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ELECTRIC CABLE CONNECTOR WITH BULGING CONTOUR FOR TAPING

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FIG. 1.

FIG. 2.

FIG. 4.

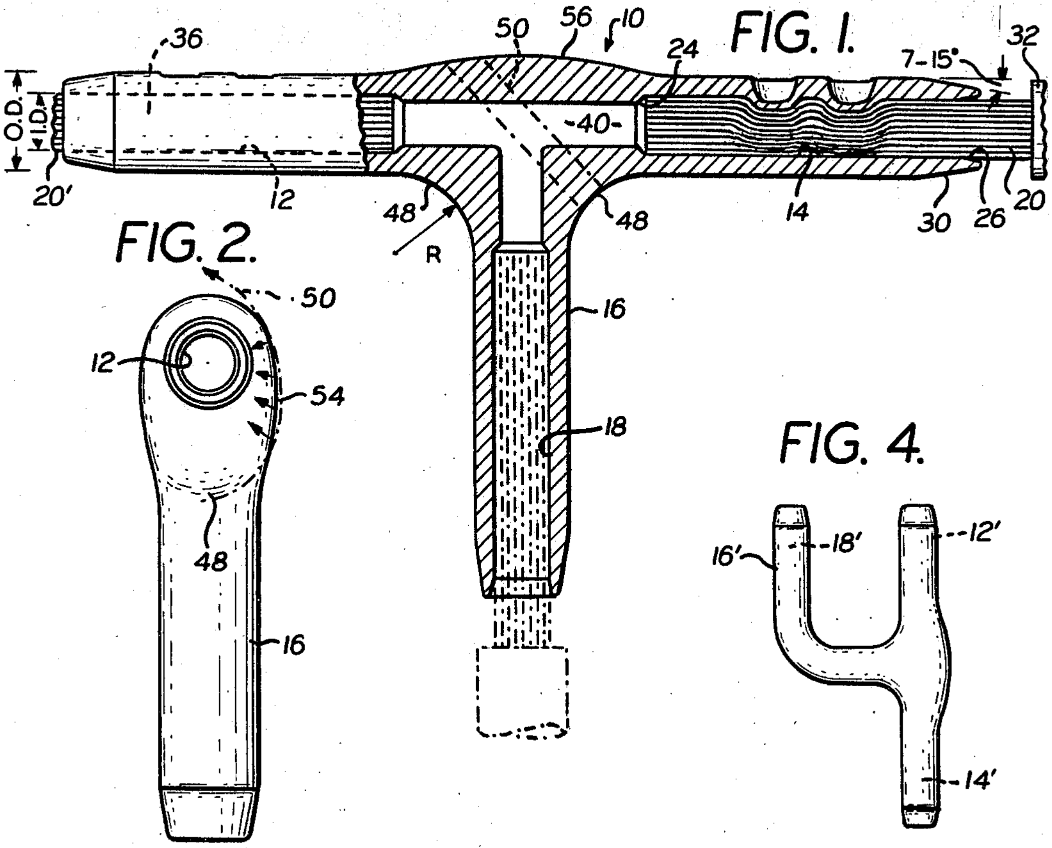
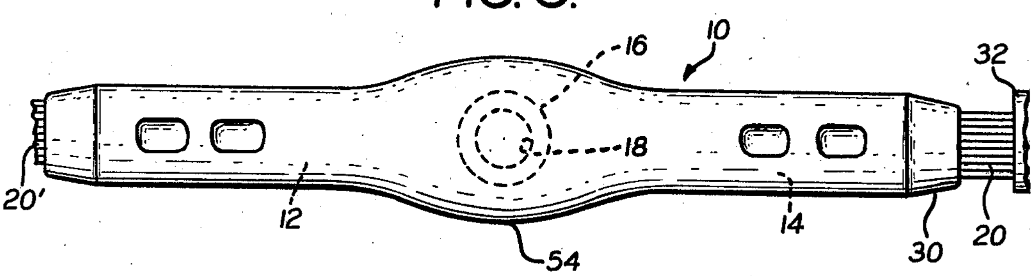


FIG. 3.



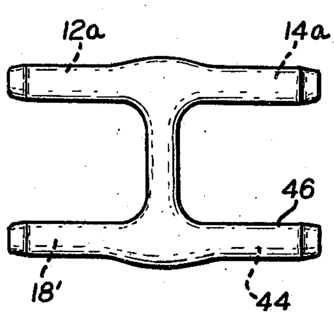


FIG. 5.

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ELECTRIC CABLE CONNECTOR WITH BULGING CONTOUR FOR TAPING

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U.S. Cl. 174—72 8 Claims

ABSTRACT OF THE DISCLOSURE

The metal connector of this invention is of a type having openings for receiving the ends of three or more electrical conductors from which insulation has been removed for slightly more than the length of the conductor that is to be inserted into the connector. The part of the conductor that is inserted is secured to the connector by crimping, swedging or otherwise distorting the connector to permanently clamp it to the conductor. Insulating of the connection is effected by wrapping the connector and the adjacent parts of the conductors with tape in superimposed layers. The novelty of this invention is the shaping of the connector with long-radius curves and bulging surfaces which facilitate the technically proper wrapping of the assembly with tape and which insure tightness of the tape over the surfaces of the connector. The character of the tape wrap will directly determine the suitability of the insulated joint for use at voltages above 600 volts and more significantly above 5000 volts.

BACKGROUND AND SUMMARY OF THE INVENTION

Where three or more electrical conductors are to be connected, it is conventional practice to use metal connectors having open ends for receiving the conductors with a reasonably snug fit. These connectors are often T-shaped, but are also made with branches in other relation to each other. The insulation is removed from the conductors for a distance equal to and usually somewhat greater than the length of the part of the conductor which is to be inserted into the connector.

The connector is then swaged, or crimped by local indenting, or otherwise distorted into a permanent clamping with intimate conductive relation to the conductor so that the conductor is tightly gripped by the connector, and then the conductor and connector are insulated by wrapping tape with enough layers to provide the desired thickness of insulation. For high-tension lines, semiconducting layers are wrapped on the connector as a first layer and as an outer layer over the insulation, in accordance with the treatment of the conductors themselves.

The wrapping of tape extends over the insulated parts of the conductors near the connector and over the main body and the branch or branches of the connector. A gap between the connector and the end of the insulation on each conductor is filled with usual filler material, and the improvement provided by this invention is the shaping of the outside surface of the connector to facilitate the wrapping of the tape and to insure a tight contact of the tape against the connector surface.

This invention has three features that facilitate the wrapping of the connector with the tape. One is the provision of long-radius curves where a branch of the connector merges with the body portion of the connector. Another is the provision of bulging side surfaces providing convex areas over most of the outside surfaces; and

the third is the providing of surfaces that are convex in a longitudinal plane on parts of the connector opposite to concave surfaces at regions where a branch merges with the body portion so that a tape can be wound from the concave surface in a diagonal direction and across the convex surface to reduce likelihood of longitudinal slippage of the tape when winding the tape on the connector with the necessary tension.

The maintenance of good contact between the connector and the tape wrapping, in spite of cycling temperature changes, is effected by having bulging side surfaces that result in a component of pressure between the tape and the surface normal to the surface of the connector; a result that is not obtained when there is a flat surface extending between separated locations across which the tape passes.

Other objects, features and advantages of the invention will appear or be pointed out as the description proceeds.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing, forming a part hereof, in which like reference characters indicate corresponding parts in all the views:

FIGURE 1 is a view, partly in elevation, but mostly in section, of a connector made in accordance with this invention;

FIGURE 2 is an end view of the connector shown in FIGURE 1;

FIGURE 3 is a top view of the connector shown in FIGURE 1; and

FIGURES 4 and 5 are reduced-scale views showing modified forms of the connector of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The cable connector **10** shown in FIGURES 1–3 comprises a fitting having aligned openings **12** and **14** at opposite ends of the body portion of the connector. There is a branch **16** extending from one side of the body portion and this branch includes an opening **18** which may be of the same size or a different size from the openings **12** and **14**. The openings **12** and **14** can also be of different size from one another, depending upon the sizes of the cables with which the connector is intended to be used. The outside diameters are sized appropriately with the center sections blended with gradual transition.

In the construction illustrated, the openings **12**, **14** and **18** are of the same size and a description of the opening **14** will explain the construction and manner of using the other openings **12** and **18**.

The opening **14** has an inside diameter slightly greater than the diameter of a conductor **20**. The conductor **20** may be sold or stranded, and is shown as stranded in the drawing. The conductor **20** fits with a snug fit into the opening **14** and is inserted into the opening **14** until it strikes a surface **24**. In the illustrated construction, this surface **24** is an annular shoulder, but the conductor can be made with the center of the body portion, beyond the opening **14**, solid so that the surface **24** is a circular end wall.

There is a bell-shaped or flared end portion **26** at the entrance end of the opening **14** to facilitate the insertion of the conductor **20** into the opening. The outside surface of the body portion of the connector has a tapered length **30**, preferably at an angle of from 7° to 15° to the cylindrical outside surface of the wall that surrounds the opening **14**.

The conductor **20** is covered by insulation **32** which is cut back for a distance equal to the length of the conductor which is to be inserted into the opening **14**, and preferably somewhat further. The space between the end of the insulation **32** and the end of the connector **10** is

filled up with insulating material in accordance with conventional practice, before the conductor itself is wound with insulating tape, also a conventional practice.

In order to permanently secure the conductor **20** to the connector **10**, the wall of the connector surrounding the opening **14** is swedged or indented locally, or otherwise distorted so that the connector **10** firmly grips the conductor **20**.

The left-handed end of the connector **10** is shown in elevation in FIGURE 1 and a number of indentations **36** are shown securing a conductor **20'** in the opening **12** of the connector. The material used for the connector **10** is preferably metal of high conductivity, such as aluminum, and it must be a grade of metal than can stand the crimping or distortion without cracking. There is an open space **40** within the connector in communication with the openings **12**, **14** and **18**, but the connector can be made without this open space if desired, depending upon the method of manufacture.

The connector **10** is T-shaped, i.e., the branch **16** extends at right angles to the longitudinal axis of the aligned openings **12** and **14**. This is a common and convenient connector shape, but the invention can also be made with the branch extending at an acute angle to the other branches so that the connector is Y-shaped and if all of the openings are in portions equally spaced around a center, the connector forms a wider Y-shape.

If desired, openings **12'** and **14'** can be combined with a branch **16'** which locates an opening **18'** parallel to one of the other of the openings **12'** and **14'**, as shown in FIGURE 4. The connector can also be made in a modified form of this FIGURE 4 construction, as shown in FIGURE 5 where parts corresponding to FIGURES 1 and 4 are indicated by the same reference characters with a letter *a* appended. FIGURE 5 has a fourth opening **44** in a branch **46**. Other correlations of the branches and openings for receiving conductors can be made within the scope of this invention. The characteristic shapes which will be described for the connector **10** apply also to the construction shown in FIGURES 4 and 5, as will be apparent from a comparison of the different figures of the drawing.

The branch **16** in FIGURE 1 merges with the body portion of the connector **10** along curved surfaces **48**. These surfaces are concave along a radius R in a plane defined by the longitudinal axes of the openings **12**, **14** and **18**, but the surfaces **48** are convex in planes which extend transversely of these longitudinal axes. It is a feature of the invention that the radius R is a long radius so that a tape **50**, indicated by dot-and-dash lines in FIGURE 1, can be wrapped over the surface **48** without requiring excessive transverse flexing of the tape and possible wrinkling of the tape or spanning of a gap between the tape and the surface **48** such as can result when the radius at the junction of the branch with the body portion is too short for the tape to conform to the arc of the connector surface. The long radius has the further advantage that the tape **50** can change from concave to convex curvature more gradually as it wraps around the surface **48** and onto side surfaces **54**, as shown in FIGURE 2, allowing necessary tape conformance to connector body and successive tape layers.

The side surfaces **54** are convex in both a transverse and a longitudinal direction, as will be evident by a comparison of FIGURES 2 and 3. A top surface **56** of the body portion of the connector is also convex in both transverse and longitudinal directions, as will be evident from a comparison with FIGURES 1 and 2. This reduces the danger of the tape **50** slipping lengthwise of the connector when wrapped diagonally across a side surface **54** from either of the surfaces **48**, as will be apparent from FIGURES 1 and 3.

In the preferred construction, the maximum bulge of the surface **56** and the bulge in the side surfaces **54** amounts to approximately 5% to 35% of the outside diameter of the cylindrical portions of the connector which surround the openings **12** and **14**. These bulges need not be the same as long as they merge with fair curves. These values are given by way of illustration.

It will be understood that the actual dimensions of the radius R and other dimensional features of the connector depend upon the size of the connector, and this, in turn, depends upon the size of the conductor with which the connector is intended to be used.

The important feature of the bulging top and sides of the connector is to eliminate any flat areas where a tape wrapped across the area would not have a component of force holding it in contact with that area. With the bulging surfaces, the tension of the tape results in a component of force normal to the surface for maintaining pressure between the tape and the conector surface at all times, even though this pressure may vary to some extent with temperature changes.

The bulging surfaces of the connector are located at those parts of the connector where the merging of the branch to the body portion results in larger areas of surface than occur at other parts of the connector. This bulging portion merges with the cylindrical end portions of the connector along fair curves, at regions where the connector has its cylindrical surfaces surrounding the openings that receive the conductors. This locates the regions of flecture at places where the tape is wrapped in a generally circumferential direction so that it readily conforms to the shape of the connector surface.

What is claimed is:

1. A cable connector comprising a fitting having openings at opposite ends for receiving the ends of cables that are to be connected, a branch extending from the bottom of the fitting and having an opening for receiving the end of a third cable that is to be connected with the fitting, part of each opening having an inside surface extending in a direction having a component directed toward the longitudinal axis of the opening to limit the extent to which the end of a cable is inserted into the connector, the outside surface of the fitting where the branch merges with an end being curved along an arc having a radius of curvature not less than the radius of the outside diameters of said ends into which the cables are received, and the cross section of the fitting opposite the branch increasing from both ends, in both height and width, and having a fair curve opposite the branch passage free of reversals of longitudinal curvature and extending for a distance substantially greater than the width of the branch, to give the connector a bulging contour as it approaches a mid region for smoother application of electrical insulating tape to the outside of the connector.

2. The cable connector described in claim **1** characterized by the curve of the outside surface of the fitting on its top opposite the branch increasing to a maximum cross section at the mid region of the fitting along a curve having a center of curvature at a point within the branch of the fitting.

3. The cable connector described in claim **1** characterized by the curve of the outside surface of the fitting on the side opposite the branch having its center of curvature on the branch side of said outside surface and providing a convex curvature in both its longtiudinal and normal transverse sections for receiving tape with which the cables and the fitting are wrapped.

4. The cable connector described in claim **3** characterized by the outside radius of the fitting, at the mid region, increasing to value between about 5% to 35% of the outside diameter of at least one of said ends of the fitting.

5. The cable connector described in claim **3** characterized by the fitting having its radius increase toward the mid region intermediate said ends not only on its top surface but also on its side surfaces.

6. The cable connector described in claim **5** characterized by the openings in the opposite ends of the fitting being in substantial alignment with one another, the

branch merging with the remainder of the fitting intermediate the aligned end openings and increasing in cross section as it approaches the region of its merger with the remainder of the fitting, the outside surfaces of the branch and the remainder of the fitting merging along fair curves and the branch having surfaces that are convex in transverse cross section taken normal to the longitudinal axis of the aligned ends of the fitting but concave in longitudinal cross section, the radius of concave curvature being not smaller than approximately the outside diameter of the opposite ends of the fitting.

7. The cable connector described in claim 6 characterized by the opposite ends of the fitting being of circular cross section in a plane normal to the longitudinal extent of said ends and having its cable-receiving openings of an inside diameter that is slightly larger than the diameter of the cable with which the fitting is intended to be used, the ends of the fitting being made of metal which can be clamped firmly to the bare cable, the inner ends of the cable-receiving openings in said opposite ends of the connector communicating with one another through an open space of less cross section than the cable receiving openings and there being shoulders where said openings meet the open space providing the parts of the inside surface which extend in a direction having a component directed toward the longitudinal axis of the opening for limiting the extent to which the cable is inserted into the connector, and cables in said openings secured to the connector by crimping the side of the connector along the length of said openings.

8. The cable connector described in claim 1 characterized by the bulge being substantially the same on the sides and top of the fitting and of approximately constant curvature in planes normal to the longitudinal axis and the increase in bulge being approximately constant on the sides and top at both sides of the mid region.

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LARAMIE E. ASKIN, Primary Examiner

U.S. Cl. X.R.

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