

- [54] **ELECTRICAL CONNECTOR APPARATUS** 3,307,137 2/1967 Tordoff et al. 339/61 R
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[58] **Field of Search** 339/19, 45, 46, 60, 61;
 29/200 D, 200 H, 203 H, 203 HM, 203 HT,
 258, 259, 262, 266

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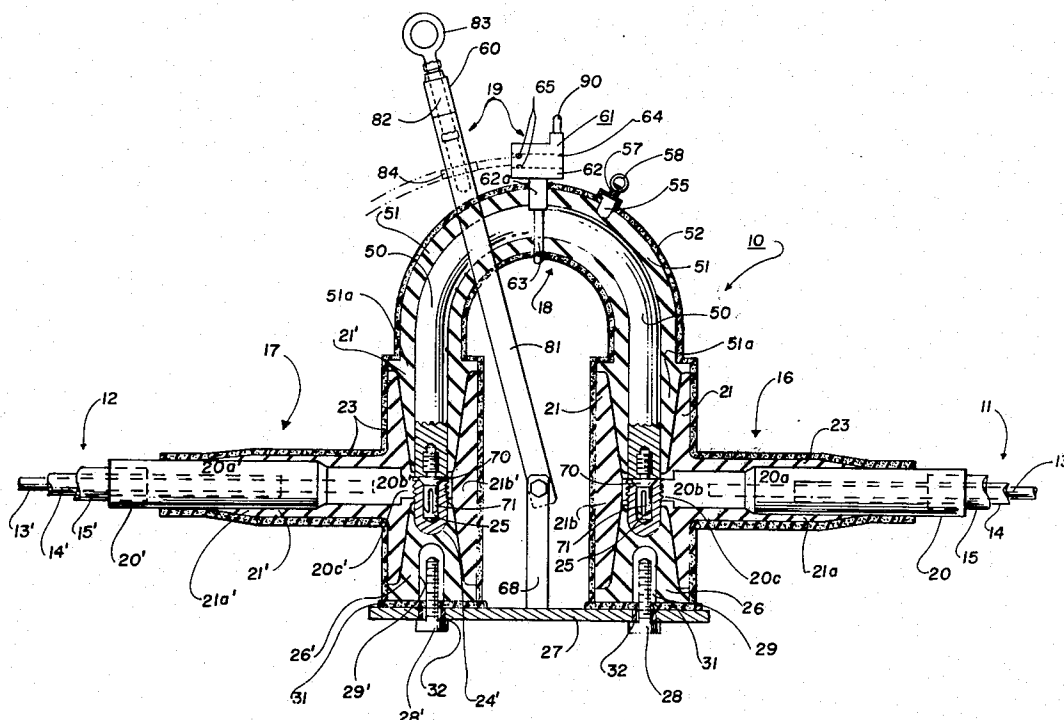
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[57]

ABSTRACT

Disclosed is electrical connector apparatus having an insulated conductive link disconnectably coupling a pair of high voltage electrical cables. The electrical coupling is effected by way of conductive studs formed at the end portions of the link having a plurality of resilient extending fingers mateably received by sockets disposed within the cable connectors. A jack assembly comprising a pivotally mounted frame with a lifting washer and a catch assembly coupled to the link for receiving the lifting washer facilitates the insertion and retraction of the link assembly.

2 Claims, 5 Drawing Figures



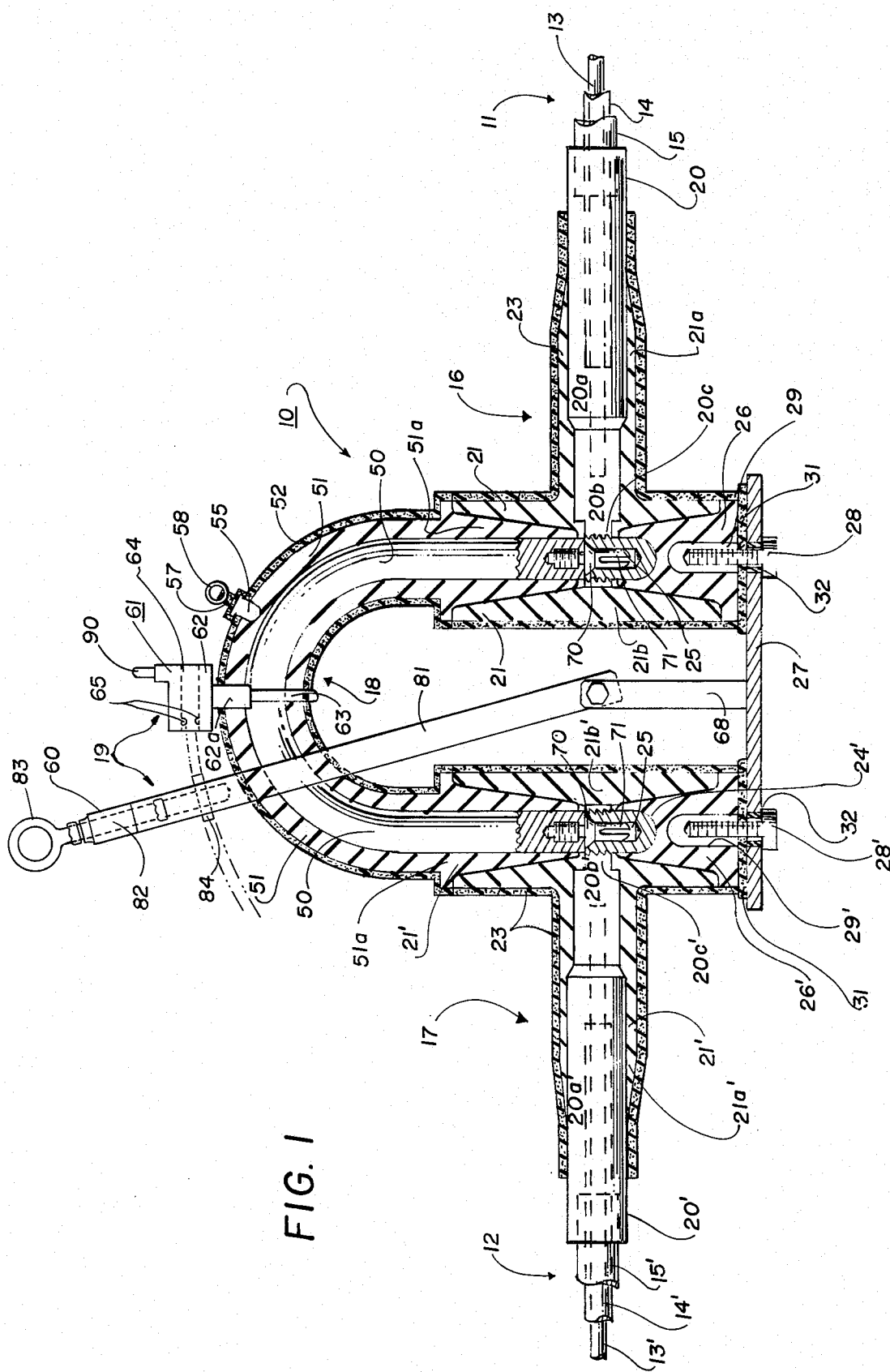
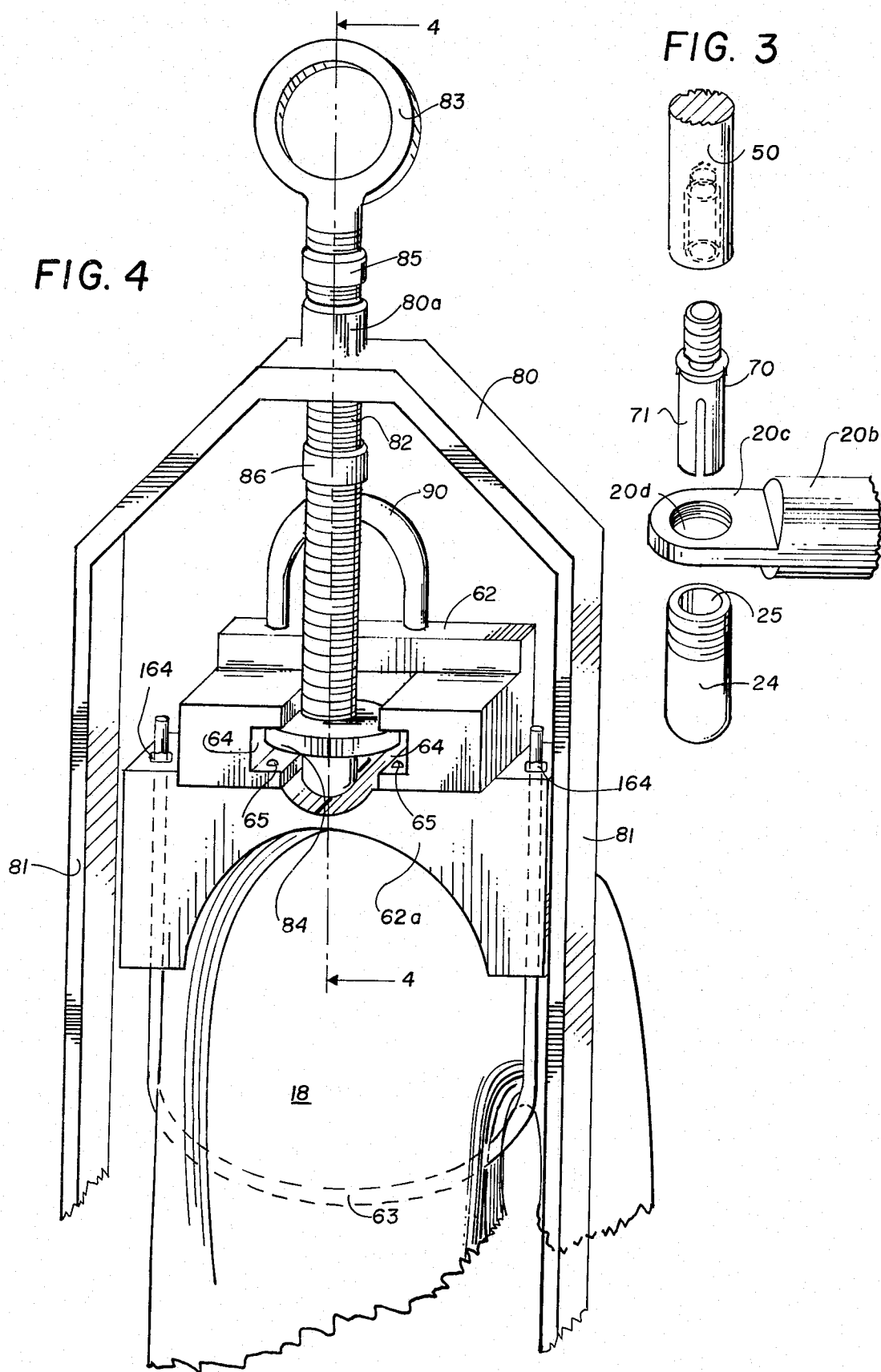


FIG. 2



ELECTRICAL CONNECTOR APPARATUS

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

The need for coupling electrical power between high voltage cables and 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 cable connecting portion conductively coupled to the electrical apparatus by way of a bushing assembly extending through an opening in the housing of the apparatus. This type of connector is not entirely satisfactory, however, since difficulties are often encountered when it is necessary to disconnect the cable from the apparatus. Specifically, this disconnection requires that the cable be physically uncoupled from the connector assembly and, since these cables are normally very large and bulky, such disconnection is extremely inconvenient. Furthermore, in underground distribution networks, the relative inaccessibility to these cables further complicates the situation.

To overcome these problems, a unique electrical connector assembly has been designed which comprises a generally U-shaped disconnectable link which enables the quick, convenient connection and disconnection between cables or between a cable and electrical apparatus, this apparatus being described in co-pending U.S. patent application Ser. No. 315,636, filed Dec. 15, 1972, now U.S. Pat. No. 3,853,375, assigned to the assignee of the present invention. While this apparatus has served its intended purpose, it has been found useful to provide improved means coupled to the link for facilitating its connection and disconnection with the remainder of the assembly.

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 new and improved apparatus for disconnectably coupling high voltage power cables with one another or with electrical apparatus without physically moving the cable.

It is a still further object of the invention to provide means for facilitating the disconnectable coupling and uncoupling of high voltage electrical cables.

In accordance with these and other objects, the present invention is directed to an electrical connector assembly having means for disconnectably coupling high voltage electrical cables with one another or with electrical utilization apparatus by way of a generally U-shaped link which is forced into, or lifted from, electrical connection with one or more stationary cables. In accordance with specific features of the present invention, a uniquely designed jack assembly assists in the insertion and retraction of the link.

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, illustrating the disconnectable link in its "connected" position;

FIG. 2 is an elevational view, substantially in cross-section, of the electrical connector assembly constructed in accordance with the teachings of the invention, illustrating the disconnectable link in its "disconnected" position;

FIG. 3 is a pictorial view illustrating the construction of, and cooperating relationship between, the connector elements at the situs of interconnection of the disconnectable link with another one of the cable connector subassemblies;

FIG. 4 is a pictorial view of a portion of the apparatus of the invention, illustrating the engagement of the respective portions of the jack assembly for inserting and retracting the disconnectable link; and

FIG. 5 is a partial sectional view of the apparatus depicted in FIG. 4, taken along the section lines 4-4.

Referring now to the drawings, and initially to FIG. 1, there is depicted the disconnectable electrical connector assembly 10, constructed according to the teachings of the invention, for respectively electrically connecting and disconnecting a pair of high voltage cables 11 and 12. The assembly 10 broadly includes cable connector subassemblies 16 and 17 to which the cables 11 and 12 are respectively rigidly coupled; a disconnectable link subassembly 18 for disconnectable electrical connection of the cables 11 and 12; and a jack assembly 19 for facilitating the respective engagement and disengagement of the link 18 with the cable connectors 16 and 17.

Cable connector subassembly 16 includes an elongated conductive rod 20 having a plurality of axially related stepped portions 20a, 20b, and 20c, an internally threaded opening 20d (FIG. 3) being provided in the portion 20c. A generally cylindrical T-shaped jacket 21 has an extending portion 21a disposed around the major portion of the length of the conductor 20, the lower end of the transversely extending portion 21b enclosing a support body 26, as illustrated in FIG. 1. The main body of the jacket 21, as well as the support body 26, is of electrically insulating material, preferably insulating elastomeric material, the outer surface portion 23 of the jacket 21 preferably being of a conductive elastomeric material which provides a semi-conductive shielding for the overall subassembly 16. As depicted in the drawings, the surface portions 23 extend out and engage the outer surface of the stepped portion 20a of the conductive rod 20.

Threadably coupled to the axially extending end portion 20c within the opening 20d is a conductive body 24 having an internally defined socket 25 (FIGS. 2 and 3). The body 24 is snugly received within a seat defined by the circumferentially extending walls at the upper end of the insulating support body 26. As subsequently described in greater detail, the socket 25 is aligned with, and adapted to receive, a male extension of the axially extending conductive rod of the link assembly 18.

The cable connector subassembly 17 is identical in configuration and construction as the just described cable connector assembly 16, corresponding portions thereof bearing the same numerical references as the portions of the assembly 16, but "primed" to distin-

guish therefrom. (conductive rod 20' corresponds to conductive rod 20, insulating jacket 21' corresponds to insulating jacket 21, etc.)

Both the cable connector subassembly 16 and 17 are rigidly connected to a common mounting plate 27 by way of studs 28 and 28' respectively threadably coupled with inserts 29 and 29' in the base of the support bodies 26 and 26'. Insulating discs 31, preferably of insulating elastomeric material, and insulating washers 32 are provided, as illustrated, at the situs of attachment. The subassembly 16 and 17 are thus adapted to respectively receive high voltage electrical cables 11 and 12 which extend in directions generally parallel to the mounting plate 27.

The high voltage cable 11 conventionally includes a central conductor 13 disposed within an insulating jacket 14 around which is disposed a conductive shield 15. The end of the cable 11 is coaxially terminated within an axially extending opening in the end of the conductive rod 20 in the manner conventionally known in the art, and is thereby electrically connected therewith. In similar manner, the high voltage cable 12 including central conductor 13', insulating jacket 14', and conductive shield 15', is coaxially terminated with the conductive rod 20' of cable connector subassembly 17.

Electrical coupling is effected between the conductive rod 20 of the cable connector subassembly 16 and the conductive rod 20' of the cable connector subassembly 17 (and therefore between cables 11 and 12) by way of the generally U-shaped link assembly 18 which is adapted for removable mateable engagement with the assemblies 16 and 17. Specifically, the link assembly 18 comprises a central conductive rod 50 axially extending through an integrally joined insulating jacket 51 around which a surface semi-conductive shield or coating 52 is provided. Ends 51a of the insulating jacket 51 are tapered so that when the link 18 is in its engaged position (illustrated in FIG. 1), the ends 51a are removably, but snugly, received within the upper end of the portions 21b (and 21b') of the jacket 21.

A conductive plug 55 desirably extends through a portion of the insulating jacket 51 (to the location shown in FIG. 1) to provide a voltage test point for the entire connector assembly. An insulating cap 57 can be removed from the end portion of the conductive insert 55 by way of a pull ring 58 when it is desired to determine if the assembly is "hot".

The opposed ends of the axially extending conductive rod 50 have conductive studs 70 threadably secured thereto, each of the studs 70 having a plurality of resilient extensions or fingers 71. Thus, when the link assembly 18 is in the connected position (illustrated in FIG. 1), the fingers 71 of the studs 70 are firmly seated within the sockets 25 (25'), a tight electrical connection thereby being provided between the conductors of the cable connector assemblies. As best viewed with respect to FIG 3, this electrical connection is essentially a three-way contact between the conductor rod 50, body 24 (24'), and cable connecting rod portion 20c (20c'), the fingers 71 passing through the opening 20d into the socket 25 (25').

In order to electrically disconnect the cables 11 and 12 from one another, without having to physically move the cables, the link assembly 18 is pulled upward to simultaneously disengage from the cable connector subassemblies 16 and 17 (position generally depicted

in FIG. 2). During such disengagement, the end portions 51a of the link insulating jacket separate from the upper end portions of the jacket extension 21b (and 21b') with the conductive studs 70 being withdrawn from sockets 25 (25'). This consequently results in the quick electrical disconnection of the cables.

In accordance with the unique feature of the present invention, the engagement or disengagement of the link assembly 18 with the cable connectors 16 and 17 is effected by the jack apparatus 19 which comprises a lifting assembly 60 and a catch assembly 61. Referring to the drawings, and particularly FIGS. 1 and 4 thereof, the catch assembly 61 comprises a housing 62 having a portion 62a straddling the link 18 and secured thereto by a U-bolt 63 passing through the portion 62a and threadably joined thereto by nuts 164. At the top of the housing 62 is a ring 90 through which a "hot stick" 95 (FIG. 2) can be inserted. A channel 64 extends through the housing 62, dimples 65 extending a small distance into this channel.

The lifting assembly 60 comprises a frame 80 having parallel opposed arms 81 pivotally coupled to a pair of support extensions 68 (one of which is depicted in FIG. 1) rigidly secured to the mounting plate 27. An internally threaded flange portion 80a is adapted to receive an externally threaded shaft 82 therethrough. An eye portion 83 disposed at the top of the shaft 82 is provided for turning the shaft 82 in the clockwise or counterclockwise direction, thus lowering or raising the shaft. A pair of nuts 85 and 86 disposed at desired locations along the length of the shaft 82 respectively limit the downward and upward movement thereof.

Rigidly coupled at the end of the shaft 82 is a lifting washer or disc 84 of a size and construction capable of being inserted into the channel 64 of the catch assembly. The disc is so positioned that when the frame 80 is pivoted from the position shown in FIG. 1 to its vertical position (FIGS. 4 and 5), the disc 84 is received within the confines of the channel 64, the dimples 65 assisting in retaining the disc therein. Thereafter, by cranking the eye 83 (and shaft 82) in the appropriate direction, the disc 84 will be urged against the top wall 69 of the channel, thereby urging the link 18 out of engagement with the cable connector assemblies 16 and 17 with the fingers 71 being released from sockets 25 and 25'. Thereafter, the link 18 can be completely removed (as shown in FIG. 2) by a hot stick 95 inserted through the ring 90.

Similarly, the link 18 can be forced into secure engagement with the assemblies 16 and 17 by initially setting the link into place, pivoting the frame 80 to position the disc 84 within the channel 64, and thereafter turning the eye 83 in a direction to force the disc against bottom wall 69a and thus stud fingers 71 into the sockets 25 and 25'.

The electrical connecting apparatus in accordance with the present invention thus provides a means for quickly and conveniently electrically connecting or disconnecting the high voltage cables while avoiding the necessity of physically moving the cables themselves. While the apparatus has been described with reference to the electrical connection of two cables, it can also be employed for the disconnectable coupling of a cable with electrical utilization apparatus, such as a distribution transformer, electrical switch, etc. For such use, the subassembly 17 would normally be a bushing assembly (of the type shown in co-pending application

Ser. No. 315,636) having a central conductor coupled to the utilization apparatus. The jack assembly 19 would then be employed, as described, to facilitate the insertion or retraction of the U-shaped link 18 to electrically couple or uncouple the cable 11 and the electrical utilization apparatus. 5

Various other 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. 10

What is claimed is:

1. Electrical cable connecting apparatus, comprising:
 - a. common mounting support means,
 - b. first and second insulator housings rigidly affixed to said common mounting support means at laterally spaced locations thereon, said insulator housings comprising respective elongated insulating jackets extending from said common mounting support means in directions parallel to one another, each of said insulator housings having conductive means disposed within the confines of said insulating jacket, 15
 - c. an elongated conductor axially extending through an insulating jacket in a direction transverse to said parallel direction, said elongated conductor having one end adapted for coaxial termination with a high voltage electrical cable and the other end electrically connected with one of said conductive means, 20
 - d. generally U-shaped connector link means including a central conductor axially extending through, and entirely surrounded by, an insulating jacket, the end portions of the central conductor being adapted for respective removable mateable engagement with said conductive means disposed within said insulator housings, the end portions of said insulating jacket of said link means being adapted for respective removable mateable engagement with the elongated insulating jackets of 25

said insulator housings, said link means being simultaneously disconnectably coupled with said first and second insulator housings to electrically connect said conductive bodies by way of the central conductor of said connector link means, and e. jack assembly means for facilitating the respective retraction and advancement of said U-shaped connector link from and into coupling engagement with said insulator housings, said jack assembly comprising: 30

a catch assembly comprising a housing having a channel therein, said channel extending to at least one side of said housing to define an opening thereto, said housing being so mounted to said U-shaped connector link means to position said channel above, and tangential to, the apex of said U-shaped connector link means, and

an arm assembly comprising a generally U-shaped frame having parallel disposed arms, a shaft threadably connected at the apex of said frame and extending intermediate, and generally parallel to, said arms, washer means affixed at one end of said shaft and dimensioned to fit within the confines of said channel, said arm assembly being mounted so that said parallel disposed arms straddle the U-shaped connector link means and are pivotally movable about a point disposed directly below the apex of said U-shaped connector link means, whereby the pivoting of said arm assembly to a substantially vertical position disposes said washer means within said channel to enable the respective retraction and advancement of said link means from and into coupling engagement with said insulator housings in response to the rotation, in one direction and the other, of said threadably connected shaft. 35

2. The apparatus as defined by claim 1 wherein said catch assembly further includes a lifting eye adapted to receive a hot stick. 40

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