United States Patent

O'Loughlin et al.

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[45] **Oct. 10, 1972**

[54] **INSULATING PIERCING ELECTRICAL CONNECTOR**

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

[22] Filed: **Sept. 30, 1970**

[21] Appl. No.: **76,940**

[52] **U.S. Cl.**.....**174/84 C,** 29/628, 174/90, 339/97 C, 339/276 R

[51] **Int. Cl.**.....**H02g 15/08**

[58] **Field of Search**.....174/84 R, 84 C, 94 R, 90; 339/95, 96, 97 R, 97 C, 98, 223, 276; 29/628

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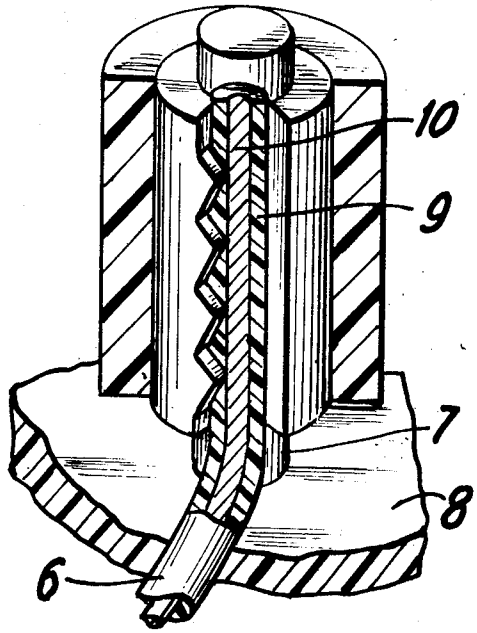
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[57] **ABSTRACT**

An electrical connector for connecting insulating wire to a round post consists of two parts, an outer powdered metal sleeve and a split insert. The insert is blanked with teeth or serrations along one edge, and is formed to the inside diameter of the outer sleeve. An insulated wire is inserted into the connector in the area provided by the split in the insert, and the connector and wire are placed over the round post and the connector is circumferentially compressed. Compression of the connector forces the serrated edge of the insert against the wire, piercing the insulation and securing the wire and the connector to the post. Electrical contact from the wire to the post is made through the insert.

14 Claims, 12 Drawing Figures



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SHEET 1 OF 2

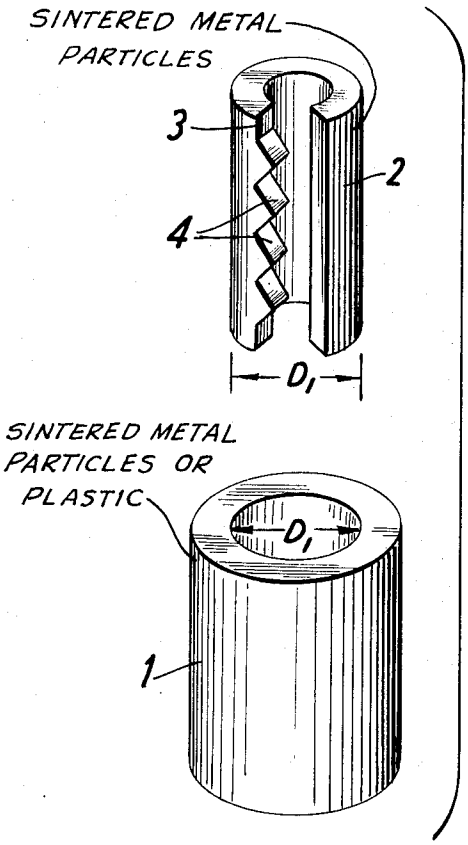


FIG. 1

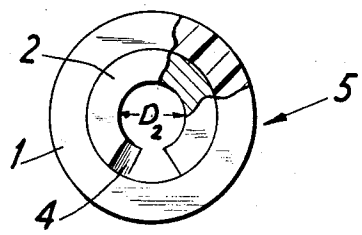


FIG. 2

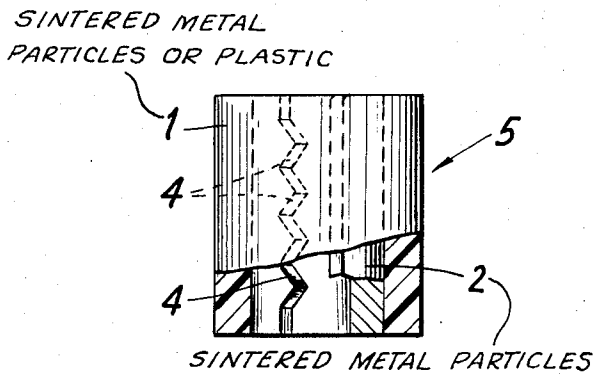


FIG. 3

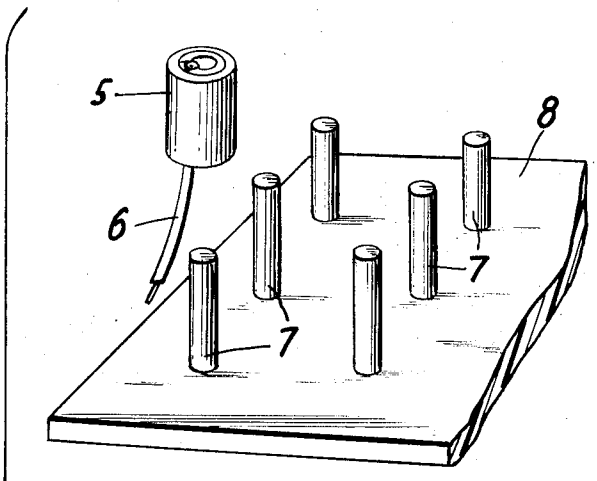


FIG. 4

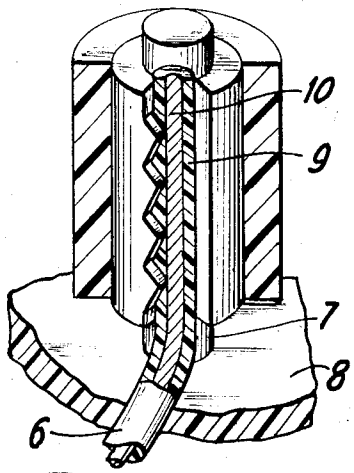


FIG. 5

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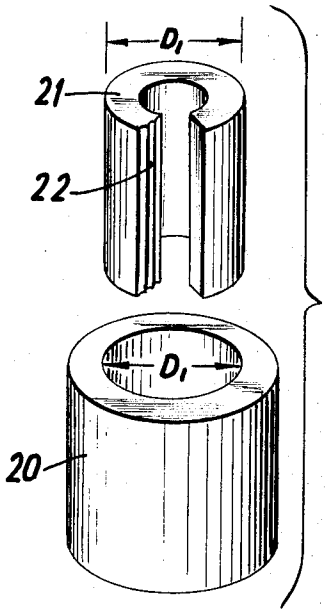


FIG. 6

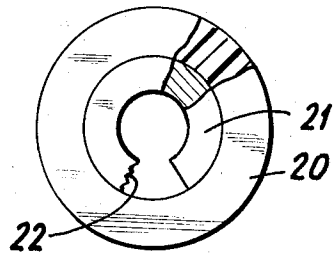


FIG. 7

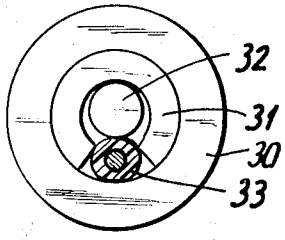


FIG. 9

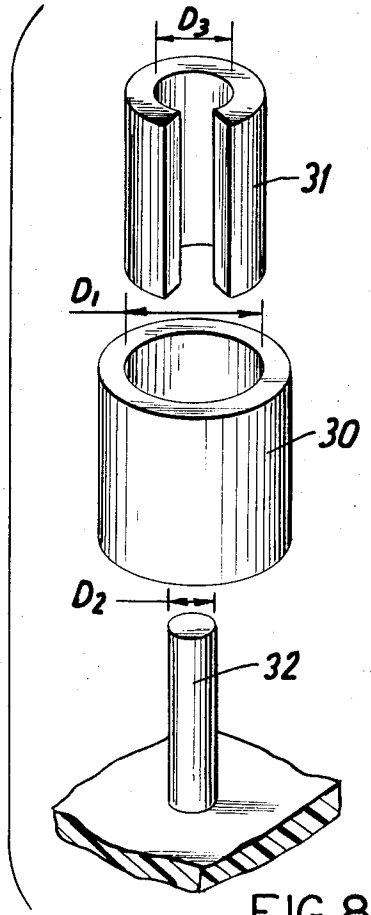


FIG. 8

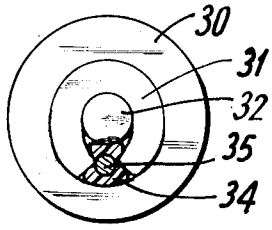


FIG. 10

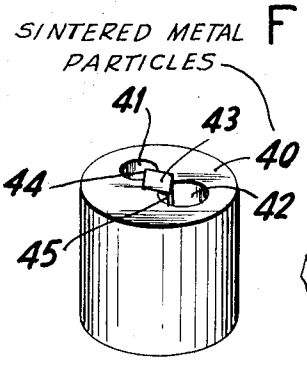


FIG. 11

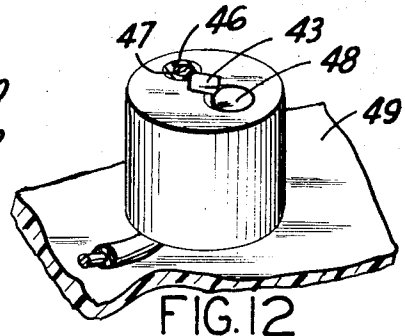


FIG. 12

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INSULATING PIERCING ELECTRICAL CONNECTOR

FIELD OF THE INVENTION

The present invention relates to crimpable electrical connectors for connecting an insulated wire to a round post, e.g., a round post forming part of a panel for interconnecting a plurality of electrical components. In sophisticated electronics assemblies, it is desirable to provide a common interconnection system, such as a panel having a plurality of upstanding pins to which the leads of various electrical components embodied in the assembly may be interconnected. The present invention relates to a means for electrically connecting the individual wires extending from such components to the round posts forming part of an interconnection panel.

DESCRIPTION OF THE PRIOR ART

The electronics industry has resorted to basically two methods of connecting wires to the round posts of an interconnection panel. The first technique involves soldering the leads to the round posts, which technique requires, first, the stripping of the insulation from the wire, followed by the subsequent step of soldering the electrical connection to the round post. This technique gives rise to certain inherent disadvantages, the first of which is the cost of assembly involved in this multiple step operation. Secondly, if more than one wire is to be connected to a round post, there is always the danger that soldering of the second wire may cause damage or possibly result in the disconnection of the first soldered connection to the round post. Accordingly, this technique requires skilled technicians, thereby further increasing the cost and reliability of this technique.

A second technique employed in the electronics industry is to prestrip the insulation from the wire and mechanically connect the bare wire to the round post by wrapping one or more turns of the stripped wire around the post to form a connection. The wrapped connection can usually only be achieved with a solid wire (stranded wires tend to break during the wrapping operation) and there is always present the possibility that because of vibration and other external forces applied to the panel, the mechanical connection between the bare solid wire and the post may be loosened, thereby possibly giving rise to electrical disconnection of the assembly.

SUMMARY OF THE INVENTION

Accordingly, in order to obviate the disadvantages of the prior art techniques discussed above, the present invention provides a composite electrical connector which simultaneously forms both a mechanical connection of an insulated wire to a round post, and forms an electrical connection between the round post and the electrical wire, without prestripping of the insulation from the wire. This is accomplished by the provision of a composite assembly of an outer crimpable sleeve having an aperture extending therethrough sufficient in size to receive a round post and an insulated wire, and to also accommodate an electrically conducting insert disposed in the crimpable body, which insert includes at least one sharp edge for penetrating the insulation coating of the wire upon compressive deformation of the crimpable body, thereby forming an electrical connection between the insulated wire and the round post. As more fully discussed below, the composite structure may take various forms, including an outer cylindrical sleeve and an inner split sleeve having serrations extending along the longitudinal or radial axes of the split insert, or alternatively the inner split sleeve and the outer crimpable sleeve may be so proportioned that serrations are not required in that the sharp edge corners of the split sleeve will pierce the insulation upon crimping of the electrical connector. In a further modification, the outer sleeve may be formed as a solid cylinder having a plurality of longitudinally extending holes and having fixedly mounted therein a hardened insert having sharp edges penetrating into the respective holes. The round post of a panel may be inserted through one of said through holes, while the insulated wire may be inserted in the other through hole. Upon crimping of the connector the hardened insert would pierce the insulation of the insulated wire to form an electrical connection, while simultaneously making an electrical connection to the round post, thereby completing the connection of the insulated wire to the round post.

From the above, it is apparent that the electrical connection of the present invention provides a means for achieving in one operation an electrical connection between an insulated wire and a round terminal post. During the crimping of the electrical connection, the sequential and interdependent actions of piercing the insulation and forming an electrical connection to the terminal post are achieved, thereby greatly reducing the cost of installation of the terminal connector, while simultaneously providing an efficient mechanical and electrical connection. Furthermore, since the electrical connector of the present invention forms a mechanical connection, the problems previously associated with soldering a plurality of uninsulated wires to a round post is obviated, thereby providing increased versatility to the subject connector.

These and other objects and advantages of the invention will become more apparent from the following description and appended claims, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates an exploded perspective view of the two components forming one embodiment of the subject connector;

FIG. 2 illustrates a partial sectional top view of the assembled components of the embodiment of FIG. 1;

FIG. 3 illustrates a partial sectional side view of the assembled components of FIG. 1;

FIG. 4 illustrates a perspective view of the electrical connector of FIG. 1 having an insulated wire extending therethrough and disposed above an electrical interconnection panel;

FIG. 5 illustrates, partially in section, the interconnection of the electrical connection of the connector of FIG. 1 connecting an insulated wire and a round post of an interconnection panel;

FIG. 6 illustrates an exploded perspective view of a second embodiment of the subject connector;

FIG. 7 illustrates, partially in section, a top view of the electrical connector of FIG. 6;

FIG. 8 illustrates an expanded perspective view of a third embodiment of the electrical connector of the subject invention, along with a partial perspective view of an interconnection panel;

FIG. 9 illustrates a top view of the assembled connector of FIG. 8 as disposed about a round post and having an insulated electrical connector extending therethrough preparatory to the crimping operation;

FIG. 10 illustrates the elements of FIG. 9 subsequent to crimping of the electrical connector;

FIG. 11 illustrates a perspective view of a fourth embodiment of the electrical connector of the subject invention; and

FIG. 12 illustrates a perspective view of the interconnection of an insulated wire to a round post using the electrical connector illustrated in FIG. 11.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning to FIG. 1, the first embodiment of the electrical connector of the subject invention is illustrated in exploded view as comprising two components including an outer cylindrical sleeve 1 and an inner split sleeve 2. The inside diameter D1 of outer sleeve 1 substantially corresponds to the outer diameter of the inner split sleeve 2. Since the inner sleeve 2 is intended to pierce the insulation of the insulated wire and to be in intimate contact with the round post of an interconnection panel, inner split sleeve 2 is made of an electrically conductive material such as brass, bronze, Phosphor bronze, or the like. One edge 3 of the split sleeve 2 is serrated as illustrated by teeth 4 to provide a plurality of sharp projections for piercing the insulation of the insulated wire.

The outer cylindrical sleeve 1 is preferably made of a compressible material having a low plastic memory whereby, after being crimped, it will maintain its crimped configuration. For this purpose, it is preferred that outer cylindrical sleeve 1 be made of a sintered powdered metal such as sintered powdered copper. Preferably inner split sleeve 2 is fixedly mounted in outer sleeve 1 either by a frictional force fit or, alternatively, by the use of a suitable adhesive. When outer sleeve 1 and inner split sleeve 2 are fully assembled (see FIG. 2), the inner diameter D2 of the composite connector 5 is of sufficient size to accommodate the round post of the round terminal post of an interconnection panel, with sufficient clearance being provided between the split edges of the inner split sleeve 2 to accommodate the insulated wire. As illustrated in FIG. 3, the serrations extend along the longitudinal axis of the electrical connector to provide a plurality of sharp edges for piercing the insulated wire.

FIG. 4 illustrates a perspective exploded view of the electrical connector 5 preparatory to the connection of an insulated wire 6 to a round terminal post 7 of an interconnection panel 8 having a plurality of round terminal posts fixedly mounted thereto. The first step in the connection of an insulated wire 6 to a round post is the insertion of one end of the insulated wire between the openings in the split sleeve of an assembled electrical connector 5 comprising the elements 1 and 2. Next, the electrical connector is slipped over the round post 7, it being noted that the inner diameter of the split sleeve is substantially equal to the diameter of the round post 7.

FIG. 5 illustrates the completed assembly of an insulated wire to the round post, subsequent to crimping of the outer sleeve 1. The crimping of the outer sleeve is preferably achieved by a circumferential compression force, although a simple crimping force applied to the opposing sides of the connector may also be employed in order to force the serrated sharp teeth 4 through the insulation 9 of wire 6 in order to form an electrical connection to the conductor 10 of the wire 6. In that the inner sleeve 2 is made of electrically conductive material, and in that the serrations contact the conductor 10, while the inner diameter of the split sleeve 2 is in intimate contact with the round post 7, an electrical and mechanical connection between the insulated wire and the round post is achieved.

As previously mentioned, the outer sleeve 1 is preferably made of a material which is crimpable and has a low plastic memory or tendency to return to its original configuration, whereby the crimped configuration of the outer sleeve 1 will be maintained to enhance the mechanical connection between the insulated wire and the terminal post. Accordingly, outer sleeve 1 may be made of a sintered powdered metal, or alternatively a non-electrically conductive material such as plastic thereby providing an insulated connection of the insulated wire to the round terminal post.

In that the insulated wire 6 is connected to the round post in a simple one-step operation wherein the sequential steps of piercing the insulation and mechanically and electrically connecting the conductor 10 of the insulated wire 6 to the round terminal post 7 is accomplished in one operation, the present invention overcomes the disadvantages of the prior art techniques which required prestripping the insulation, followed by soldering or wrapping of the wire around the terminal post. In addition, the use of an outer crimpable sleeve having a low plastic memory further enhances the mechanical connection of the wire to the round post thereby enabling the connection to withstand vibrational stresses and other external loads which may be applied to the connection, e.g., pulling of the wires 6.

It is readily apparent that although FIG. 5 illustrates the longitudinal length of the connector being substantially equal to the length of the round terminal post, the length of the connector may be proportioned whereby a plurality of connectors may be accommodated on a single terminal post, thereby enabling the connection of more than one insulated wire to a single terminal post. In that the electrical connection is formed by a mechanical connection of the insulated wire to the round terminal post, the prior art problems associated with soldering (whereby the heat of subsequent soldered connections could possibly affect any other connections to the round post), are not present when employing the connector of the subject invention.

It is also readily apparent that although the internal sleeve 2 is illustrated as having a plurality of teeth 4, the inner sleeve could be formed with merely one sharp pointed tooth 4 for piercing the insulation of wire 6 in order to contact conductor 10.

FIGS. 6 and 7 illustrate a second embodiment of the subject electrical connector, which embodiment also includes an outer cylindrical sleeve 20 having an internal diameter D1 corresponding to the outer diameter of an internal split sleeve 21. Internal split sleeve 21 is characterized by a plurality of longitudinally extending

teeth 22 disposed along one edge of the split portion of the inner sleeve. As illustrated in FIG. 7, the serrations 22 extend along the longitudinal axis of the connector, and the latter is adapted to receive an insulated wire between the split portions of the inner split sleeve 21. The assembly of sleeves 20 and 21 to form a composite assembly, and the operation of the resulting connector is identical to the operation of connector 5 described above with reference to FIGS. 1 through 5.

Turning to FIGS. 8, 9 and 10, a third embodiment of the present invention comprises a two part assembly including an outer cylindrical sleeve 30 having an internal diameter D1, and an inner split ring 31, the split edges of which are not serrated as in the previous embodiments. The inner diameter D3 of split sleeve 31 is greater than the diameter D2 of the round terminal post to which the electrical connector is to be connected. The outer diameter D1 of the split sleeve corresponds in size to the inner diameter D1 of the outer cylindrical sleeve 30.

As illustrated in FIG. 9, when the electrical connector of the third embodiment is assembled around a round post 32 and an insulated wire 33 is positioned between the split ends of the inner split sleeve, the pointed edges of the inner split sleeve contact the insulation 34 of insulated wire 33. As illustrated in FIG. 10, upon crimping of the electrical connector the pointed inner edges of the inner split sleeve pierce the insulation 34 of the electrical conductor to make electrical contact to conductor 35 of insulated wire 33, with the inner surface of split sleeve 31 being in intimate contact with the round terminal post 32, thereby forming an electrical connection between the post 32 and the conductor 35.

FIGS. 11 and 12 illustrate a fourth embodiment of the electrical connector of the subject invention, which embodiment comprises a ductile body 40, preferably made of a sintered powdered metal, having two apertures 41 and 42 extending therethrough. Disposed intermediate the apertures 41 and 42 is a hardened metal insert 43 having sharp corners 44 and 45 projecting into the apertures 41 and 42, respectively. In order to connect an insulated wire to a round post, apertures 41 and 42 should be dimensioned so as to correspond substantially to the diameters of the round terminal post and the insulated wire. As shown in FIG. 12, the fourth embodiment of the subject connector is employed to connect an insulated wire 46 having a conductor 47 to a round terminal post 48 formed on an interconnecting panel board 49. In order to connect the insulated wire 46 to a round terminal post, the insulated wire is first threaded through, for example, the aperture 41, and the connector is then slipped over the round terminal post 48 so that the latter extends through the aperture 42. Upon circumferential compression of the sintered powdered metal body 40, the sharp edge 44 of the internal insert 43 pierces through the insulation of wire 46 to make electrical and mechanical contact with the conductor 47. At the same time the sharp edge 45 of the internal insert 43 is forced against the round post 48, whereby the internal insert 43 forms an electrical connection between the conductor 47 and the round post 48. It is readily apparent that the internal insert 43 should be of a hardened metal material which is electrically conductive, while the outer cylindrical body 44 is preferably made of a material having a low plastic memory so as to maintain the electrical and mechanical connection of the insulated wire to the round post.

It is also readily apparent that although the various embodiments of the subject invention are illustrated as comprising cylindrical members, other configurations may be readily designed in order to satisfy particular requirements for the specific applications for which the electrical connector is intended. Similarly, the materials used in making the internal sleeve or insert and the external crimpable member may be varied to suit the required applications, with the only requirement being that the internal insert be made of an electrically conductive material so as to establish an electrical path between the conductor of the insulated wire and the round terminal post to which the wire is to be connected.

Having thus described the invention, it is not intended that it be so limited, as changes may be made therein without departing from the scope of the invention. Accordingly, it is intended that the foregoing Abstract of the Disclosure and the subject matter described above and shown in the drawings be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A connector for electrically and mechanically connecting an insulated conductor to a round post comprising:
   - a crimpable body having an aperture extending therethrough for receiving a round post and an insulated wire; and
   - an insert disposed in the aperture of said crimpable body, said insert being a split inner sleeve having an outer diameter less than the inner diameter of said crimpable body, and an inner diameter greater than the diameter of said round post, said sleeve being split for receiving the insulated wire between the split edges thereof, with said insert including at least one sharp edge along a split edge thereof for penetrating an insulated conductor upon compressive deformation of said crimpable body.

2. A connector as set forth in claim 1, wherein said insert is fixedly mounted within the crimpable body.

3. An electrical connector as set forth in claim 1, wherein the crimpable body is cylindrical in configuration, and wherein the insert has a serrated edge surface to provide a plurality of elongated sharp edges for penetrating the insulated conductor upon compressive deformation of said crimpable body.

4. An electrical connector for connecting an insulated conductor to a round post comprising:
   - an annular outer sleeve;
   - an arcuate inner sleeve disposed in the annular outer sleeve and of sufficient diameter for receiving the round post, said inner sleeve having a slit extending along the longitudinal axis thereof for receiving the insulated wire, with one edge of the inner sleeve along said slit being serrated to define a plurality of sharp edges for penetrating the conductor upon the electrical connector being compressively deformed about the round post.

5. An electrical connector as set forth in claim 4 wherein the annular outer sleeve is made of a plastic material.

6. An electrical connector as set forth in claim 4 wherein the annular outer sleeve is made of sintered powdered metal.

7. A connection electrically and mechanically connecting an insulated conductor to a round post comprising:

an annular outer sleeve;

an annular split inner sleeve disposed in said outer sleeve, said split inner sleeve receiving the round post in its inner cylindrical surface and receiving the insulated wire between the split edges thereof, said outer sleeve and inner sleeve being compressibly deformed with the edges of the split sleeve piercing the insulation of the insulated conductor.

8. A connection as set forth in claim 7 wherein said split inner sleeve is fixedly mounted within said annular outer sleeve.

9. A connection as set forth in claim 7 wherein said split inner sleeve includes a serrated edge surface extending along the longitudinal axis thereof providing a plurality of sharp edges penetrating the insulated conductor.

10. A connection as set forth in claim 7 wherein said annular outer sleeve is made of a plastic material.

11. A connection as set forth in claim 7 wherein said annular outer sleeve is made of a sintered powdered metal.

12. A connection as set forth in claim 7 wherein both the annular outer sleeve and the split inner sleeve are made of sintered powdered metal.

13. A connection as set forth in claim 7 wherein said split inner sleeve includes a serrated edge surface extending along the radial axis thereof providing a plurality of sharp edges piercing the insulation of the insulated conductor.

14. A connection as set forth in claim 7 wherein the outer diameter of the split inner sleeve is less than the inner diameter of the annular outer sleeve, and the inner diameter of the split sleeve is greater than the diameter of the round post.

* * * * *