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Ettinger

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[54] **QUICK DEMOUNTABLE LOAD TAP CHANGER TERMINAL**

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[73] Assignee: **General Electric Company**

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[52] **U.S. Cl.** ..... **339/263 R,** 403/290, 339/272 R

[51] **Int. Cl.** **H01r 7/08**

[58] **Field of Search** 339/263, 264, 265, 266, 339/272, 255; 403/290, 305, 313, 362

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[57] **ABSTRACT**

A quick demountable clamp-type electrical connector of cylindrical shape for use in a high voltage environment where space is limited such as that which occurs at the connection between a load tap changer and its associated power transformer. The connector has an opening at one end, offset from the longitudinal centerline of said connector, which mates with a male terminal. This offset opening permits the use of a clamping arrangement that results in a quick demountable compact unitary connector with a relatively smooth projection free exterior surface which produces relatively low voltage stresses in a high voltage environment.

5 Claims, 4 Drawing Figures

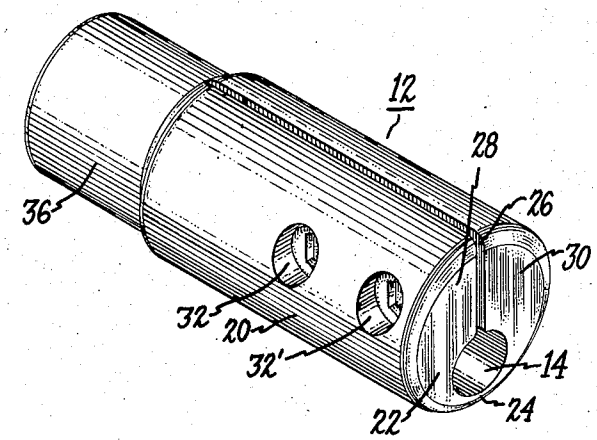


Fig. 1.

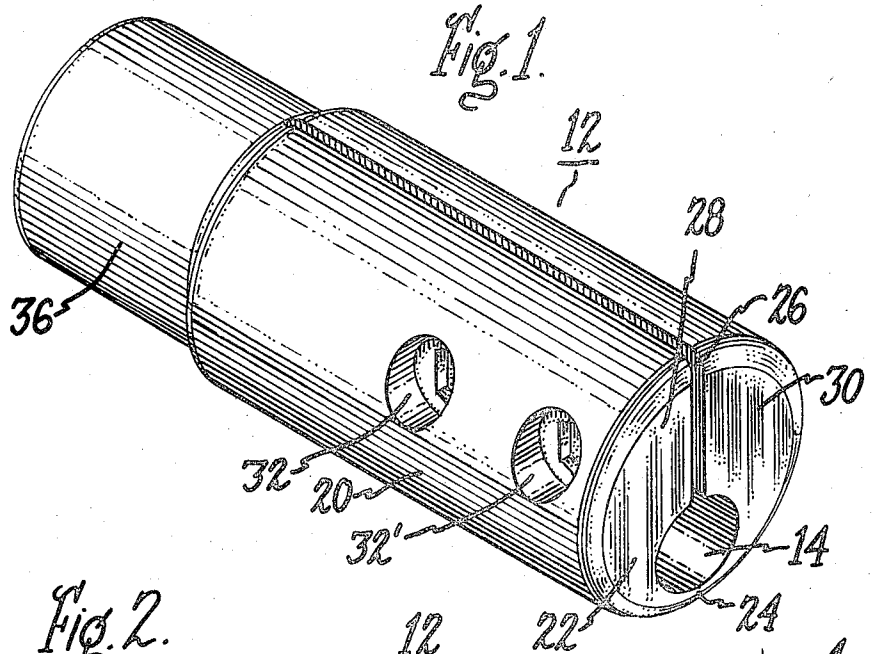


Fig. 2.

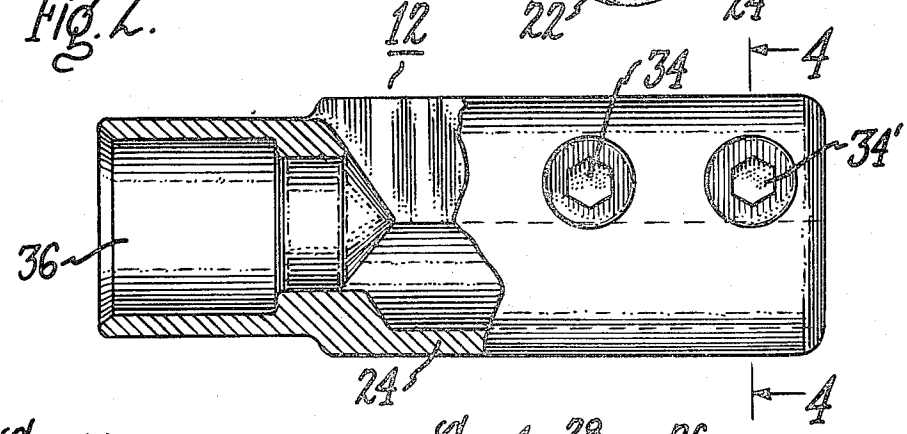


Fig. 3.

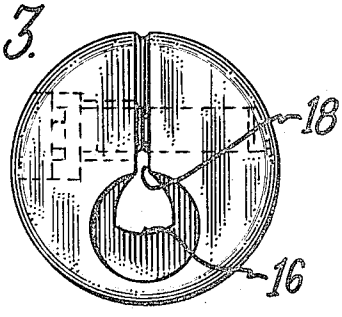
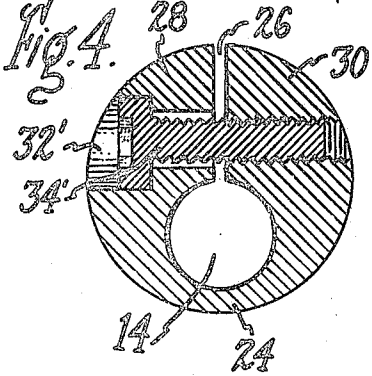


Fig. 4.



QUICK DEMOUNTABLE LOAD TAP CHANGER TERMINAL

BACKGROUND OF THE INVENTION

This invention relates to connectors in general, and more particularly to such connectors as are used on high voltage electrical connectors of the type used in power transformer load tap changers where space is limited. The invention, however, is not limited to such connectors, as in its broadest aspects it is capable of general application, it being applicable wherever a connection must be made in high voltage conductors and space in the vicinity of the connection is limited.

Load tap changers are devices that select the appropriate power transformer output voltage for the load being supplied by such a transformer. A power transformer is one that usually steps up voltage to a magnitude in excess of several hundred kilovolts. These load tap changers, normally attached to their associated transformers, are sometimes removed for shipment. The connectors of the present invention are used to electrically connect the load tap changer to its associated power transformer, whether the load tap changer is removed for shipping or not.

Before this invention the type of connector used to connect a load tap changer to a power transformer had several disadvantages. These prior art connectors had irregularly shaped exterior surfaces due mainly to the means used to attach these connectors to mating male electrical terminals. In a high voltage environment it is desirable to provide a connector having a smooth exterior surface free of outward projections and sharp corners thereby avoiding the voltage stresses, dielectric breakdown and arc-over resulting from such shapes. In order to reduce voltage stresses caused by using connectors with such irregularly shaped external surfaces in a high voltage environment, the time consuming procedure of contouring these irregular shapes with a putty filler and then wrapping the contoured region with both aluminum backed and oil impregnated paper insulating tapes was employed.

Prior to shipping a load tap changer with its associated transformer, the load tap changer and transformer are assembled as a unit for testing purposes, including contouring and wrapping the external surfaces of these irregularly shaped prior art connectors. Upon completion of testing, the filler and various tapes are removed from the connector in order to expose the connector attaching means so that the load tap changer can be disconnected from its associated power transformer.

In order to avoid these and other disadvantages it would be desirable to provide a connector for connecting a load tap changer to its associated transformer which is quick demountable, which has a smooth exterior surface and which is relatively compact in size.

Accordingly, a primary object of the present invention is to provide a new and improved quick demountable terminal for connecting a load tap changer to its associated transformer.

Another object of the present invention is to provide a new and improved connector for use in a high voltage environment which has a smooth exterior surface.

A further object of the present invention is to provide a new and improved connector for use in a high voltage environment that is relatively compact in size.

SUMMARY OF THE INVENTION

A quick demountable connector has been devised for use in a high voltage environment where space is limited, such as that which occurs at the connection between a load tap changer and its associated power transformer. The connector is made of an electrically conductive material, such as metal, and is in the shape of an elongated cylinder. One end of the cylinder is formed into a standard crimp-type fitting and the other connector end has an opening whose longitudinal axis is oriented generally parallel to and displaced a substantial distance or is offset from the longitudinal axis of the elongated cylindrical connector. This opening creates a wall between said opening and the outer surface of the cylindrical connector. Opening offset causes wall thickness to vary from a minimum thickness at one radius on the cylindrical connector to a maximum thickness diametrically opposite the minimum thickness radius. A longitudinally extending slot connecting the opening to the exterior of the connector is cut in the maximum wall thickness portion of the connector. The length of the longitudinally extending slot is at least as long as the depth of the opening. Clamping means are attached to and are connected between those portions of the connector adjacent the longitudinally extending slot. Force exerted by the clamping means bends the connector in the region of minimum connector wall thickness, which reduces slot thickness and opening dimensions, thereby clamping the subject connector to a mating male terminal of appropriate size that has been inserted into said opening to the proper depth. This arrangement results in a quick demountable compact unitary connector with a relatively smooth, projection free exterior surface which produces relatively low voltage stresses in a high voltage environment.

The invention, which is sought to be protected, will be particularly pointed out and distinctly claimed in the claims appended thereto. However, it is believed that this invention and the manner in which its objects and advantages are obtained, as well as other objects and advantages thereof, will be more readily understood by reference to the following detailed description of the preferred embodiment thereof, particularly when considered in light of the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view showing the offset opening and longitudinally extending slot of a preferred form of the present invention.

FIG. 2 is a side elevation, partially in section, showing the connector of FIG. 1 with its offset opening and a pair of screws used in clamping said connector to a male terminal of appropriate size.

FIG. 3 is a view of the end of the connector of FIG. 1 that mates with the appropriate size male terminal.

FIG. 4 is a section taken along the line 4—4 in FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing wherein like numerals are used to indicate like parts throughout, in FIG. 1 a preferred embodiment of the inventon is shown as an elongated cylindrical connector **12**, with an opening **14** at one end whose longitudinal axis **16** (FIG. 3) is dis-

placed a substantial distance from the centerline **18** (FIG. **3**) of the cylindrical connector **12.** The displacing or offsetting of the opening **14** creates a wall **22** between said opening **14** and the outer cylindrical surface **20** of the connector **12.** The offsetting of opening **14** causes the thickness of wall **22** to vary from a minimum wall thickness at **24** to a maximum wall thickness at a position diametrically opposite the minimum wall thickness position **24.** A longitudinally extending slot **26** between the opening **14** and the exterior of connector **12** is cut in the maximum wall thickness region of connector **12.** Slot **26** divides wall **22** into two portions **28** and **30,** said portions being on opposite sides of and immediately adjacent slot **26.** Clearance holes **32, 32'** in portion **28** of connector **12** are of appropriate size to receive clamping screws **34, 34'**, the heads of which are best shown in FIG. **2.** The small diameter end **36** of connector **12,** a cross section of which is shown in FIG. **2,** is a crimp-type fitting capable of being crimped onto an electrical conductor of appropriate size. Any equivalent projection free attaching arrangement having a smooth exterior surface may be substituted for the crimptype fitting.

FIG. **4** shows clamping screw **34'** of appropriate size inserted through portion **28** of connector **12** and rotated into a threaded hole in portion **30** of connector **12,** stopping just before a compressive force is exerted between portion **28** and portion **30** of connector **12** and therefore slot **26** is shown in its normal non-compressed position.

To attach connector **12** to a male terminal (not shown) said male terminal is fully inserted into opening **14** in connector **12.** Referring again to FIG. **4,** clamping screw **34'** is rotated or screwed further into portion **30** of connector **12** than previously described which forces portion **28** toward portion **30.** This clamping force causes connector **12** to bend at minimum wall thickness **24,** which reduces the size of slot opening **26** and the dimensions of opening **14,** thereby clamping connector **12** to a mating male terminal. This procedure is repeated for the other clamping screw **34.**

It will be apparent to those skilled in the art, from the foregoing description of the invention, that various improvements and modifications can be made in it without departing from the true scope of the invention. Accordingly, it is my intention to encompass within the scope of the appended claims the true limits and spirit of my invention.

GENERAL CONSIDERATIONS

Opening **14** has been described as substantially offset from the longitudinal centerline of connector **12.** The word substantial is used because in normal machining operations even an allegedly concentric opening is offset to some degree even though the offset might be barely detectable.

The amount of offset designed into a connector is a function of the particular connector application. Once minimum physical size of the connector has been established from power, space limitation, etc. considerations, the amount of offset is then determined. The greater the offset the thinner and therefore weaker is minimum wall portion **24.** This permits the use of a smaller amount of clamping force, but if wall portion **24** is too thin structural failures might result. On the other hand, the smaller the degree of offset the greater is the clamping force required to bend said minimum wall portion **24.** The greater force requirement necessitates the use of larger clamping screws which in turn requires that connector diameter increase so that these larger screws can be contained within the cylindrical connector envelope. In actual practice however, the amount of offset is optimized after the previous considerations have been taken into account. The amount of offset, as a practical matter, usually falls somewhere in the neighborhood of half way between the longitudinal centerline of the connector and the outer cylindrical surface of the connector.

The length and diameter of both the male terminal and opening **14** in connector **12** is determined by the amount of surface contact required between the connector and terminal to handle the current being carried by their associated conductors.

To minimize voltage stresses that mght result from projections of screws **34, 34'** said screws should be of such a size that they are fully contained within the cylindrical envelope of connector **12,** once said connector **12** is fully clamped to the mating male terminal.

With this connector arrangement it is no longer necessary to contour and wrap or unwrap such a load tap changer connector with various tapes in order to connect or disconnect the load tap changer from its associated power transformer because of the substantial reduction in voltage stress resulting from the connector arrangement of the present invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A clamp-type electrical connector for connecting a cable to a male electrical terminal comprising:

a. an elongated metal cylinder having a longitudinal axis, and having a cylindrical end adapted to receive a cable;

b. said cylinder having a cylindrical opening at an end opposite from the cable end, said opening having a longitudinal axis that is generally parallel to and displaced a substantial distance from the longitudinal axis of said cylinder, said axis of said cable end being parallel to said axis of said cylindrical opening;

c. a longitudinally extending slot between said opening and the exterior of said cylinder dividing a region of said connector into two portions; and

d. clamping means attached to and connected between said two portions of said cylinder for the purpose of bringing said two portions closer together thereby reducing the dimensions of said opening, and clamping said electrical connector to a mating male electrical terminal.

2. A clamp-type electrical connector as defined in claim **1** wherein the clamping means are contained wholly within the outer surface of said clamp-type electrical connector.

3. A clamp-type electrical connector as defined in claim **1** wherein the end adapted to receive a cable is of the type that can be crimped onto said cable.

4. A clamp-type electrical connector as defined in claim **1** wherein said clamping means comprises at least one bolt, having a threaded end and a head end, the threaded end of said bolt being screwed into one portion of said connector to the point where the head of said bolt engaged the remaining portion of said connector and forces both portions together to the desired clamped position.

5. A clamp-type electrical connector as defined in claim **4** wherein said clamping means comprises a multiplicity of bolts.

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