United States Patent [19]

Haitmanek

[11] **3,897,127**

[45] **July 29, 1975**

[54] **MEANS FOR GROUNDING A SHIELDED CABLE**

[75] Inventor: **Louis F. Haitmanek,** Florham Park, N.J.

[73] Assignee: **Thomas & Betts Corporation,** Elizabeth, N.J.

[22] Filed: **Mar. 8, 1974**

[21] Appl. No.: **449,270**

[52] **U.S. Cl.** ..... **339/97 C;** 339/223 R; 339/276 R

[51] **Int. Cl.²** **H01R 11/08;** H01R 11/20

[58] **Field of Search** ..... 339/97 R, 97 C, 98, 220 R, 339/223 R, 276 R, 276 T

[56] **References Cited**

UNITED STATES PATENTS

2,890,267	6/1959	Forney	339/276 R X
2,901,528	8/1959	Lazar	339/223 R X
3,546,365	12/1970	Collier	339/276 R X
3,549,787	12/1970	Churla	339/223 R X

Primary Examiner—Roy Lake
Assistant Examiner—E. F. Desmond
Attorney, Agent, or Firm—David Teschner; Jesse Woldman

[57] **ABSTRACT**

A pair of concentric hollow metallic sleeves are provided with sheath engaging means which may be in the form of raised protrusions disposed on one or both of the opposing surfaces of said sleeves to engage and electrically join the sheath of a sheathed cable to an external conductor upon the radial compression of the outer one of said sleeves after positioning a portion of the sheath and the external conductor within the annular gap existing between said sleeves. The resulting composite structure provides secure mechanical and electrical engagement between the external conductor, the sheath of the sheathed cable and the inner and outer metallic sleeves while additionally providing a smooth burr-free termination thereat. The sheath engaging means may comprise a series of raised ridges extending either parallel to the longitudinal axis of each of the sleeves or oblique thereto in selective patterns. The inner or outer sleeves may be further provided with selectively formed recesses designed to at least partially encompass the external conductor while additional recesses may be provided within the outer surface of the outer sleeve to relieve the stress formed thereby by the compression of the outer sleeve about the inner sleeve.

3 Claims, 14 Drawing Figures

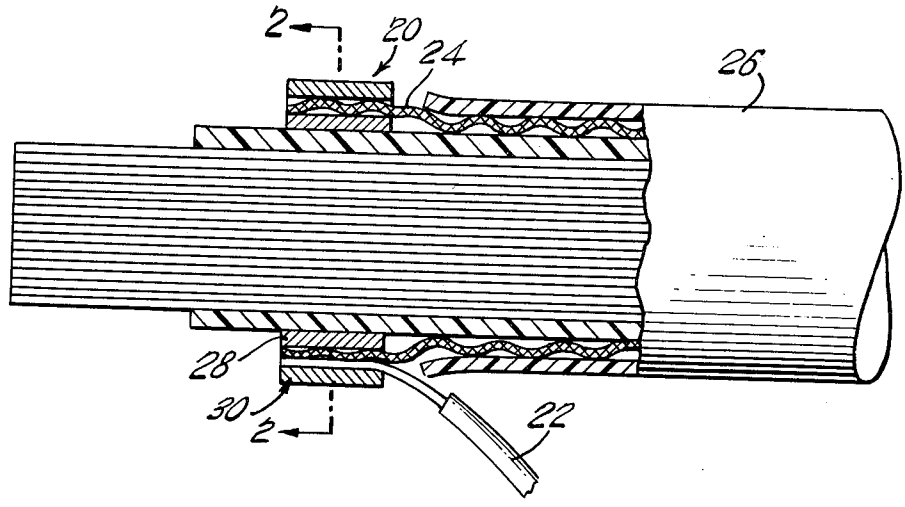


Fig. 1.

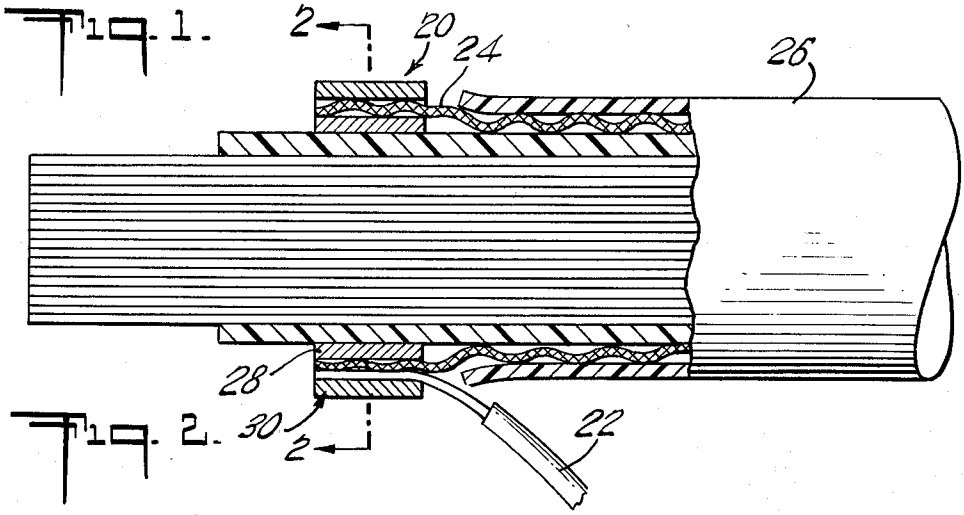


Fig. 2.

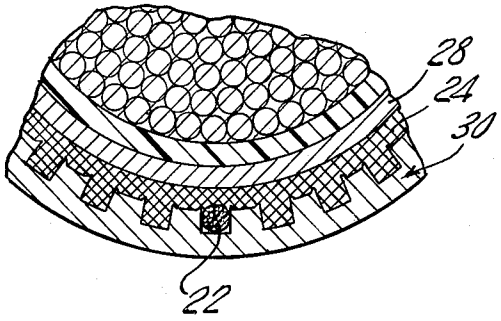


Fig. 3.

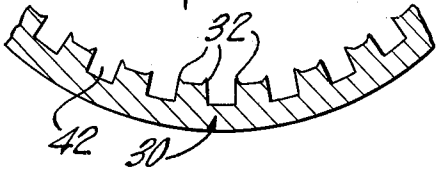


Fig. 4.



Fig. 5.

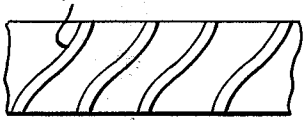


Fig. 6.

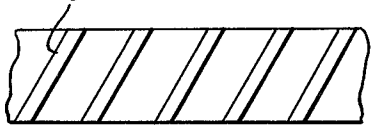


Fig. 7.

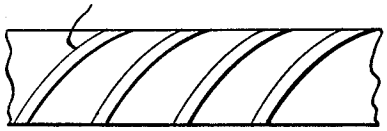


Fig. 8.

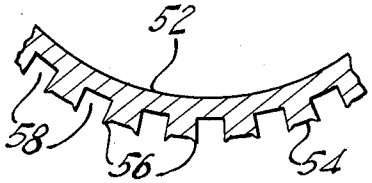


Fig. 9.

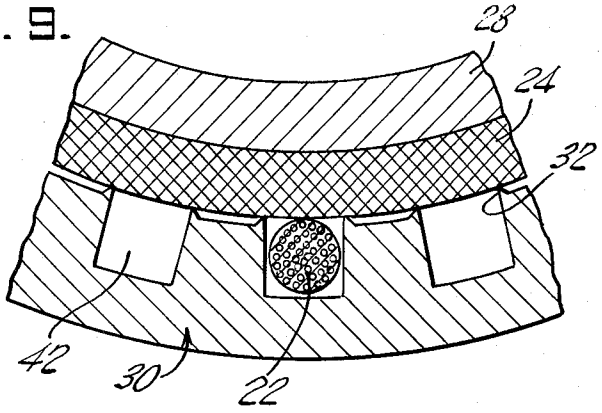


Fig. 10.

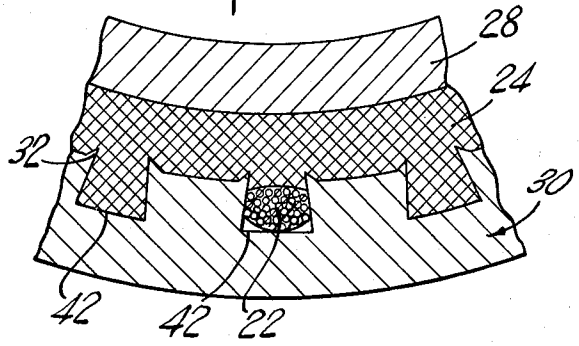


Fig. 11.

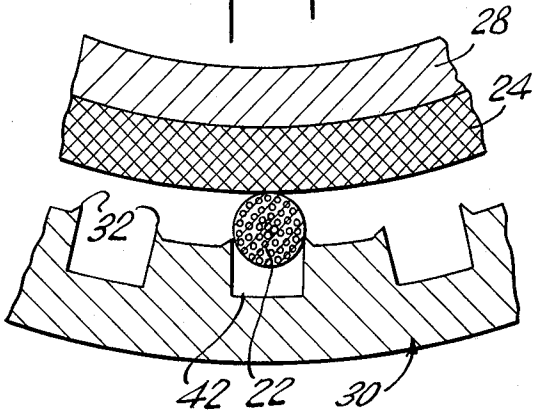


Fig. 12.

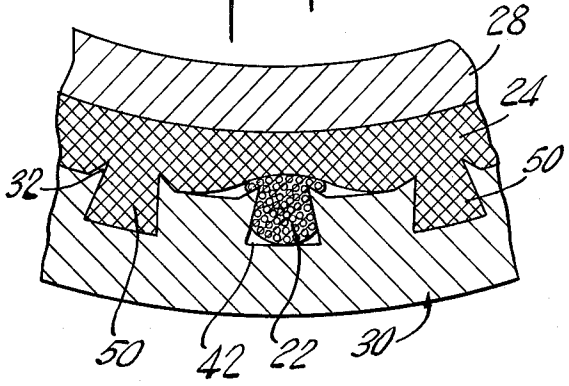


Fig. 13.

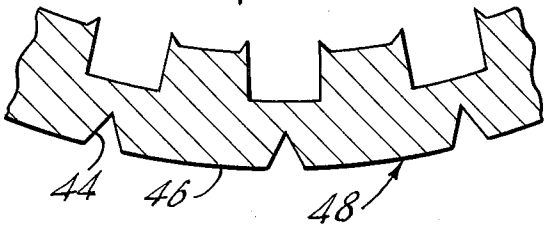
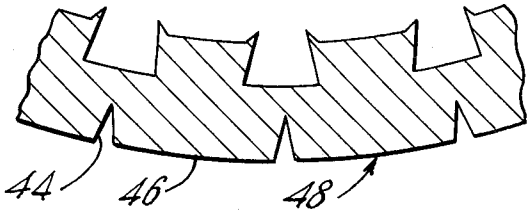


Fig. 14.



MEANS FOR GROUNDING A SHIELDED CABLE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention is directed to the field of connectors and principally to means for grounding the sheath of a sheathed cable.

2. Description of the Prior Art

With the increasing use of aluminum in the manufacture of electrical cables and specifically as a sheath material for shielded cable many problems have arisen in the field of terminating devices adapted to join the cable sheath to an external conductor for the purpose, for example, of connecting the sheath to a common ground point. Although a variety of terminating devices have been designed to accomplish this purpose, and include assemblies requiring the sheath to be separated from the remainder of the cable and formed into a tail-like extension for insertion within the barrel of a terminal or the like, the employment of such devices has often proved to be quite cumbersome, inefficient, and of a relatively primitive nature. Furthermore, these devices generally require that the smooth contour of the cable be disturbed to effect the aforementioned connection, an arrangement which may cause serious difficulties in high frequency applications. More recent devices have attempted to overcome this limitation by providing, for example, a pair of concentric rings adapted to provide a sandwich-like assembly comprising the cable sheath and the external conductor interposed between the concentric rings or sleeves whereby an electrical connection is formed by compressing the outer sleeve radially inwardly towards the inner sleeve. Although such arrangement has found a measure of success in use, the increasing employment of aluminum sheath material has resulted in a high failure rate with respect to such grounding means since the relatively smooth opposing surfaces of the inner and outer sleeve members may provide a mechanically secure assembly, such surfaces are ineffective in penetrating insulative coverings such as the oxide coating of an aluminum sheath to establish electrical contact with the underlying conductive portion thereof.

SUMMARY OF THE INVENTION

The invention overcomes the limitations and difficulties noted above with respect to prior art devices by providing improved means for joining an external conductor to the sheath of a metallically sheathed cable to insure a positive electrical and mechanical connection therebetween in a manner more reliable, efficient, and convenient than such prior art devices. A pair of hollow, metallic, concentrically disposable sleeve members are selectively dimensioned to provide an annular gap therebetween adapted to receive both the sheath of a metallically sheathed cable and an external conductor therebetween. Either one or both of the opposing surfaces of the sleeve members may be provided with a sheath engaging means which may take the form preferably of a series of selectively formed raised ridges adapted to engage the interposed sheath and external conductor upon compression of the outer metallic sleeve radially inwardly against the inner sleeve. One or more selectively dimensioned recessed portions may be provided between the ridges to provide a discreet pocket for the external conductor. The outer periphery of the second or outer metallic sleeve may be suitably

slotted or grooved to provide reduced cross sectional areas for relieving the stress generated in the outer sleeve by the radial compression thereof. The inner and outer metallic sleeves may be formed of similar electrically conducting material with the inner sleeve having a substantially greater hardness to provide an anvil-like abuttment against which the outer sleeve may be compressed to effect the electrical assembly. Thus, for example, the inner sleeve may be formed from full hard brass material while the outer sleeve is formed from a relatively soft copper or copper alloy. It is therefore an object of this invention to provide an improved connector.

It is another object of this invention to provide means for insuring electrical integrity between the aluminum sheath of a shielded cable and an external conductor.

It is yet another object of this invention to provide means for connecting the sheath of a sheathed cable to an external conductor with minimum deformation of the sheath.

It is a further object of this invention to provide an improved connection between the sheath of an aluminum sheathed cable and an external conductor.

It is yet another object of this invention to provide a concentric ring assembly having sheath engaging means for electrically connecting the aluminum sheath of a sheathed cable to an external conductor.

Other objects and features 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 side elevational view, partially cut away and partly in section, showing an external conductor connected to the sheath of a metallically sheathed cable by means constructed in accordance with the concepts of the invention.

FIG. 2 is a fragmentary sectional view of a portion of the assembly illustrated in FIG. 1.

FIG. 3 is a fragmentary sectional view of a portion of the second sleeve member of the device illustrated in FIG. 1, showing sheath engaging means located about the inner surface thereof.

FIG. 4 is a fragmentary sectional view of a further embodiment of the second sleeve member of means constructed in accordance with the concepts of the invention.

FIGS. 5, 6 and 7 are fragmentary views showing further embodiments of the sheath engaging means as employed with a device constructed in accordance with the concepts of the invention.

FIG. 8 is a fragmentary sectional view of a further embodiment of the first sleeve member of a device constructed in accordance with the concepts of the invention.

FIG. 9 is an enlarged fragmentary sectional view showing a portion of the assembly illustrated in FIG. 1, preparatory to completion of the connection.

FIG. 10 is an enlarged fragmentary sectional view showing the assembly illustrated in FIG. 9 after completion of the connection.

FIG. 11 is an enlarged fragmentary sectional view showing the manner in which recessed portions in the

second sleeve member may be employed to engage an external conductor prior to compression.

FIG. 12 is an enlarged fragmentary sectional view showing the assembly of FIG. 11 after compression.

FIG. 13 is an enlarged fragmentary sectional view of a further embodiment of a second sleeve member constructed in accordance with the concepts of the invention.

FIG. 14 is an enlarged fragmentary sectional view showing the second sleeve member of FIG. 13 after compression.

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

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to FIGS. 1 and 2 there is shown a connecting means 20 constructed in accordance with the concepts of the invention, for joining an external conductor 22 to a sheath 24 of a metallically sheathed cable 26. Means 20 comprises a pair of concentric elements including an inner or first sleeve member 28 and a second or outer sleeve member 30. Sleeves 28 and 30 may be of almost any convenient width although it is preferable that the first sleeve member 28 be at least as wide as the second sleeve member 30. Additionally, due to the nature of the assembly and the manner in which it is employed to effect the desired connection, the first sleeve member 28 is constructed of metallic stock having a hardness greater than the second sleeve member 30 so as to provide an anvil-like support as the second sleeve member 30 is compressed thereagainst. It has been found, for example, that a first sleeve member constructed of full hard brass will provide a satisfactory support for a second sleeve member constructed preferably from soft copper or copper alloy. To increase the electrical engagement between the sleeve members 28 and 30, the interposed sheath 24, and the external conductor 22, either or both of the opposing surfaces of the sleeve members 28 and 30 are provided with sheath engaging means as illustrated, for example, in FIG. 3 wherein the inner surface of the second sleeve member 30 is shown provided with a series of ridges 32 extending above the inner surface of the sleeve member 30 and adapted to penetrate the outer surface of the sheath 24 to a predetermined depth to provide increased electrical engagement with the inner portion thereof. Thus, in the case where the sheath 24 is formed from aluminum material, the ridges 32 provide means for penetrating the outer oxide coating of the aluminum to engage the conductive portion therewithin. The ridges 32 may extend generally parallel to the longitudinal axis of the second sleeve member 30 and may be disposed either uniformly about the inner surface thereof or in a given pattern comprising spaced groups thereof in either a uniform or non-uniform arrangement according to the application and within the concepts herein disclosed. Accordingly, the inner circumferential surface of the second sleeve member 30 may include ridges 32 disposed in groups of two or more of such ridges, each group occupying radial segments of from 5° to the full 360° of arc of the inner surface of the sleeve member. Moreover, the ridges 32 may extend continuously across the inner surface of the second sleeve member or may comprise a series of interrupted portions (not shown) approximating individual teeth. Furthermore, the orientation and shape of the ridges 32 may be modified as shown, for example, in FIGS. 5, 6 and 7, at 34, 36 and 38, respectively, wherein ridges 34 are shown extending undulatingly across the sleeve surface, ridges 36 are shown extending across the sleeve surface at an oblique angle to the longitudinal axis of the sleeve member, and ridges 38 are shown extending generally arcuately across the sleeve surface. It will of course be clear that the ridges 34, 36 and 38 may also be arranged in selective groups comprising a single pattern or combination of configurations, as necessary or desirable. As further illustrated in FIG. 4, the ridges may be formed as a series of triangular teeth 40 similarly adaptable for employment as sheath engaging means. Those skilled in the art will further appreciate that although only two basic ridge configurations have been illustrated and described herein, other suitable configurations adapted to function as sheath engaging or insulation piercing means may be provided in similar manner for the purposes herein disclosed. As further illustrated in FIG. 3, there may be additionally provided recesses such as 42 interspersed between adjacent ridge pairs 32 for accommodating the bared portion of the external conductor 22, in the manner shown in both FIGS. 9 and 11. As further illustrated in FIGS. 9 and 11, respectively, the width of the recess 42 may be selected so as to either completely or partially accommodate the conductors 22 before compression of the second sleeve member 30 thereabout. The additional advantages of the arrangement shown in FIG. 11 will become more apparent as the operation of the device is explained in further detail hereafter. The second sleeve member 30 may be further modified as illustrated, for example, in FIG. 13 where there is shown an additional series of recesses 44 extending generally transversely across the outer surface 46 of a second sleeve member 48. The recesses 44 may be selectively located at desired positions about the periphery of the second sleeve member 48 not only to assist in providing a more uniform collapse of the second sleeve member upon its compression against the first sleeve member 28, but also to relieve the stress induced in the second sleeve member 48 upon such compression by providing reduced cross sectional areas thereat. Accordingly, upon compression of the second sleeve member 48, the sidewalls defining the recesses 44 converge towards one another, as illustrated in FIG. 14, in response to the stress exerted on the second sleeve member 48 during compression.

Turning now specifically to FIG. 2, upon the inward radial compression of the outer sleeve member 30, the encompassed sheath 24 and the external conductor 22 are caused to be sandwiched between the outer sleeve member 30 and the inner sleeve member 28, substantially as shown. Portions of the sheath 24 are, accordingly, displaced and locked into the areas between the ridges 32 to provide increased mechanical and electrical engagement between the second sleeve member 30, the sheath 24, and the first sleeve member 28. The external conductor 22, being interposed between the sheath 24 and the second sleeve member 30, is, accordingly, tightly confined between said elements to insure electrical engagement at least with the outer or second sleeve member 30. Thus, although the presence of an oxide film on an aluminum sheath may hinder direct electrical contact between the external conductor 22 and the surface of the sheath 24 these two elements are electrically joined to one another at least through the

second sleeve member **30.** Where the external conductor **22** is inserted in a recess **42** having a width larger than the diameter of the conductor, as in the case illustrated in FIG. **9,** compression of the second sleeve member **30** causes the conductor **22** to be deformed within the recess **42** substantially as shown in FIG. **10,** and urged against the side walls thereof partly as a result of the displacement of the sheath **28** into the recess **42** and partly as a result of the contraction of the recess **42** upon compression of the assembly. Where, however, the conductor diameter is greater than the width of the recess **42** into which it is inserted so as to be only partially encompassed thereby, as illustrated in FIG. **11,** upon compressive deformation of the second sleeve member **30** the ridges **32** flanking the associated recess **42** are caused to bite into the sides of the external conductor **22** in a manner more clearly seen in FIG. **12,** thus insuring that adequate electrical engagement between the second sleeve member **30** and the conductor **22** is provided in those cases where the engaged portion of the conductor **22** has an oxide or other insulative film thereabout. It should further be noted that the recesses **42,** although having an essentially rectangular shape in their undeformed state, are caused to deform in such manner as to provide an essentially truncated triangular pocket, in section, thus securely locking the sheath **24** to the second sleeve member **30** and preventing movement or displacement of the sheath **24** with respect to the outer sleeve member **30** during handling and use. This arrangement also insures that the entrapped portions of the sheath member **24,** as shown at **50** in FIG. **12,** will tend to expand and contract within the pockets formed by the recesses **42** to insure permanent electrical contact with the second sleeve member **30** during thermal cycling of the assembly.

Referring now to FIG. **8** there is shown a further embodiment of a first or inner sleeve member **52** constructed in accordance with the concepts of the invention. The first sleeve member **52** comprises an outer surface **54** on which are disposed a series of ridges **56** essentially duplicative of the ridges **32** described hereinabove. Accordingly, the ridges **56** will operate in a manner similar to that described above with respect to the ridges **32** to effect engagement with the sheath **24** upon compression of the outer sleeve member thereagainst. Furthermore, the ridges **56** may be oriented and positioned as described heretofore with respect to the ridges **32.** It will thus be clear that either or both inner and outer sleeve members may be provided with sheath engaging means to provide the necessary electrical connection between the sheath **24** and the external conductor **22.** As will be apparent from the embodiment illustrated in FIG. **8,** the ridges **56** may be separated by conductor receiving recesses **58** operating in a manner similar to the recesses **42** described hereinabove. Accordingly, each of the recesses **58** may be selectively dimensioned to at least partially or fully accept the external conductor **22** therewithin to insure electrical engagement between the inner sleeve, the sheath **24,** and the external conductor **22.**

I claim:

1. Means for joining an external conductor to the sheath of a metallically sheathed cable comprising: a first hollow metallic sleeve member having an inner surface and an outer surface; a second hollow metallic sleeve member having an inner surface and an outer surface, said first sleeve member being arranged to fit coaxially within said second sleeve member while providing a predetermined annular gap therebetween for receiving a portion of the sheath of a metallically sheathed cable within said gap; and insulation piercing sheath engaging means selectively positioned about at least one of said first member outer surface and said second member inner surface; said second sleeve member being compressible about said first sleeve member so as to cause said sheath engaging means to engage such cable sheath portion and an external conductor interposed within said gap to electrically join such external conductor to such cable sheath portion at least through one of said first sleeve member and said second sleeve member upon the compression of said second sleeve member about said first sleeve member, said first sleeve member outer surface having at least one generally longitudinally extending recess arranged to at least partially accommodate a given length of such external conductor therewithin.

2. Means for joining an external conductor to the sheath of a metallically sheathed cable comprising: a first hollow metallic sleeve member having an inner surface and an outer surface; a second hollow metallic sleeve member having an inner surface and an outer surface, said first sleeve member being arranged to fit coaxially within said second sleeve member while providing a predetermined annular gap therebetween for receiving a portion of the sheath of a metallically sheathed cable within said gap; and insulation piercing sheath engaging means selectively positioned about at least one of said first member outer surface and said second member inner surface; said second sleeve member being compressible about said first sleeve member so as to cause said sheath engaging means to engage such cable sheath portion and an external conductor interposed within said gap to electrically join such external conductor to such cable sheath portion at least through one of said first sleeve member and said second sleeve member upon the compression of said second sleeve member about said first sleeve member, said means further comprising longitudinally extending slotted portions disposed selectively about said outer surface of said second sleeve member to at least partially relieve the stress in said second sleeve member as said second sleeve member is compressed about said first sleeve member, said sheath engaging means comprising longitudinally extending recessed portions disposed selectively within said inner surface of said second sleeve member and in general coincidence with said longitudinally extending slotted portions disposed about said second sleeve member outer surface.

3. Means for joining an external conductor to the sheath of a metallically sheathed cable comprising: a first hollow metallic sleeve member having an inner surface and an outer surface; a second hollow metallic sleeve member having an inner surface and an outer surface, said first sleeve member being arranged to fit coaxially within said second sleeve member while providing a predetermined annular gap therebetween for receiving a portion of the sheath of a metallically sheathed cable within said gap; and insulation piercing sheath engaging means selectively positioned about at least one of said first member outer surface and said second member inner surface; said second sleeve member being compressible about said first sleeve member so as to cause said sheath engaging means to engage such cable sheath portion and an external conductor

interposed within said gap to electrically join such external conductor to such cable sheath portion at least through one of said first sleeve member and said second sleeve member upon the compression of said second sleeve member about said first sleeve member, said sheath engaging means comprising a series of raised ridges disposed in a generally helical pattern about said first sleeve member outer surface.

* * * * *