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[54] **DISCONNECTABLE ELECTRICAL CONNECTOR**

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[52] **U.S. Cl.** ..... **339/60 C;** 339/61 R; 339/103 R; 339/111

[51] **Int. Cl.²** **H01R 11/02**

[58] **Field of Search** .... 339/59 R, 60 R, 61 R, 94 R, 339/111, 60 C, 103 R, 177 R, 75 R, 129, 91 R, 108

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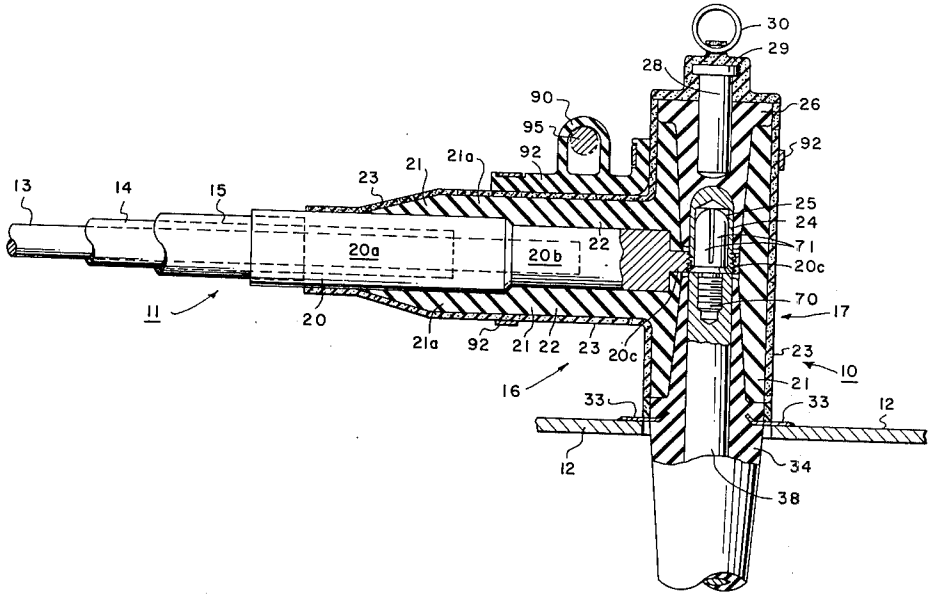
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[57] **ABSTRACT**

Disclosed is electrical connecting apparatus including a cable connecting portion and a transversely extending bushing assembly conductively coupled to the electrical apparatus, the cable connecting portion and the bushing assembly portion being disconnectably coupled by way of a socket and socket engaging means located at the situs of the coupling. The socket engaging means comprises a conductive plug having a plurality of resilient extending fingers mateably received by the socket, and means are provided for disconnecting the cable connecting portion from the bushing assembly portion by use of a hot stick.

6 Claims, 2 Drawing Figures



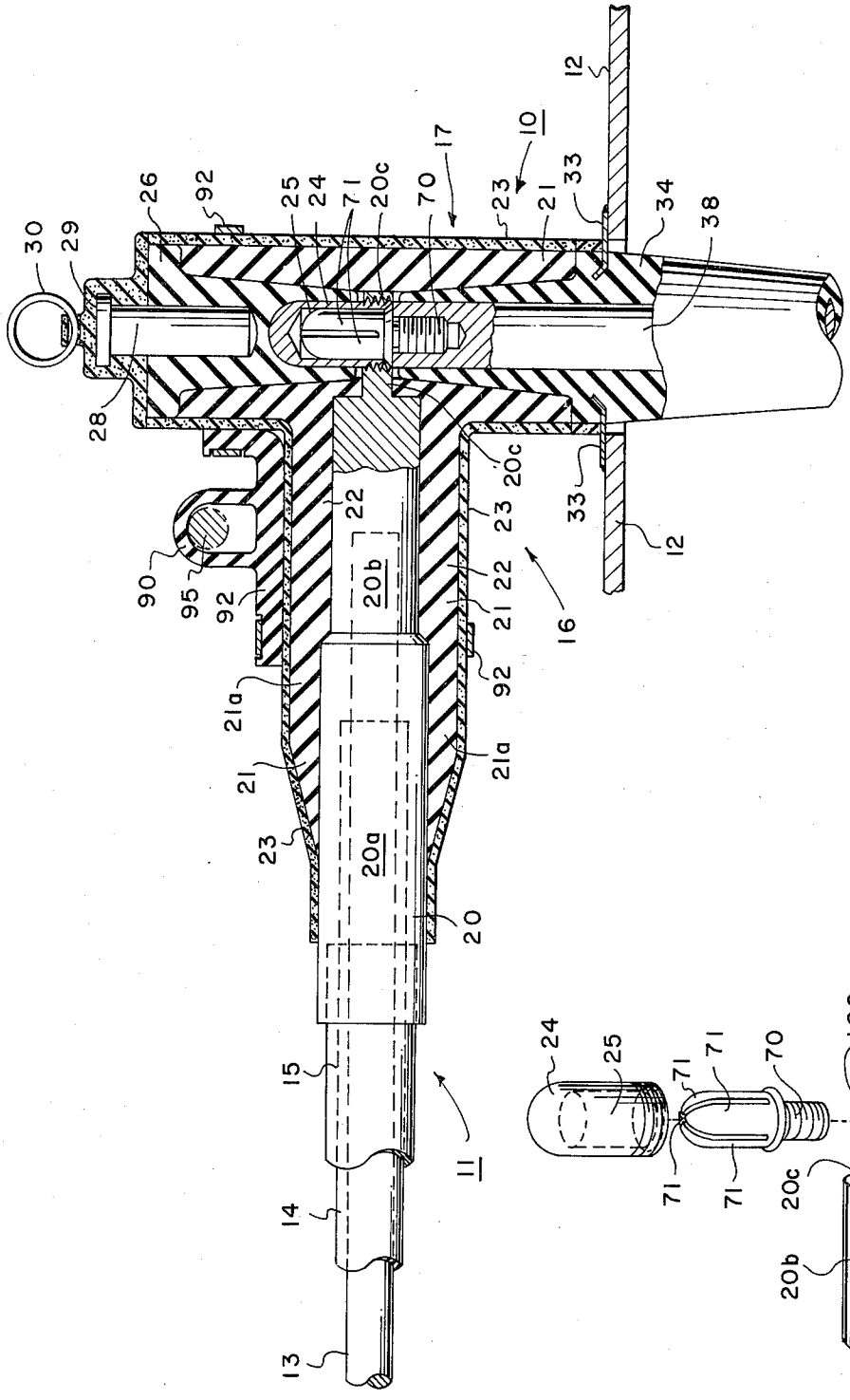

12
10
17
26
92
25
24
71
20c
70
23
21
33
34
38
30
29
28
20c
33
12
22
23
90
95
92
20b
21
22
16
92
21a
21a
21
23
20a
20
15
11
14
13

FIG. 1

24
25
71
71
70
100
38
71
71
20c
20b

FIG. 2

DISCONNECTABLE ELECTRICAL CONNECTOR

The present invention relates generally to electrical connectors, more particularly to electrical connectors for high voltage electrical systems, and even more particularly to mateably disconnectable electrical connectors for coupling high voltage electrical cables with electrical apparatus.

The need for coupling electrical power to and from high voltage electrical apparatus has resulted in the development of many types of electrical connection apparatus ranging from complex automatic switching equipment to simple plug-in type connectors. One class of commonly employed plug-in type electrical connectors utilizes an "elbow" assembly comprising a first portion conductively coupled to the high voltage cable and a second transversely extending portion conductively coupled to the electrical apparatus by way of a bushing assembly extending through an opening in the housing of the apparatus. The first and second portions are rigidly coupled together normally by way of a threaded coupling means. While this type of connector has generally served its intended purpose, difficulties are often encountered when it is necessary to disconnect the cable from the apparatus. Specifically, since the various portions of the connector itself are rigidly joined, the disconnection, when required, demands that the high voltage cable be physically uncoupled from the connector assembly, an extremely inconvenient procedure considering the fact that these cables are normally very large and bulky. Furthermore, in the case of underground distribution networks, the relative inaccessibility to the cables further complicates the disconnection procedure.

It is therefore a primary object of the present invention to provide a new and improved electrical connector assembly.

It is a further object of the present invention to provide for the disconnection of the high voltage power cable from the electrical apparatus without physically uncoupling the cable itself.

It is a still further object of the invention to provide an electrical connector assembly particularly useful in underground electrical distribution networks.

It is an even further object of the invention to provide electrical connector assembly having relatively simple construction capable of economical fabrication.

In accordance with these and other objects, the present invention is directed to an electrical connector assembly having a cable connecting portion disconnectably coupled to the electrical apparatus bushing assembly. Specifically, uniquely designed male and female mateably engaging portions are respectively provided at the situs of the connection of the cable connecting portion with the bushing assembly, means being provided on the cable connecting portion to enable the "hot stick" disconnection of these coupled parts.

Additional features, as well as further objects and advantages, of the invention will become more readily understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an elevational view, substantially in cross section, of the electrical connector assembly constructed in accordance with the teachings of the invention; and

FIG. 2 is a pictorial view illustrating the construction of, and cooperating relationship between, the mateably engaging portions at the situs of the interconnection of the cable connecting portion and the bushing assembly illustrated in FIG. 1.

Referring now to the drawings, and particularly to FIG. 1, there is depicted the electrical connector assembly **10**, constructed according to the teachings of the invention, for electrically connecting a high voltage cable **11** with electrical apparatus disposed within the housing **12**. The type of electrical apparatus within the housing **12**, and the details thereof, are not material to the present invention, and could be, for example, a distribution transformer, an electrical switch etc., all as conventionally known in the art.

The connector assembly **10** broadly includes a cable connector subassembly **16** to which the cable **11** is coupled and a bushing subassembly **17** extending through the apparatus housing **12** and electrically connected to the electrical apparatus disposed therein. As subsequently described, the cable connector subassembly **16** when joined to the bushing subassembly **17** electrically couples cable **11** with the electrical apparatus.

The cable connector subassembly **16** includes a conductive rod **20** having a plurality of axially related step portions **20***a*, **20***b*, and **20***c*. A generally cylindrical T-shaped jacket **21** has an extending portion **21***a* disposed around the major portion of the length of the conductor **20**, the jacket **21** comprising a main body portion **22** of insulating material, preferably insulating elastomeric material, and an outer surface portion **23**, preferably of conductive elastomeric material, providing a semiconductive shielding therefor. As depicted in FIG. **1**, the surface portions **23** engage the outer surface of the stepped portion **20***a* of the cable connector.

The high voltage cable **11** includes a central conductor **13** disposed within an insulating jacket **14** around which is disposed a conductive shield **15**, all as is conventionally known in the art. The end of the cable **11** is coaxially terminated within an axially extending opening in the end of the conductive rod **20**, and is thereby electrically connected thereto.

Threadably coupled to the axially extending end portion **20***c* is a conductive body **24** having an internally defined socket **25** therein. The body **24** is snugly received within a seat defined by the circumferentially extending walls at the lower end of an insulating support body **26**, as illustrated in FIG. **1**. As subsequently described in greater detail, the body **24** is aligned with one end of the conductive rod of the bushing assembly **17** so as to allow the socket **25** to removably receive the conductive stud **70** at the end of this conductive rod. As pictured in the drawing, the support body **26** is snugly received and confined by a portion of the body **22** of the jacket **21**.

In accordance with a specific feature of the present invention, as clearly depicted in FIG. **1**, a plug **28** of conductive material is disposed within, and extends through, the insulating support body **26** to a position adjacent, but spaced from, the conductive body **24**; the conductive plug **28** thus provides a voltage test point for the entire connector assembly. Accordingly, and for this purpose, an insulating cap **29**, preferably elastomeric material, can be removed from the end portion of the plug **28** by way of the pull ring **30**, when it is desired to probe the plug **28** to determine if the assembly is "hot."

Extending through the apparatus housing **12**, and affixed thereto by extensions **33**, is an insulating housing **34** formed preferably of an insulating elastomer material. Axially extending through the jacket **34** is a cylindrical conductor **38** electrically coupled at its lower end (not shown) to the electrical apparatus within the housing **12**. At its opposite end and threadably affixed thereto, is a conductive stud **70** having a plurality of resilient fingers or extensions **71** adapted to be received within the socket **25**. It is to be noted that an electrically conductive path is defined between the electrical apparatus within the housing **12** and the projections or fingers **71**. Thus, when the fingers **71** of the conductive stud **70** are disposed within the cavity **25**, the conductive rod **20** of the cable connector portion **16** is conductively coupled to the conductor **38**, and electrical communication established between the cable and the apparatus. As is apparent by reference to the drawing, the conductive stud **70** can be alternatively inserted into or removed from the cavity **25**, thus providing for a convenient disconnectable coupling between the cable and the electrical apparatus.

Referring specifically to FIG. **2**, the resilient fingers or extensions **71** are illustrated. While any number of these fingers can be utilized consistent with the purpose of the invention, it has been found that the use of four such fingers (each occupying approximately ninety degrees along the circumference of the contact) provides an optimum number of conductive surfaces for effective current transferrence at the situs of the coupling. As depicted, an essentially 3-way contact is effected between the rod **38**, body **24**, and cable connecting conductive rod portion **20***c*. Accordingly, an opening **100** is provided within the portion **20***c* to receive the body **24**, and to enable the fingers **71** to pass therethrough into the socket **25**.

Referring again to FIG. **1**, the connector is illustrated with the cable connector **16** being joined, the fingers **71** of the stud **70** being firmly seated within the socket **25**, and the end portion of the insulating jacket **34** being snugly received by the jacket **21**, as illustrated. When it is desired to disconnect the cable **11** from the electrical apparatus, the cable connector portion **16** is lifted from the bushing assembly **17**, thus uncoupling the socket **25** from the finger extensions **71**. As a particular feature of the present invention, and to assist in this disconnection, a body **92** having a ring **90** is clamped to the T-shaped jacket **21**. Thus, when an elongated rod or "hot stick" **95** is inserted through the ring **90**, the desired disconnection can be achieved by lifting the portion **16** from the assembly **17** with the "hot stick." This feature is particularly advantageous when the connector assembly **10** is disposed underground.

Various modifications to the disclosed embodiment, as well as alternate embodiments of the present invention may become apparent to one skilled in the art without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. Electrical connecting apparatus for disconnectably electrically coupling a high voltage electrical cable with electrical apparatus, comprising:

a. cable connecting means including an elongated first central conductor axially extending through an insulating jacket and adapted for coaxial termination with said cable, said first central conductor having an extending end portion thereof with an opening defined in said end portion; conductive body means rigidly affixed to said end portion and having a socket therein aligned with said opening; an insulating support body; said conductive body means disposed within said insulating support body; a conductive plug disposed within the base of said insulating support body and having an end portion spaced from said conductive body means, said conductive plug providing a conductive test point for said electrical connecting apparatus,

b. bushing assembly means including an elongated second central conductor axially extending through an insulating jacket for electrical connection with said electrical apparatus,

c. said second central conductor having socket engaging means provided at one end thereof, said socket engaging means comprising a plurality of conductive resilient extensions which extend through said opening into said socket, and

d. means attached to said cable connecting means to enable the lifting of said cable connecting means out of coupling engagement with said bushing assembly.

2. The apparatus as defined by claim **1** wherein each of said resilient extensions extend along a substantially 90° arc.

3. In a high voltage electrical connector assembly for electrically coupling a high voltage electrical cable with electrical apparatus, the said connector assembly being of the type comprising a bushing assembly for mounting in the housing of said electrical apparatus and including a first insulating jacket and first elongated central conductor axially extending through said first jacket; and a cable connector assembly for coaxial termination with said high voltage electrical cable and including a second insulating jacket and second elongated central conductor axially extending through said second jacket transverse to said first elongated central conductor; the improvement comprising means to be disposed at the intersection of said bushing assembly and said cable connector assembly for disconnectably electrically coupling said first and second elongated central conductors and joining said cable connector assembly with said bushing assembly, wherein said means comprises:

a. a first electrically conductive body adapted for rigid coupling engagement with the end portion of said second elongated central conductor at said intersection and defining a socket therein axially aligned with said first elongated central conductor; and

b. a second electrically conductive body adapted for rigid coupling with, and having socket engaging means axially aligned with, the end portion of said first elongated central conductor at said intersection, said second conductive body to be received within said socket and comprising a plurality of conductive resilient extensions disconnectably receivable within said socket.

4. The improvement as defined in claim **3** further including, in combination, means coupled to said cable connector assembly at a location which enables the lifting of said cable connector assembly out of joinder with said bushing assembly.

5. The improvement as defined in claim **3** wherein each of said resilient extensions extend along a substantially 90° arc.

6. The improvement as defined by claim **3** wherein said first electrically conductive body is received within

a recess defined in an insulating support body joined with said second insulating jacket and further includes, in combination, a conductive plug disposed within said insulating support body and having an end portion spaced from said first electrically conductive body to provide a test point for said connector assembly.

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