

[54] **METHOD AND MEANS FOR CONNECTING TO A METALLICALLY SHEATHED CABLE**

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[52] U.S. Cl. **339/97 R**

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

[58] Field of Search **339/95, 97, 99**

[56] **References Cited**

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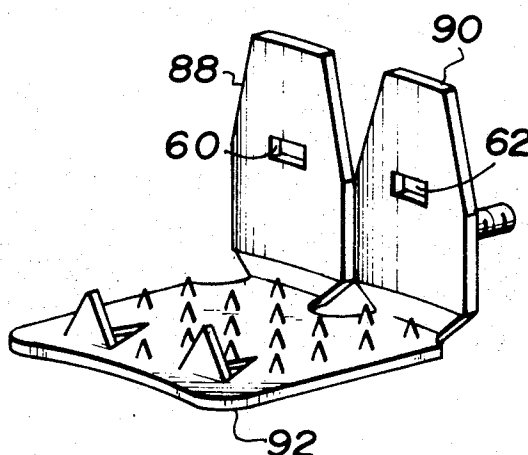
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Attorney—David Teschner et al.

[57] **ABSTRACT**

A connector and method for rapidly and conveniently connecting the sheath of a metallically sheathed cable to a further conductive member and including in one embodiment, a body member having at least a pair of hingedly coupled, superpositionally disposable arms at least one of which is provided, on its interior face, with insulation piercing teeth and at least one elongate member serving as a locking tab, and the other of which is provided with a mating tab receiving aperture to facilitate the interlocking of said arms, and coupling means preferably for attaching the connector to a conductive strap or lead. The connector may be integrally formed to provide a unitary foldable cliplike structure readily securable about a selectively exposed portion of the metallic cable sheath. The coupling means may include a threaded extension, deformable projections, or apertured tongue formed integrally with, or suitably attached to, the connector body member.

1 Claim, 15 Drawing Figures



3 Sheets-Sheet 2

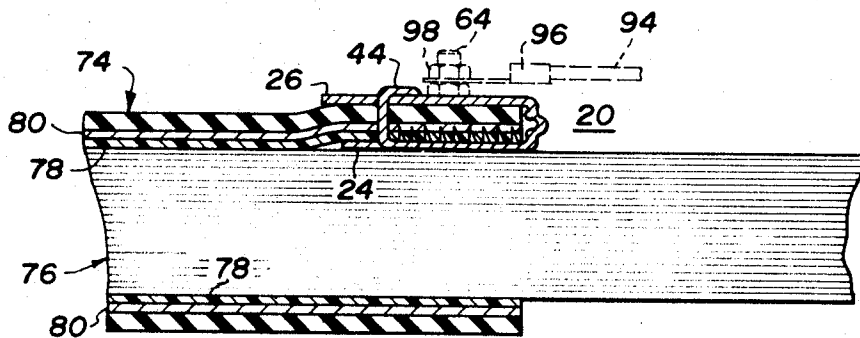


FIG. 6

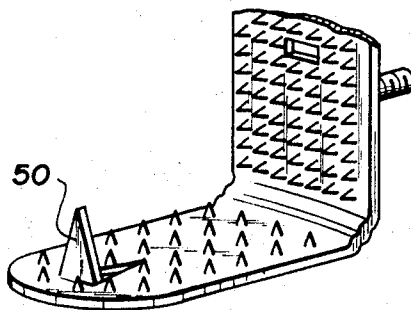


FIG. 7

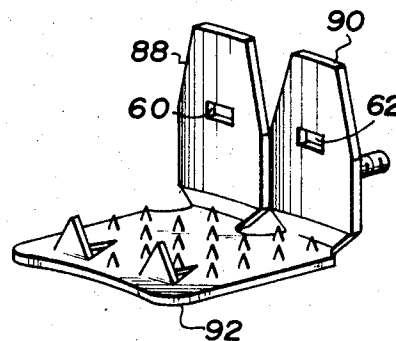


FIG. 8

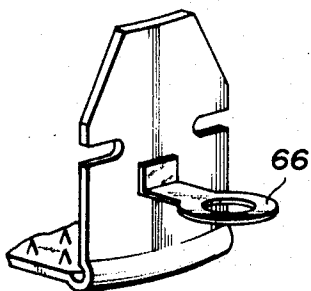


FIG. 9

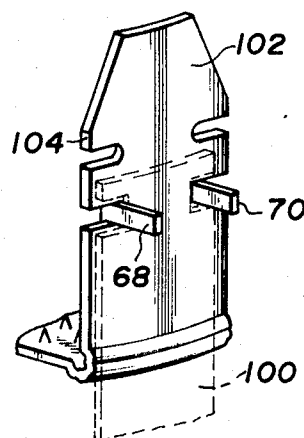


FIG. 10

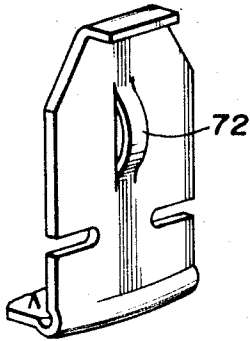


FIG. 11

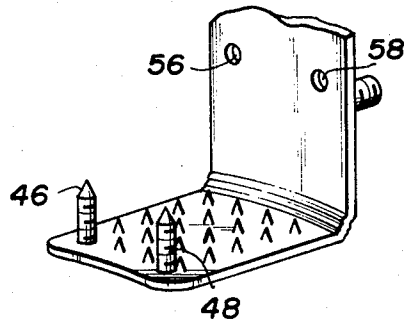


FIG. 12

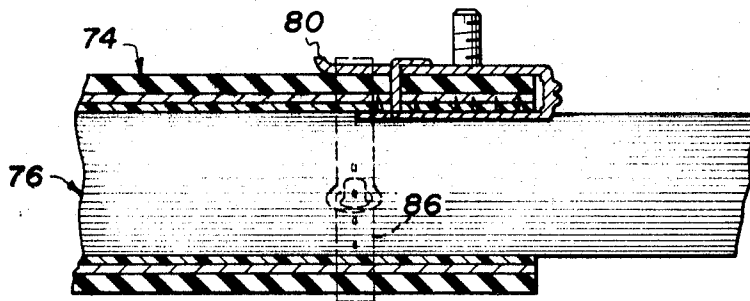


FIG. 13

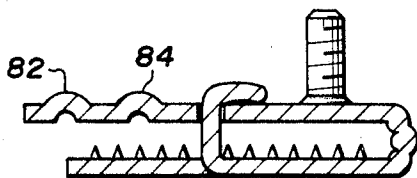


FIG. 14

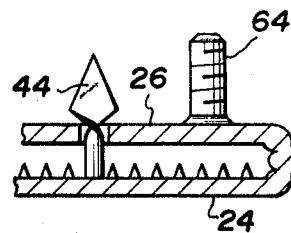


FIG. 15

METHOD AND MEANS FOR CONNECTING TO A METALLICALLY SHEATHED CABLE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention is directed to the field of connectors and principally to a method and means for connecting the sheath of a metallicly sheathed cable to a further conductive member or to ground.

2. Description of the Prior Art

Many present day applications require the use of cable bundles suitably covered with generally a thin, insulated, aluminum sheath or foil which is required to be electrically connected to an appropriate further conductive member of suitable ground point to effect adequate shielding of the enclosed cable conductors. Because of the difficulty in effecting a suitable bond directly to the relatively thin and structurally weak aluminum sheath, which would require removal of the insulation thereabout, with the high probability of damage thereto, various connectors have been devised in an attempt to alleviate this problem. Such connectors, according to the prior art, generally comprised, in one form or another, a multiplicity of individual components adapted to provide a sandwich-like assembly including a portion of the insulated sheath interposed between the connector components. The assembly was then generally tightened by the engagement of a threaded nut onto a threaded stud extending from the lower connector component through the previously apertured insulated sheath and thence through a receiving aperture in the upper connector component. To effect an adequate electrical connection between the connector components and the insulated sheath, it was necessary to laboriously scrape the sheath clean of insulation adjacent the area of mutual contact in a time-consuming and expensive operation, and thereafter rely on direct pressure between the adjacent surfaces to afford adequate electrical contact therebetween, which, in turn, depend on the degree of force applied to the engaging nut. To connect a further conductive member such as a ground strap or the like to the connector, a further nut was required to attach the ground strap or its associated terminal onto the extending portion of the threaded stud. In many cases either the nut or stud was stripped, distorted, or deformed during the tightening operation, due to the high degree of force required to establish sufficient contact for an adequate connection, thereby seriously impairing the resulting connection, and requiring a time-consuming and costly disassembly and re-assembly procedure. Attempts to at least partially overcome the above-described difficulties by providing insulation piercing teeth on the interior face of one or more of the individual connector components to avoid the sheath stripping operation still failed either to reduce the required number of components, or to overcome the additional difficulties mentioned heretofore.

SUMMARY OF THE INVENTION

The invention overcomes the problems and limitations noted above with respect to prior art devices by providing a preferably integrally formed, foldable connector which is more economical, convenient, reliable, and efficient than such devices. A plurality of insulation piercing means preferably in the form of sharpened teeth are disposed on at least a portion of the inte-

rior face of at least one of preferably a pair of hinged coupled arms, a first of which further includes at least one elongate member extending from its interior face and aligned for cooperable engagement with an associated receiving aperture in a second of said arms to maintain said arms in tightly closed engagement about an interposed portion of the cable sheath, as the first arm is inserted between the sheath and the encompassed cable and the second arm is preferably folded thereover. The elongate member may take the form of either a threaded or unthreaded preferably pointed projection, the free end of which may be either twisted, bent, deformed, or arranged to receive a nut or enlarged member thereover to maintain the aforementioned closure. The pointed projection may be further advantageously utilized to pierce through the cable sheath during the assembly operation, thereby obviating the need for providing a pre-punched or slit aperture therefore. Extending outwardly from the exterior face of the second or outer arm is coupling means which may comprise a threaded stud or one or more deformable projections which may be effectively employed to attach the connector to a conductive strap or ground wire. It is therefore an object of this invention to provide an improved connector.

It is another object of this invention to provide a reliable means for grounding the sheath of a metallicly sheathed cable.

It is a further object of this invention to provide a method of forming a reliable, rapid, convenient and economical connection between the sheath of a metallicly sheathed cable and a further conductive member such as a ground strap or the like.

It is still another object of this invention to provide an improved means for grounding the insulated sheath of a metallicly sheathed cable while obviating the need for removing the insulation therefrom prior to effecting the connection thereto.

It is yet another object of this invention to provide an integrally formed, foldable connector adapted for attachment to the sheath of a metallicly sheathed cable and including means integral therewith for coupling said sheath to a further conductive member.

It is still a further object of this invention to provide an improved connector adapted to be attached to the sheath of a metallicly sheathed cable, locked thereon, and coupled to a further conductive member such as a grounding strap or the like.

Other objects and features of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings which disclose, by way of example, the principle of the invention and the best mode contemplated for carrying it out.

BRIEF DESCRIPTION OF THE DRAWINGS:

In the drawings:

FIG. 1 is a perspective view of an improved connector constructed in accordance with the concepts of the invention.

FIG. 2 is a fragmentary elevational view of a portion of the device of FIG. 1.

FIG. 3 is a fragmentary plan view, partly in section of a portion of the device of FIG. 1 taken along the line 3-3.

FIG. 4 is a fragmentary side elevational view of a portion of the device of FIG. 1.

FIG. 5 is a perspective view of the device of FIG. 1 showing the partial assembly thereof to the sheath of a typical metallicly sheathed cable.

FIG. 6 is a side elevational view, partly in section, showing the completion of the partial assembly shown in FIG. 5.

FIG. 7 is a fragmentary perspective view, partly in section, of a further embodiment of a connector constructed in accordance with the concepts of the invention.

FIG. 8 is a perspective view, of yet another embodiment of a connector constructed in accordance with the concepts of the invention.

FIGS. 9, 10, 11 and 12 are fragmentary perspective views of still further embodiments of a connector constructed in accordance with the concepts of the invention.

FIG. 13 is a side elevational view, partly in section, in which a further embodiment of a connector constructed in accordance with the concepts of the invention is shown attached to the sheath of a typical metallicly sheathed cable, and further engaged thereto by a strap.

FIG. 14 is a side elevational view, in section, of still a further embodiment of a connector constructed in accordance with the concepts of the invention.

FIG. 15 is a fragmentary side elevational view, partly in section, showing an embodiment of a method for interlocking the arms of a connector constructed in accordance with the concepts of the invention.

Similar elements are given similar reference characters in each of the respective drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

Turning now to FIGS. 1, 2, 3, 4, 5, and 6 there is shown a connector 20 constructed in accordance with the concepts of the invention. Connector 20 comprises essentially a preferably integral body member 22 which may be suitably formed from preferably electrically conductive metal stock or sheet to define first and second arms 24, 26 respectively, hingedly coupled together by an interconnecting portion 28 which may be provided with one or more generally transverse recesses 30 (FIG. 4) to enhance the foldability of connector 20 during the assembly operation more fully described hereafter. Each of the respective arms 24, 26 comprises an interior face 32, 34 and an exterior face 36, 38, respectively. Extending outwardly from the interior face 32 of arm 24 are insulation piercing means in the form of pointed teeth 40 which may be disposed on either one or both interior faces 32, 34 or on selective portions thereof, as necessary, desirable, or convenient. A pair of spaced elongate members 42, 44, which may be formed either as generally pointed protrusions, substantially as shown in FIGS. 1 and 2, or as preferably pointed threaded studs 46, 48, as shown in FIG. 12, and which may be either increased in number or limited to a single member such as 50 (FIG. 7), extend outwardly from the interior face 32 of arm 24, each of said members 42, 44 being aligned for cooperable mating engagement with an associated receiving aperture such as open slots 52, 54, respectively, extending through arm 26, as arms 24 and 26 are superpositionally disposed. The associated receiving apertures may, of course, take various other suitably dimensioned convenient configurations such as, for example, the substantially round

openings 56, 58 shown in FIG. 12, or the generally rectangular openings 60, 62 shown in FIG. 8. To permit the attachment of a further conductive member such as a ground strap or the like to connector 20, there is provided coupling means such as threaded stud 64 extending outwardly from the exterior face 38 of arm 26. The exact location of stud 64 on the exterior face 38 of arm 26 will, of course, generally be a matter of choice, but it has been found that the closer the stud 64 is located to the juncture of the arms 24, 26, within practical limits, the less tendency there will be for the arms 24, 26 to separate upon the application of a tensile force upon the stud 64. The stud 64 may, of course, be readily replaced by other suitable coupling means such as, for example, the apertured terminal-like extension 66 shown in FIG. 9, the deformable projections 68, 70 shown in FIG. 10, or the lanced protrusion 72 shown in FIG. 11. It will, of course, be readily apparent to those skilled in the art that one or more of the aforementioned coupling means may be used in combination with anyone or more of the others illustrated without departing from the spirit of the invention. Each of the arms 24, 26 may be configured to define a substantially planar member or may be suitably contoured in a generally arcuate configuration substantially as shown in FIGS. 1, 2 and 3 wherein the connector will more closely conform to the generally curved contour of the metallic sheath about which it is to be fastened. In FIG. 6 there is illustrated a typical assembly of a connector 20 to the sheath 74 of a metallicly sheathed cable 76. The arms 24, 26 of connector 20 have been disposed about the opposing sides of an exposed portion of the sheath 74 and closed thereagainst substantially as shown. The sheath 74 may be suitably apertured prior to assembly, as at 43, 45 (FIG. 5), to freely receive the elongate members 42, 44 therethrough. Where, however, the sheath 74 has not been pre-punched or otherwise apertured to freely accept the elongate members 42, 44, the piercing of the sheath may be readily accomplished by the use of the pointed configuration of said elongated members 42, 44 wherein as the arms 24, 26 are brought into contact with said sheath 74, as shown in FIG. 6, the elongate members 42, 44 are caused to pierce through the sheath and enter and extend at least partially through the receiving apertures 52, 54 in the arm 26. Sufficient pressure is then applied to the arms 24, 26 to cause the piercing members 40 to pierce through the insulation 78 disposed on the under side of sheath 74 and thereafter contact the metallic portion 80 of the sheath 74 thereby establishing adequate electrical and mechanical contact therewith. The elongate members 42, 44 are thereafter bent over to maintain the arms 24, 26 in closed engagement about the portion of sheath 74 interposed therebetween. A sufficient retention of the arms 24, 26 in the closed position may be accomplished by twisting or otherwise deforming the generally elongate members 42, 44 substantially as shown in FIG. 15. The deformation need only be sufficient to prevent the elongate members 42, 44 from retrogressing back through the apertures 52, 54 in arm 26. Where there is substituted for the elongate members 42, 44 threaded studs such as 46, 48 shown in FIG. 12, appropriately threaded nuts (not shown) may be threaded upon such studs 46, 48 to maintain the arms 24, 26 in closed relationship. Arm 26 may be provided with an up-turned lip 80, substantially as shown in FIG. 13, or at least a pair of generally transverse ribs 82, 84, as shown in

FIG. 14, which may be conveniently employed to selectively position and retain a strap such as 86 which may be circumferentially disposed about the cable 76 to further maintain the arms 24, 26 in a closed position upon the sheath 74. It should be noted that the closure of arms 24, 26 about a selective portion of the sheath 74 has been accomplished independently of the use of stud 64, thereby advantageously avoiding the problems noted above with respect to prior art connectors. The single arm 26 shown in FIG. 1 may be replaced by, for example, a pair of such arms 88, 90 as illustrated in FIG. 8, each of said arms 88, 90 being independently deformable upon its respective portion of the opposing arm 92. This structure may be effectively utilized, for example, to reduce the force required to bend the arms 88, 90 into engagement with the interposed sheath during the assembly operation. To effect the coupling of connector 20 to either a further conductive member of a ground strap such as 94, as shown in FIG. 6, a portion of the strap 94 may be either wrapped around the stud 64 or affixed thereto by means of a terminal 96 attached to the free end thereof and placed about the stud 64. A nut 98 may thereafter be tightened about the stud 64 to secure the strap 94 thereto. The deformable members 68, 70 shown in FIG. 10 may be effectively employed to engage a suitably recessed conductive strap such as 100 to the exterior face 102 of the arm 104 shown in FIG. 10. The strap 100 may be placed against the exterior face 102 substantially as shown and the deformable members 68, 70 folded tightly thereagainst to accomplish the coupling assembly. The coupling means 66 shown in FIG. 9 and 72 shown in FIG. 11 provide alternate means for attaching a conductive strap or wire to the connector. The wire may be fastened thereto either by soldering, welding, or other suitable bonding techniques. To facilitate the insertion of arm 24 between the metallic sheath 74 and the cable 76, the sheath 74 may be slit as shown at 105 in FIG. 5 to expose a sufficient portion thereof for engagement with arm 24. Although the slits 105 shown in FIG. 5 are

deposited in a generally longitudinal direction, one or more circumferentially disposed slits may be alternatively utilized to effect a similar result. It should be readily appreciated that the assembly as described provides secure mechanical and electrical engagement between connector 20 and sheath 74 and that the conductive strap 94 may be repeatedly removed from the connector and reassembled thereto without disturbing the electrical connection previously made.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A connector comprising: a body member having at least one first arm, at least two second arms, and an interconnecting portion therebetween joining said first and said second arms in hinged relationship, said first and said second arms each having an interior face and an exterior face, said faces being disposed in generally spaced parallel planar relationship, said respective interior faces being positionable in adjacent opposing relationship as said first and said second arms are superpositionally disposed, said second arms being in juxtaposition, each being independently joined to its associated interconnecting portion; coupling means extending outwardly from said second arm exterior face for coupling said connector to a further article; insulation piercing means disposed on at least a portion of at least one of said interior faces; said second arm having at least one aperture extending therethrough between said interior and exterior faces thereof; at least one generally elongate member extending outwardly from said first arm interior face and aligned for engagement with said second arm apertured as said first and second arms are disposed in substantially superpositional relationship, said elongate member and its associated aperture being arranged to provide locking means for maintaining said first and said second arms in tight engagement about a further article inserted therebetween.

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