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Levy

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[54] **PRE-INSULATED CONNECTOR FOR ELECTRICAL CONDUCTORS**

[75] Inventor: **Sidney Levy**, Belle Mead, N.J.

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

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[52] **U.S. Cl.** ..... **339/272 A**, 339/213 R, 339/276 R

[51] **Int. Cl.** **H01r 7/12**

[58] **Field of Search** 339/223, 272, 242, 248, 339/276, 213

[56] **References Cited**

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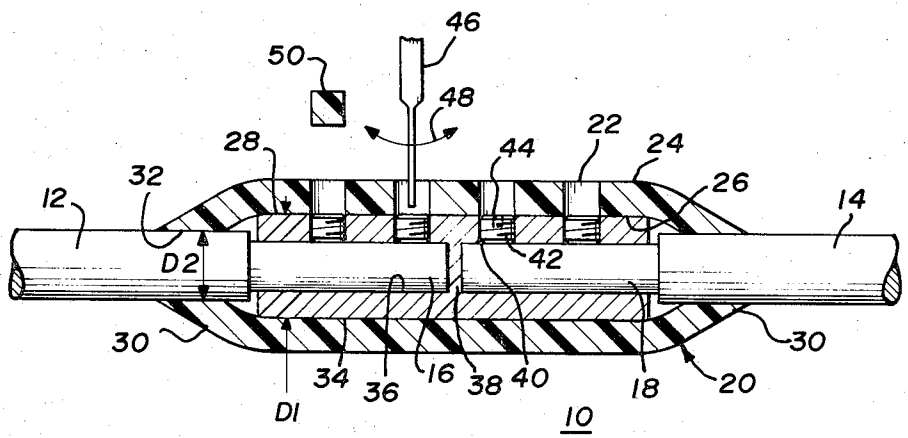
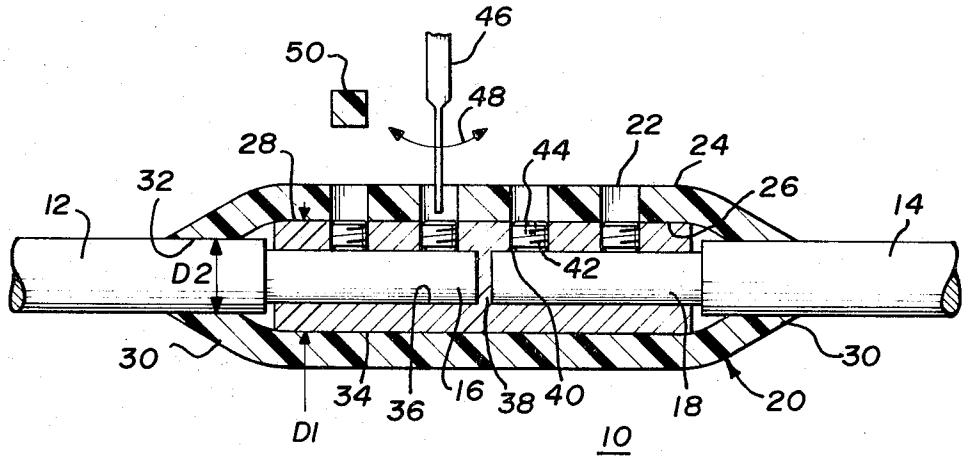
Primary Examiner—Roy D. Frazier
Assistant Examiner—Robert A. Hafer
Attorney, Agent, or Firm—David Teschner; Jesse Woldman

[57] **ABSTRACT**

The disclosure is directed to a pre-insulated connector for joining two electrical conductors which have had the insulation removed from the ends thereof. The connector is fabricated from an insulating outer sleeve having a plurality of apertures which extend from the outer surface thereof to the inner surface thereof and which are adapted to be sealed after the connector is assembled to conductors by means of plugs placed in the aperture so as to form a continuous insulating outer sleeve. Concentrically mounted within the outer sleeve is a metallic inner sleeve having a wire stop in the center thereof to limit the insertion of the bared ends of the electrical conductors. In a first embodiment, the rigid inner metallic sleeve has a plurality of threaded apertures each receiving a set-screw in aligned position with the apertures extending through the outer sleeve. An appropriate tool may be introduced through the outer sleeve to engage the set-screws and permit their tightening upon a conductor placed within the connector to join the two. In a second embodiment of the invention the inner metallic sleeve is formed of a deformable material such that the indenter of a crimping tool may be inserted through the outer sleeve and operated so as to deform the inner metallic sleeve into intimate engagement with the conductors placed within the connector.

6 Claims, 2 Drawing Figures

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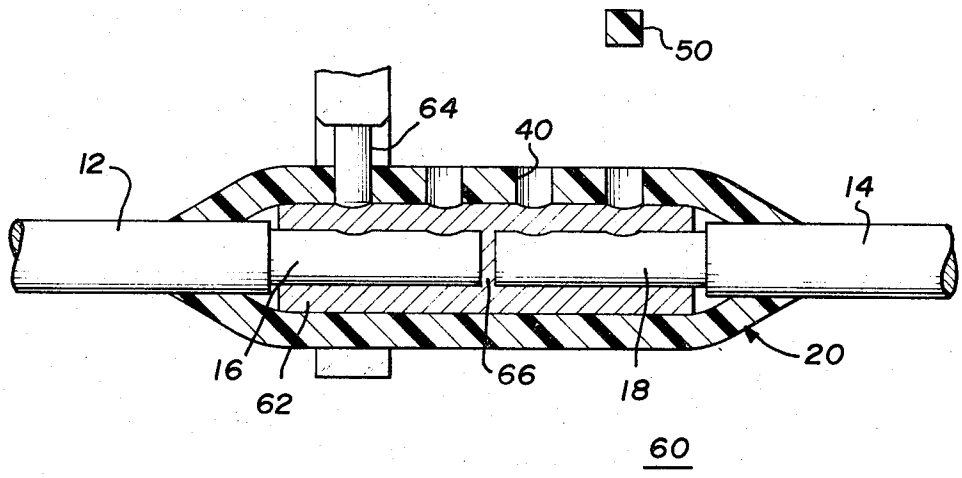
20
D1
10

FIG. 1


50
64
40
12
14
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62
66
18
20
60

FIG. 2

PRE-INSULATED CONNECTOR FOR ELECTRICAL CONDUCTORS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention is directed to the field of joining together or coupling mechanically and electrically electrical conductors.

2. Description of the Prior Art

According to prior art techniques for coupling conductors for underground use, first a mechanical sleeve is crimped or deformed into engagement with the conductors to be joined. This is followed by the taping of the joint thus produced employing numerous layers of tape to provide a seal about the conductors which is both waterproof and dirtproof and which insulates the cable from adjacent phases of the power lines carried within the same cable vault. It is not uncommon for a single phase, of a three phase line, to take eight hours to complete the taping required and it is not possible to tell at that time whether or not the joint is good. Upon the loading of the cable, that is, applying full voltage to all phases of the cable, small pin holes within the tape itself might cause arcing or corona discharge which would be destructive to the cable, the vault and the surrounding area. Also, even if the cable joints were good when completed, the presence of dirt, moisture, ozone, or other gases or chemicals in the cable vaults as the cable joints were exposed to their environment for a period of time often caused breakdowns.

SUMMARY OF THE INVENTION

The present invention seeks to overcome the difficulties noted above with respect to prior art devices and techniques by providing a splice or connector for joining cables to be placed in underground cable vaults or to be used overhead, which can be pretested and whose dielectric strength is known prior to the time that such cables are connected by means of the connector. This is accomplished by providing a metallic inner sleeve which will receive the cables to be joined, an outer insulating sleeve, the integrity and dielectric strength of which can be determined by suitable testing. Operating devices are then introduced through apertures in the outer insulating sleeve to operate upon the inner metallic sleeve to cause it to intimately engage the conductors and thereafter the apertures are sealed with suitable insulating plugs to form a continuous insulating sleeve about the inner metallic sleeve.

More particularly, the outer insulating sleeve has a plurality of apertures extending from an outer surface to the inner surface thereof, each of which can receive a plug of similar material which can be fastened, cemented or otherwise adhered thereto to form a continuous insulating sleeve. Contained within and concentrically mounted with respect to the outer insulating sleeve is an inner metallic sleeve of somewhat shorter dimension than the outer insulating sleeve. The outer insulating sleeve has a central passage therethrough large enough to receive such metallic sleeve and the portions that extend beyond the metallic sleeve have passages of somewhat smaller diameter such as to receive and intimately engage the outer insulating layer of the conductors themselves. In a first embodiment, the inner metallic sleeve has a plurality of threaded apertures extending from its outer surface to its inner surface. Contained within each of the threaded apertures

of the inner metallic sleeve is a set-screw too which access can be gained through the aligned apertures extending through the outer insulating sleeve. A tool, such as a screwdriver or the like, is inserted through the apertures in the outer insulating sleeve to engage the slot of the set-screw and operate same until intimate engagement is produced between the inner metallic sleeve and the bared ends of the conductors inserted within the connector. Thereupon, plugs are inserted through the apertures of the outer insulating sleeve in order to form the desired continuous insulating sleeve about the metal sleeve.

In a second embodiment, the inner metallic sleeve is formed of deformable metal and is contacted by means of the indenter of a suitable tool place through the apertures in the outer insulating sleeve. The operator will cause deformation locally of the inner metallic sleeve to cause interengagement between such inner metallic sleeve and the conductor. In a similar fashion, plugs are positioned in the apertures of the outer insulating sleeve to complete the outer insulating sleeve. It is therefore an object of this invention to provide an improved connector for electrical conductors.

It is another object of this invention to provide a preinsulated connector for electrical conductors.

It is yet another object of this invention to provide a reusable preinsulated connector for electrical conductors.

It is still another object of this invention to provide a preinsulated connector for electrical conductors the integrity of which can be preserved after the connector has been installed to the conductor.

It is still another object of this invention to provide a set-screw operated preinsulated electrical connector for electrical conductors.

It is yet another object of this invention to provide a suitable crimpably applied preinsulated electrical connector for electrical conductors.

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 principles of the invention and the best modes which have been contemplated for carrying them out.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings in which similar elements are given similar reference characters.

FIG. 1 is a side elevational view, in section, of a connector constructed in accordance with the concepts of the invention installed to two fragmented electrical conductors.

FIG. 2 is a side elevational view, in section, of a second form of electrical connector constructed in accordance with the concepts of the invention installed upon two fragmented electrical conductors.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to FIG. 1 there is shown a connector **10** constructed in accordance with the concepts of the invention. Connector **10** is used to join together two electrical cables **12** and **14** which have their outer insulating layer removed to expose a portion of the conductors **16** and **18** respectively. Connector **10** is constructed of an outer insulating sleeve **20** having a plurality of apertures **22** extending from the outer surface

24 to the inner surface 26 thereof. The central portion of the outer insulating sleeve 20 has a passage 28 to a first dimension D1 positioned to accept therein inner metallic sleeve, as will be discussed below. The ends 30 of the outer insulating sleeve 20 tapers to provide a smooth transition between the insulating jacket of the cables 12 and 14 and the outer surface of the insulating sleeve 20. Contained therein are second passages of decreased dimension D2 sufficient to accept therein the outer insulating layer of the cables 12 and 14 and which prevent the inner metallic sleeve from being removed.

Contained within the central passage 28 of the outer insulating sleeve 20, is an inner metallic sleeve 34 having a central passage 36 therein sufficient to accept the bared conductive portions 16 and 18 of the cables 12 and 14. A wire stop 38 divides central passage 36 of the metallic inner sleeve 34 into two portions so that equal forces may be applied to both of the conductors 16 and 18 inserted equally within the connector 10. In a first wall of the inner metallic sleeve 34 is a plurality of threaded apertures 40, in which is placed a setscrew 42 having a slot 44 arranged to be engaged by a tool such as a screwdriver 46 and rotated in the direction of the arrows 48 to advance or retract the set-screw 42 from within the aperture 40. Rotating the set-screws 42 in the direction to advance them into the central passage 36 causes them to engage the conductor 16 and 18 of the cables 12 and 14 and thus assemble the inner metallic sleeve 34 to said conductors 16 and 18. A plug 50, constructed of material similar to the material of which the outer insulating sleeve 20 is constructed, is then placed in each of the apertures 22 to seal them. The material used is usually rubber and may, if desired, have a semi-con layer on the outer surface thereof similar to the semi-con layer usually found upon cables such as 12 and 14. Plugs 50 may be made oversized and stretched as applied to the apertures 22 in order to perform a sealing function without the requirement for additional materials or it may be cemented, or epoxied or otherwise compounded into position to provide a continuous insulating sleeve having no points of dielectric weakness.

In order to use the connector 10 of FIG. 1, it is necessary first to prepare each of the cables 12 and 14 by removing the outer insulating layer therefrom for a prescribed length to expose the bare metallic conductors 16 and 18 thereof. The cables 12 and 14 are then inserted so as to position bare conductors 16 and 18 to either side of the wire stop 38 of the inner sleeve 34. A screwdriver such as 46 is then inserted successively through the apertures 22 of the outer insulating sleeve 20 to engage the slots 44 of the set-screws 42 tightening each against the conductors 16 and 18 of the cables 12 and 14. When this is completed the screwdriver 46 is removed and a plug 50 positioned in each of the apertures 22 to seal the outer insulating sleeve 20. By pretesting the connector 10, that is, before installation, it can be told in advance whether or not it will produce a complete joint, electrically and mechanically sound, prior to the time it is actually installed.

If it is desired, the connector of FIG. 1 may be reused by prying out, or removing, the plugs 50, inserting a screwdriver 46 within the apertures 22 and backing off each of the set-screws 42. Thus, the connector 10 of FIG. 1 may be employed as a temporary or permanent connector and may be used as a repair device, if such be necessary.

Turning now to FIG. 2 a permanent type of connector 60 is shown for joining the bared conductor portions 16 and 18 of two cables 12 and 14. The outer insulating sleeve 20 is constructed in a manner similar to that described with respect to the insulating sleeve 20 of FIG. 1. Inner metallic sleeve 62 is different than that of the inner metallic sleeve 34 of FIG. 1 in that the inner metallic sleeve 62 of FIG. 2 is constructed of a deformable material such as heat treated aluminium such that it may be readily deformed by the introduction of the indenter 64 of a suitable tool through each of the apertures 40 extending through the outer insulating sleeve 20. As is shown in FIG. 2, there is an indented area in the inner metallic sleeve 62 adjacent each one of the apertures 40 extending through the outer insulating sleeve 20. Wire stop 66 is provided in the central portion of the inner metallic sleeve 62 to limit the insertion of each of the bared conductor portions 16 and 18 of the two cables, 12 and 14 respectively. Upon completion of the crimping of the individual conductors 16 and 18 to the metallic sleeve 64, the plugs 50 will be placed in each of the apertures 40 as was described above with respect to FIG. 1 to provide an integral fully insulating sleeve about the joint between the cables 12 and 14.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to the preferred embodiments, it will be understood that various omissions and substitutions and changes of the form and details of the devices illustrated and in their operation may be made by those skilled in the art, without departing from the spirit of the invention.

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

1. A pre-insulated coupling for joining two electrical conductors comprising: a metallic sleeve of a first predetermined length having a passage therethrough proportioned to accept therein the end of an electrical conductor from which the insulation has been removed; an insulating sleeve formed from a given insulating material and having a second predetermined length greater than said first predetermined length, said insulating sleeve having a generally uniform first outer diameter along said first predetermined length, the opposite ends of said insulating sleeve being tapered so as to terminate in a second outer diameter less than said first outer diameter and arranged to provide a smooth transition between the outer surface of said insulating sleeve and the outer surface of the insulation of an insulated electrical conductor inserted within a respective end of said insulating sleeve; said insulating sleeve having a central passage proportioned to receive therein said metallic sleeve, said central passage extending for said first predetermined length; a plurality of apertures extending through said insulating sleeve from the outer surface thereof to said central passage thereof; means coupling said metallic sleeve to the ends of electrical conductors from which the insulation has been removed which have been inserted into said metallic sleeve; and a plurality of plugs formed from said given insulating material, one for each of said apertures, said plugs when inserted into their associated apertures sealing said apertures; the exposed surfaces of said plugs lying flush with the outer surface of said insulating sleeve and providing a continuous insulating sleeve

of homogeneous composition about said metallic sleeve.

2. A pre-insulated coupling as defined in claim 1, wherein said means coupling said metallic sleeve to the bared ends of electrical conductors is a plurality of set-screws, one for each of said apertures in said insulating sleeve.

3. A pre-insulated coupling as defined in claim 1, further comprising a plurality of threaded apertures in said metallic sleeve, equal in number to the number of apertures in said insulating sleeve; one of said threaded apertures in said metallic sleeve being associated with one of said apertures in said insulating sleeve; said means coupling said metallic sleeve to the bared ends of electrical conductors being a plurality of set-screws equal in number to the number of threaded apertures in said metallic sleeve; said set-screws when advanced in their associated threaded apertures by tools inserted through their associated apertures tightly gripping the bared ends of conductors inserted therein joining said metallic sleeve to said conductors and said apertures being sealed by said plugs after said set-screws have been tightened and the tools removed from said apertures.

4. A pre-insulated coupling as defined in claim 1, further comprising a conductor stop in said passage of said metallic sleeve to limit the insertion of the bared end of an electrical conductor therein whereby each of the conductors will be permitted to enter the metallic sleeve the same amount.

5. A pre-insulated coupling as defined in claim 1, wherein said insulating sleeve has two additional passages, one at each end of said central passage and communicating therewith, each of said additional passages being equal in length to one half the difference between said second and said first predetermined lengths; said additional passages proportioned to receive therein and tightly fit about the insulation of an electrical conductor inserted into said coupling.

6. A pre-insulated coupling as defined in claim 1, wherein said metallic sleeve is deformable and said means for coupling said metallic sleeve to said bared electrical conductor ends is an indentor inserted via each of said plurality of apertures to deform said metallic sleeve into intimate contact with the bared ends of electrical conductors inserted into said metallic sleeve.

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