United States Patent

[11] 3,617,616

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[54] **DUAL-WIRE CONNECTOR**
4 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **174/94,**
29/628, 174/71, 174/78
[51] **Int. Cl.** **H02g 15/08**
[50] **Field of Search** 174/84.1,
88.2, 75.2, 88, 90, 94, 71, 72, 78; 339/276;
29/624, 628; 287/75, 109

[56] **References Cited**
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3,387,080 6/1968 Dibble et al. ..... 174/71 X

Primary Examiner—Darrell L. Clay
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ABSTRACT: This disclosure is directed to a connector and a method for joining electrical conductors thereby. The connector may be crescent shaped with its interior arcuate walls defining two cavities for conductors separated by a rib. The connector is crimped around uninsulated portions of the wires to form an electrical and mechanical connection. The conductors may be secured into the connector seriatim or simultaneously.

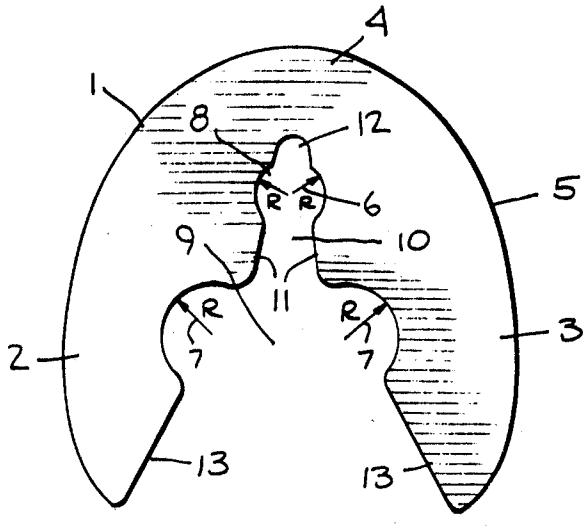


Fig. 1.

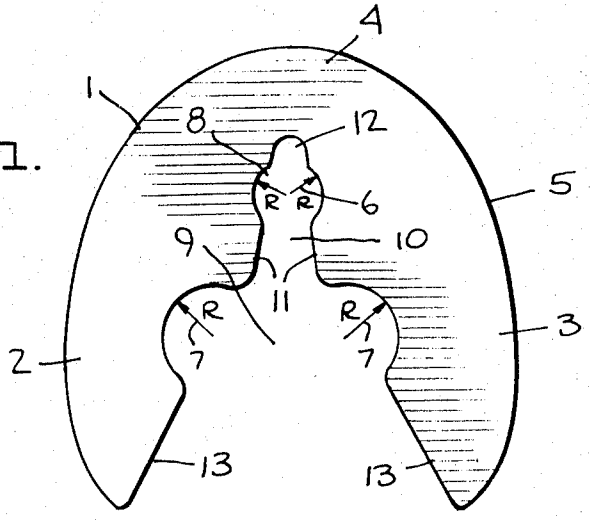


Fig. 2.

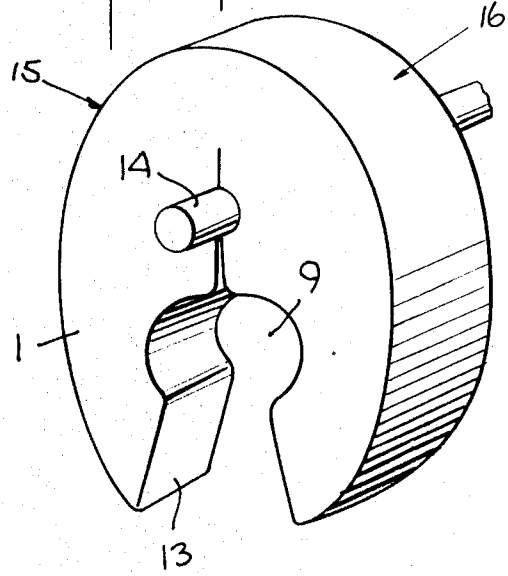
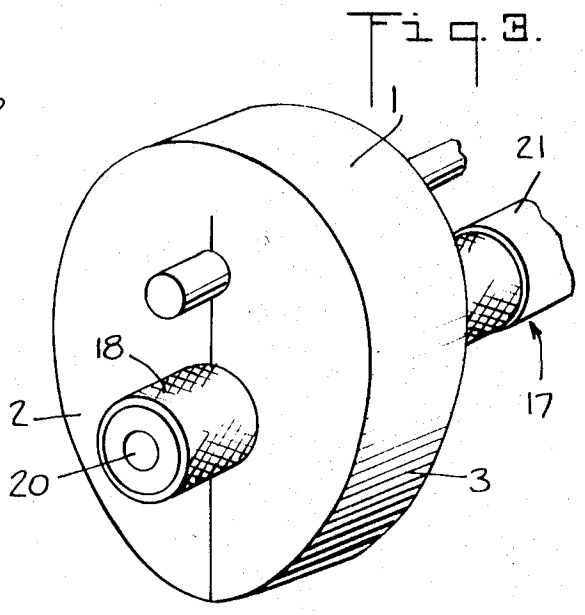


Fig. 3.



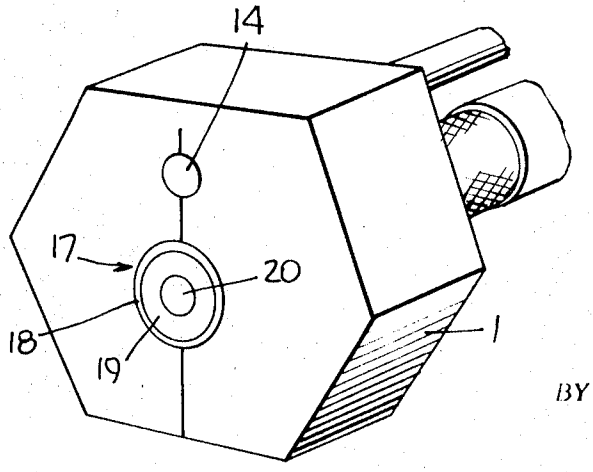


Fig. 4.

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DUAL-WIRE CONNECTOR

BACKGROUND

It is general practice to solder electrical conductors when a joint between them is desired. This procedure does not produce a uniformly good electrical connection and, in particular, does not produce a good mechanical joint. Further difficulties arise when one of the wires is a braided wire which must be partially pulled off its insulation. To meet these difficulties, solderless connectors have been developed to join wires by crimping a metal sleeve around them. The typical metal connector, which may be a disc of malleable metal with a single hole therein, raises problems when used to join two wires of different sizes. In such a case it is difficult to crimp the connector uniformly about the two wires in a single opening and to obtain uniform contact of the connector about the surfaces of the wire. If two holes of different size are provided in the connector it is usually necessary to insert both wires into the connector prior to crimping. The present invention is directed to an improved construction for a connector and method of connection which provides the required mechanical attachment and intimate electrical contact between two wires.

THE INVENTION

This invention is directed to an improved electrical connector of a malleable and electrically conductive metal, having an open slot which defines two openings to receive and grip wires of different sizes. The connector is defined by two arms and an intermediate integral connecting portion therebetween. Each of the arms have first and second inner arcuate surfaces, by which these surfaces are adapted to surround and grip conductors placed therein upon crimping together the arms of the connector. Each of the second or outer set of arcuate surfaces is positioned near the extremity of each of the arms and is larger than the first or inner set of arcuate surfaces which are positioned near the intermediate connecting portion. The electrical connector also has an integral rib between the first and second arcuate surfaces on each of the arms, and a slot in the connecting portion between the inner arcuate surfaces. This slot facilitates crimping of the arms, about a conductor placed within the inner arcuate surfaces. Upon crimping connector, the arms come together to an extent that the inner arcuate surfaces securely grip a first conductor and the opposed ribs abut. A mandrel may be placed between the extremities of the arms during this operation to maintain the spacing therebetween. Further crimping of the connector with a second conductor between the outer arcuate surfaces brings the arms together so that the extremities of the arms abut. Thus, by this invention an excellent mechanical and electrical connection is obtained between the two conductors.

The one-piece connector is capable of forming an electromechanical connection, for example, between a ground wire to an exposed shield or braided wire. Further, the ground wire can be preassembled with the connector by a applying pressure at points or areas located on opposite external sides of the connector in the areas nearest the connecting portion, that is , at places which will permit the imposed pressure to cause a slight coming together of the inner set of surfaces on the ground wire without detrimentally stressing the connector. Additionally, the integrity of the spacing between the outer set of surfaces can be maintained by inserting a rigid mandrel therein during a preassembling operation with a ground wire. Once the connector is placed over the shield or braided wire the entire connector is crimped to effect the connection.

It is noted that the connector can be applied to the end of a shield or braided wire or at intermittent points due to the crescent shape which allows a radial movement of the connector with respect to the wire.

The invention will be defined in greater detail by reference to the following figures:

FIG. 1 depicts a connector of this invention;

FIG. 2 depicts the connector and first conductor secured therein;

FIG. 3 depicts the connector and two conductors secured therein; and

FIG. 4 depicts a modified connection of the connector after being tightly crimped into a hexagonal shape about two conductors.

As illustrated in FIG. 1, the connector has a body 1 of generally crescent shape which, however, is intended to include similar configurations such as C- or U-shaped. The connector is integrally defined by two arms, 2 and 3, integrally connected by an intermediate portion 4. The crescent shape is defined by its outer surface 5. The arcuate inner wall surfaces of the crescent, 6 and 7, form two main cavities, respectively, one cavity 8 and one larger cavity 9, for receiving electrical conductors therein. These arcuate inner wall surfaces have radii, R, of about 0.013 inch for inner walls 6, and 0.031 inch for inner walls 7. These dimensions, as with others set forth below, are of course only to illustrate a particular embodiment since the connectors of this invention may be made in a wide variety of sizes. The two main cavities 8,9 are separated by channel 10 defined by opposed integral ribs 11 on the inner walls. During use this channel 10 closes upon crimping of the connector, as set forth below. In addition, a slot 12 which runs the length of the connector is formed midway of the connecting portion 4 of the connector to reduce the cross section of the connector at this point in order to facilitate crimping. The mouth of the connector is defined by flat inner wall sections 13 which are in opposed relation to abut upon crimping of the connector.

The connector of this invention is particularly adapted to electrically and mechanically join two conductors which have exposed conductive surfaces. One of the conductors 14, for example an ordinary lead or ground wire, is of a size which permits its insertion into cavity 8. The lead wire 14 may be threaded from the end a short distance through the cavity 8, or if use of the end of the conductor is not desired or convenient the body of the conductor may be slipped through the mouth of the connector and thence through channel 10 and nested into the cavity 8.

As shown, after the first conductor 14 is placed in the cavity 8, the connector is then crimped about the conductor 14, for example, by pressure at points 15 and 16 on the arms of the connector near the connecting portion. During the crimping operation, a rigid member or mandrel (not shown) is inserted between the inner walls 13 of the connector to maintain sufficient space therebetween for subsequent insertion of a second conductor into cavity 9. During this first crimping operation the points 15, 16 of pressure and the applied pressure are such that the walls of the cavity 8 are brought together slightly to grip the wire 14 without detrimentally stressing the connector 1 and without closing the arms 2, 3 to any significant degree, if any. Thus, the inner walls 6 of the connector 1 substantially completely surround the lead wire 14 providing an excellent mechanical and electrical joint. The crimped connector about the lead wire 14 forms an embodiment of the invention which may be used and sold as a unit for later attachment to a second wire.

Referring to FIG. 3, the second conductor for use in the connector is preferably a braided or shielded wire 17 of larger size than the first conductor. The second conductor 17 may be inserted into the connector in the same manner as the first conductor 14. The connector may be used in either of the forms as shown in FIGS. 1 or 2, that is, with or without the first conductor 14 prestressed thereto. For example, with the connector of FIG. 1 a single crimping operation may be carried out after both wires are placed in the connector; whereas with the smaller wire 14 first crimped in place, the second wire 17 is thereafter inserted and the connector 1 is crimped about both wires. The shielded wire 17 which is formed with an outer insulation 21, braid 18, an inner concentric layer 19 of dielectric material and a central conductor 20 is stripped of a section of outer insulation 21 to expose a portion of the braid 18 so that upon crimping of the connection 1 about the stripped area the inner arcuate walls 7 contact the braid 18 to form a secure electrical joint between the ground wire 14 and the braid 18.

Referring to FIG. 4, the connector 1 can alternatively be compressed into a hexagonal shape, for example, by the use of a hexagonal crimping tool. In this instance, the soft ductile characteristics of a powdered copper connector can be used to facilitate the deformation of the connection into the hexagonal shape. Alternatively, the connector may be compressed by a tool having a pair of semicircular jaw openings to form a substantially cylindrical outer wall surface on the connector. In either instance, the compacting produces a gastight contact between all inner surfaces of the connector, and between the conductor and connector. The slot 12, channel 11 and the mouth formed by wall sections 13 completely close during crimping and the conductors are securely gripped around their circumference by inner walls 6 and 7.

Typical dimensions of a connector of this invention are approximately 0.15 inch square and about 0.09 inch thick. It may be made of any malleable, or soft ductile current-conductive metal, such as copper, tin-coated copper, bronze, aluminum, suitable alloys and the like. Preferably, the connectors are made of sintered powdered metal, such as copper powder, which, after being crimped to the conductors by compression, can easily be broken away by the application of a tensile force to the connector as desired. The use and fabrication of this type of metal in a connector is set forth in detail in U.S Pat. No. 3,345,452 which is incorporated herein by reference. The metal powder compact is distinguished from other metal connectors by its compressive-tensile leading characteristics. The metal compact is sufficiently ductile or malleable so that it deforms to completely surround the conductors during compressive crimping but is sufficiently frangible so that it will break into pieces when a tensile force is applied to it, for example by the flattening action of plier jaws.

Preferably, to make the connector very conductive and more suitable in application to a conductor and more frangible under tensile forces, the sintered connector is made from materials comprised of a mixture of copper powders, a maximum of 60 percent of which is smaller than 325 mesh and the remainder of which is smaller than 150 mesh, thoroughly blended. This mixture is introduced into a die cavity and through the actions of a punch pressed so tightly within the cavity that the powder compacts and adheres into a fairly unitary mass and will readily hold together when removed from the mold.

If desired, an air and moisture impervious resinous coating may be applied to the connector to prevent corrosion of the connector. This coating may be applied to any of the connectors of the type disclosed herein.

This invention has been described in terms of specific embodiments set forth in detail. Alternative embodiments will be apparent to those skilled in the art in view of this disclosure, and accordingly such modifications are to be contemplated within the spirit of the invention as disclosed and claimed herein.

What is claimed is:

1. The combination of an electrical connector and a conductor secured therein, said connector being of a malleable, ductile, electrically conductive metal having two arms forming an open recess diverging outwardly at the extremities thereof and integral intermediate connecting portion therebetween, each of said arms having first and second arcuate surfaces, said second arcuate surfaces being positioned near the extremities of said arms to form a closable wire-receiving opening, said second arcuate surfaces being larger than said first arcuate surfaces, and an integral rib between said first and second arcuate surfaces on each of said arms, said rib on each arm being in substantially abutting position with each other and said first arcuate surfaces being in tight mechanical contact with said conductor

2. An integral electrical connector of malleable ductile metal having a pair of arms and an integral connecting portion therebetween defining an open recess between the arms, each of said arms having a first and second inner arcuate surface, each of said second arcuate surfaces being positioned near the extremity of each of said arms and being larger in length than said first arcuate surfaces, and each of said first surfaces being positioned near said connecting portion, each of said arms having an integral rib disposed between said first and second arcuate surfaces, said integral ribs providing a first pair of oppositely outwardly diverging surfaces, and the extremities of the arms providing a second pair of opposed surfaces that are divergent outwardly at a greater angle than the surfaces provided by the ribs, said arms being formed to cause said first arcuate surfaces to surround and grip a first conductor placed therein and to cause said integral ribs to be in abutting relationship thereto upon crimping together the portions of said arms containing the first arcuate surfaces while maintaining open said recess between the second arcuate surfaces to permit later insertion and crimping the second arcuate surfaces about a second conductor.

3. An integral electrical connector as in claim 2 wherein the connector is crescent shape in configuration.

4 An integral electrical connector as in claim 2 wherein the connector is made of a sintered powdered metal.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,617,616 Dated November 2, 1971

Inventor(s) Francis A. O'Loughlin

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 27, "leading" should be -- loading --

Signed and sealed this 16th day of May 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

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