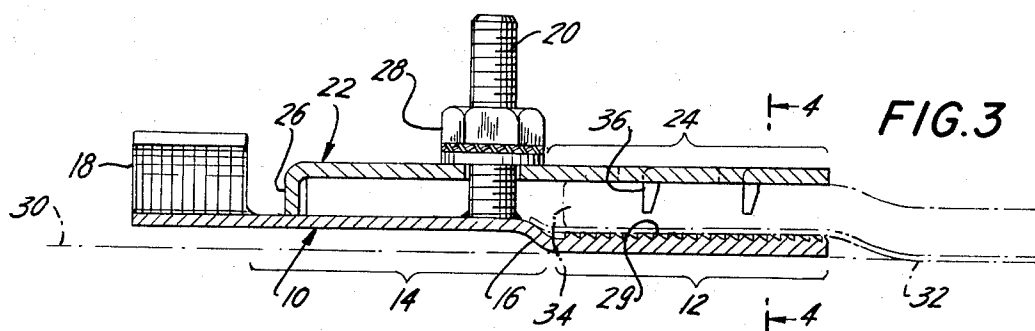


FIG. 3

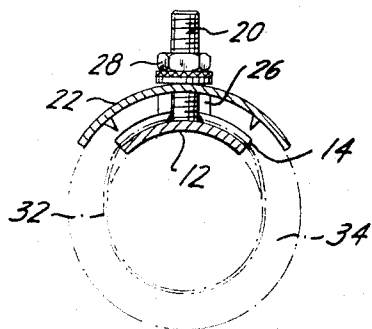


FIG. 4

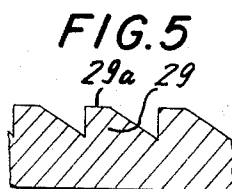


FIG. 5

GROUNDING CONNECTORS FOR SHIELDED CABLE

This invention relates to connectors for grounding the shields of electrical cables.

BACKGROUND OF THE INVENTION

Multi-conductor cable such as those used for telephone lines have many insulated conductors or conductor pairs within a braided wire shield, which in turn has a sheath of insulation. Where a cable is to terminate, the shield is to be connected to ground. Any of a variety of known clamps and a grounding wire are used for that purpose.

SUMMARY OF THE INVENTION

The present invention aims at providing a new and improved grounding clamp intended primarily for that purpose. Several novel features pointed out below are included in the illustrative embodiment of the invention which is described in detail below. The illustrative grounding clamp includes a lower plate and an upper plate, both cylindrically curved about a common axis, the axis of the cable. A stud projects radially outward from the lower plate between its ends, through a hole between the ends of the upper plate. To one side of the stud, the lower plate has a contact portion which in use is pushed inside a metal-foil shield, and the upper plate has an opposite portion that is pressed against the insulating sheath on the shield when a nut on the stud is tightened. A foot projects from the opposite end of the upper plate to bear against the lower plate, for causing distributed pressure of the lower and upper plates against the inside of the cable shield and the outside of the insulating sheath. The novel features are applied to this form of connector.

The contact portion of the lower plate has a pattern of curved ridges facing outward, to engage the cable shield from the inside and to form a secure and highly dependable electrical and mechanical connection to the shield.

As a further feature, the lower plate is formed to include an integral solderless connector for the grounding wire. This arrangement provides a grounding current path free of mechanical joints between the contact portion of the lower plate that engages the shield and the part of the grounding connector to which the grounding conductor is united. This construction contrasts with the usual arrangement in which a grounding conductor has a screw-and-nut connection to the connector. In that case there is danger of the joint becoming poor electrically due to corrosion or due to loosening. Here, the ridged contact area of the lower plate serves the added purpose of resisting unplanned stresses imposed on the grounding wire, maintaining reliable connection to the shield.

As a still further feature, there is an off-set in the lower plate of the illustrative clamp adjacent the contact portion, spacing the rest of the lower plate up and away from the insulated conductors of the cable. Accordingly, there is no possibility of that part of the lower plate which projects from the shield causing damage to the conductors of the cable. Moreover, the off-set accommodates insulation which can be wrapped protectively around the bundle of conductors that projects from an end of the shield.

While certain of these features might be omitted, thus sacrificing their advantages, they cooperate in achieving an excellent, highly reliable, and easy-to-use grounding connector.

The nature of the invention and its novel features and advantages will be better appreciated from the following detailed description of the illustrative embodiment which is shown in the accompanying drawings.

In the drawings:

FIG. 1 is a perspective view of the illustrative grounding connector assembled to a shielded cable;

FIG. 2 is a top plan view, slightly enlarged, of the grounding connector of FIG. 1, a portion of the upper plate thereof being broken away to reveal part of the contact portion of the lower plate;

FIG. 3 is a longitudinal cross-section of the connector of FIG. 2 as viewed at the plane 3—3 therein, portions of a cable being shown in phantom;

FIG. 4 is a cross-sectional view of the illustrative grounding connector as viewed from the plane 4—4 in FIG. 3, portions of a cable being shown in phantom; and

FIG. 5 is a greatly enlarged detail of FIG. 4.

Referring now to the drawings, lower plate 10 has a contact portion 12 and a clamp portion 14, with an off-set 16 between them. A solderless connector 18 extends from the end of clamp portion 14 of plate 10. A fixed stud 20 projects from plate 10 radially outward, noting the cylindrical curvature of the portions 12 and 14 of plate 10 as shown in FIG. 4.

Stud 20 extends through a hole in upper plate 22. An area 24 of plate 22 is disposed opposite contact area 12. At the opposite end, plate 22 has a foot 26 projecting toward lower plate 10. A nut 28 on stud 20 can be tightened to pull upper plate portion 24 and contact portion 12 toward each other. Foot 26 provides for evenly distributed pressure over the common area of plate portions 12 and 24.

Contact portion 12 has cylindrical curvature, and on its outer convex surface there are many grooves that form ridges 29. Each ridge has one transverse surface, i.e., a surface perpendicular to the cylindrical axis, and each ridge has a conic surface sloping from the bottom of each groove generally toward stud 20. Each ridge has a narrow crest 29a between each groove and the next, the crest having the cylindrical curvature of the original surface of contact portion 12. The ridges are small but well-defined. In an example, there are fourteen ridges per inch, measured along a line parallel to the longitudinal axis of the connector.

The ground connector of FIGS. 1-4 is intended for use on a multiple-conductor cable shown variously in the drawings. Multiple conductors 30 of the cable project from an end of shield 32 of aluminum foil and from insulation sheath 34. The shield is shown optionally projecting a bit from the sheath.

Upper plate 22, clamp portion 14, and contact portion 12 are cylindrically curved, having successively smaller radii of curvature and having a common axis that should coincide with the axis of the cable for a connector properly matched to the cable. The difference in radii of the upper, convex surface of portion 12 and the lower concave surface of plate 22 is chosen to equal the combined thickness of shield 32 and sheath 34. Leg 26 is of a length chosen to assure uniformly distributed bearing pressure of contact portion 12 and op-

posite portion 24 of the upper plate against shield 32 and sheath 34 when nut 28 is tightened.

Barbs 36 are provided at four places, being lanced out of upper plate 22 to penetrate into sheath 34.

A grounding conductor 38 which may be No. 6 stranded wire is inserted into the hollow of solderless conductor 18. Foot 26 guards against excessive length of the grounding conductor being inserted. Connector 18 is then crimped, permanently uniting the conductor to lower plate 10 including its contact portion 12.

A grounding connector is needed for making a dependable ground to the cable shield, where the insulating sheath 34 has been cut back and shield 32 is accessible. It is not necessary to slit the metal-foil shield and the sheath in using the described grounding connector. Contact portion 12 is pushed into place underneath or inside the shield. The sloping surfaces of the ridges are helpful in this operation. Then nut 28 is tightened. Barbs 36 dig into the insulating sheath, and ridges 29 form a firm interlocking grip engaging the shield. The resulting electrical and mechanical connection to the shield is secure and stable, yet there is no danger of cutting the shield which is commonly of aluminum foil. It is well suited to prevent shift of the grounding connector, due to the edges formed between the crest of each ridge and its transverse surface. The grounding connector is also well suited to resist stresses unintentionally applied to grounding conductor 38 that might tend to shift the grounding connector in relation to the shield. Plate 10, including its solderless connector 18, and contact portion 12 are one unitary metal part, largely immune to problems of loosening and corrosion that sometimes introduce troublesome electrical resistance between component parts of other forms of grounding connectors. Moreover, the tightness of nut 28 on stud 20 is unaffected by mechanical stresses that might be imposed by the grounding conductor. This contrasts with connectors where the grounding conductor is secured to a stud.

Off-set 16 spaces clamp portion 14 and solderless connector 18 of the lower plate away from conductors 30 of the cable. This spacing protects the insulated wires of the cable against potential damage. Further, the bundle of insulated wires 30 can be wrapped with protective insulation, the thickness of which would be accommodated by the off-set.

The foregoing illustrative embodiment of the invention represents an exemplary grounding connector incorporating the various novel features of the invention, certain of which may be used to advantage without others, and which may be incorporated in modifications made by those skilled in the art. Consequently, the invention should be construed broadly in accordance with its true spirit and scope.

What is claimed is:

1. A grounding connector for shielded and insulation-sheathed cable, including elongated upper and lower plates, said upper plate having prominent cylindrical curvature about an axis parallel to its length, said lower plate having a transverse off-set dividing the lower plate into a sheath-contacting portion and a clamp portion, each of said portions having prominent cylindrical curvature about said axis, the radii of curvature of said upper plate, said clamp portion and said shield-contacting portion being successively smaller, a stud projecting radially outward from said clamp portion adjacent said off-set and a nut on the stud for

drawing said plates toward each other, and a foot projecting between an end of said upper plate and said clamp portion of the lower plate, said foot being integral with one of said plates and disposed for bearing against the other of said plates, so that when said contact portion is in position inside an end portion of the shield of a cable and said upper plate is tightened against an insulation sheath on the shield, the foot assures distributed clamping pressure of said plates against the insulation and the shield, and the grip of the shield and sheath by the contact portion and the upper plate supports the clamp portion of the lower plate in a position spaced from underlying portions of the cable projecting out of the shield.

2. A grounding connector in accordance with claim 1, including a solderless connector integral with said lower plate at the end of said clamp portion remote from said off-set, whereby the tightness of the stud and nut is virtually unaffected by stress that may be imposed on a conductor united to said solderless connector.

3. A grounding connector in accordance with claim 1, wherein the convex outer surface of said contact portion of the lower plate has many transverse grooves forming narrow ridges, one lateral face of each ridge being substantially perpendicular to said axis and another lateral face of each of said ridges sloping generally away from said stud, for secure contact of the grounding connector with the shield despite possible stress tending to pull the contact portion out of said position gripping said shield and for easy insertion thereof under such shield.

4. A grounding connector in accordance with claim 3, wherein said upper plate has teeth projecting toward said contact portion and slanting toward said off-set for complementing said ridges in resisting pull-out stress on the grounding clamp.

5. A grounding connector in accordance with claim 3, including a solderless connector integral with the clamp portion of said lower plate for securing a grounding conductor to the grounding connector, said ridges resisting connector-shifting stresses that may be applied to the grounding conductor.

6. A grounding connector for shielded and insulation-sheathed cable, including elongated upper and lower plates having prominent cylindrical curvature about a common axis parallel to their lengths, said lower plate having a contact portion for insertion directly inside the cable shield for making secure electrical and mechanical contact with the shield and having a clamp portion that, in use, projects outside the shield, a stud projecting radially outward from said clamp portion adjacent said contact portion of the lower plate, a nut on the stud for drawing the plates toward each other, a foot projecting between an end of said upper plate and the clamp portion of the lower plate, said foot being integral with one of said plates and disposed to bear against the other of said plates so that when the contact portion is inside the cable shield and the upper plate is tightened against the sheath, said plates apply distributed pressure against the insulation sheath and the shield of the cable in the area of said contact portion, the convex outer surface of said contact portion of the lower plate having many transverse grooves forming smooth-crested ridges, one lateral face of each ridge being substantially perpendicular to said axis and another lateral face of each of said many ridges sloping

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generally away from said stud, for secure contact of the grounding clamp with the shield despite possible stress tending to pull the contact portion out of said position gripping said shield.

7. A grounding connector in accordance with claim 6, including a solderless connector integral with the

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clamp portion of said lower plate for securing a grounding conductor to the grounding connector, said ridges resisting connector-shifting stresses that may be applied to the grounding conductor.

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