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(19)

(54) ELECTRICAL CONNECTOR

(71) We, WESTERN ELECTRIC COMPANY, INCORPORATED, of 222 (formerly of 195) Broadway, New York City, New York State, United States of America, a Corporation organized and existing under the laws of the State of New York, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to electrical connectors.

In a telephone communication system many of the connections between a subscriber's premises and a distribution cable are implemented, for example, with aerial service wires. Because such wires are exposed to a wide range of temperature variations, moisture, wind loading and the like, and because such wires quite frequently must be routed through trees and shrubbery, it is essential that the wires be covered with an insulative material capable of withstanding all of the aforementioned environmental rigours if a reliable connection is to be maintained over an extended period of time.

An insulative material which advantageously meets the foregoing requirements is polyvinylchloride. However, at temperatures near −18°C or lower, polyvinylchloride becomes extremely hard.

In order to effect a relatively rapid termination of an aerial service wire, it would be advantageous to utilize some form of connector which does not require extensive preparation of the wire ends. There are several connectors of this general type which have been disclosed in the prior art. One such connector which relies upon a crushing of the insulation surrounding the conductor to effect a connection is described in G.B. Patent Specification No. 1,030,235. Another prior art connector of this general type is disclosed in G.B. Patent Specification No. 1,068,741. This connector utilizes edges on a pair of jaws to pierce or tear apart the insulation to bite into the conductor. Still other prior art connectors employ a slicing action to cut through the insulation and bite into the conductor. Examples of this type of connector can be found in U.S.A. Patent Specification No. 3,521,221, and G.B. Patent Specification No. 1,423,298.

However, none of the aforementioned connectors is capable of crushing, tearing, penetrating or slicing through polyvinylchloride insulation at relatively low temperatures repeatedly without being deformed, misaligned or fractured. Upon the occurrence of any of these latter effects, the connector is no longer capable of providing a reliable termination.

According to the present invention there is provided a connector for effecting an electrical connection with an insulation covered electrical conductor, comprising electrically conductive sheet material and having an open ended elongate slot separating two prongs having end sections for abrading depressions into opposite sides of the electrical conductor, wherein the prongs and the slot each taper in width towards the said end sections, and wherein the end sections of the prongs terminate in respective chisel like cutting edges.

The invention will be better understood upon a consideration of the following detailed description taken in conjunction with the accompanying drawings in which:-

Figure 1 is a top view of a connector;

Figure 2 is a side view of the connector;

Figure 3 illustrates lines of constant tensile stress within one of the connector prongs;

Figure 4 illustrates lines of constant compressive stress within one of the connector

prongs; and

Figure 5 illustrates an application of the connector for the termination of an aerial communication service wire.

A connector 100, illustrated by the top and side view of Figure 1 and 2, respectively, comprises electrically conductive sheet material. This sheet of material is bifurcated from an intermediate base portion 10 to one end with prongs 11 and 12 resulting therefrom. The prongs have progressively tapered portions 11 and 12 which decrease in width from intermediate base portion 10 towards outer end portions or sections 13 and 14. End portions or sections 13 and 14 have widths which in use, ensure adequate spacings to provide insulation between their outer edges and an adjacent conductor in a service wire.

Extending outwardly away from base portion 10 in a direction opposite prongs 11 and 12 is a generally rectangular-shaped member 15 which has at its terminus a generally circular end face 16. Member 15 is advantageously used to accommodate an electrical connection such as, for example, a wire-wrap connection.

At an intermediate point along the length of member 15 is a beam 17 which is spaced apart from base portion 10. Beam 17, in conjunction with the spacing between base portion 10 and beam 17, serves to align the connection 100 in an insulative mounting (not shown).

Prongs 11 and 12 are spaced apart from each other by an elongate slot 20. Slot 20, near the furcation 20*a* of prongs 11 and 12, has a radius of curvature chosen so as to reduce the concentration of stress forces between the prongs when under load. Slot 20, between outer end portions 13 and 14 at 20*c*, has a width which is slightly smaller than a diameter of the smallest gauge wire to be accomodated. Slot 20 tapers at 20*b* between 20*a* and 20*c*.

The width of the slot at 20*c*, along with the characteristics of the material used to fabricate connector 100, enables connector 100 to accomodate a range of conductor diameters. For example, in the preferred embodiment of connector 100, wire sizes from 0.8 to 1 mm diameter may be advantageously accepted without any permanent deformation or misalignment of prongs 11 and 12. The material characteristics which enable the achievement of this result are a relatively high ratio of yield stress to Young's modulus for example, at least 7 x 10^{-3}. Examples of materials having these characteristics are phosphor bronze and spinodal copper. These characteristics permit prongs 11 and 12 to be fixed without exceeding the elastic limit of the material. This, in turn, ensures that connector 100 will effect a reliable termination even upon repeated usage.

Outer end portions 13 and 14 terminate in chisel-like cutting edges 21 and 22, respectively. Each of edges 21 and 22 has first and second side faces 23 and 24, as shown in Figure 2, which are oriented at between 45 and 60 degrees with respect to a face of the sheet material of outer end portions or sections 13 and 14. Furthermore, edges 21 and 22 define a generally V-shaped notch 25 adjacent outer end portions or sections 13 and 14 for directing an electrical conductor into slot 20*c*. The orientation of the arms of V-shaped notch 25 formed by edges 21 and 22 can be advantageously varied between 20 and 45 degrees with respect to a plane perpendicular to an axis of symmetry of connector 100.

Integral with base portion 10 are a pair of generally V-shaped notches 30 and 31 which enable a lateral movement of the prongs 11 and 12 as they engage an insulation covered electrical conductor. Notches 30 and 31 have their roots extending into base portion 10 such that first sides 32 and 33 lie in a plane which is generally perpendicular to the axis of symmetry of connector 100. Second sides 34 and 35 lie in a pair of oppositely directed planes which intersect at a point in the plane containing sides 32 and 33.

It should be noted that the roots of notches 30 and 31 are illustrated as having sharp corners. In actual practice such sharp corners would be avoided to simplify the die configuration utilized in the manufacture of connector 100. Also, it should be noted that the spacing 36 between the roots of notches 30 and 31 is somewhat less than the thickness of yoke 37 joining prongs 11 and 12 at their furcation point. These dimensions are purposely chosen so that prongs 11 and 12, when moved laterally when engaging conductor, do so as a unit. This ensures that the dimensions of slot 20 are maintained during a conductor insertion even if the conductor does not perfectly line up with notch 25.

Figures 3 and 4 illustrate lines along which tensile and compressive stress respectively are equal within one of the prongs 11 or 12 when a conductor is forced between the prongs. A set of corresponding lines, mirror imaging those illustrated, are developed in the other prong. These lines illustrate the internal distribution of forces within the progressively tapered cross section of prongs 11 and 12 to produce a force couple therebetween. The force couple, urges edges 26 and 27 on inner surfaces of outer end portions 13 and 14, to abrade contact depressions into opposite sides of an electrical conductor to ensure a gastight connection between the conductor and connector 100.

An illustration of an application of con-

nector 100 for terminating an aerial service wire is shown in Figure 5. It should be noted that as connector 100 engages insulation 50 surrounding conductor 51, edges 21 and 22 pierce insulation 50 without destroying its integrity along outer edges 28 and 29 of outer end portions 13 and 14, respectively. Maintaining the integrity of insulation 50 at these points aids in the development of a gastight connection even upon the repeated usage of connector 100.

WHAT WE CLAIM IS:-

1. A connector for effecting electrical connection with an insulation covered electrical conductor, comprising electrically conductive sheet material and having an open ended elongate slot separating two prongs having end sections for abrading depressions into opposite sides of the electrical conductor, wherein the prongs and the slot each taper in width towards the said end sections, and wherein the end sections of the prongs terminate in respective chisel like cutting edges.

2. A connector in accordance with claim 1, further including, opposite said slot, means for accommodating an electrical connection to said connector, and means for aligning said connector in an insulative mounting.

3. A connector in accordance with claim 1 or 2, wherein said chisel-like cutting edges define a generally V-shaped notch adjacent said outer end sections for directing the electrical conductor into said elongated slot.

4. A connector in accordance with claim 3, wherein the cutting edges have first and second side faces oriented at angles between 45 and 60 degrees with respect to the faces of the sheet material of the prongs.

5. A connector in accordance with claim 2 or any claim appendant thereto, wherein said accommodating means includes a substantially rectangular-shaped elongate member having at its terminus a generally circular end face, and said aligning means includes a beam member perpendicularly intersecting said elongate member at an intermediate point along its length.

6. A connector in accordance with any preceding claim including first and second oppositely directed substantially V-shaped notches positioned to facilitate lateral movement of the prongs as they engage, in use, a conductor, a first side of each of the notches lying in a plane substantially perpendicular to the length of the slot and the second side of the notches lying in first and second oppositely directed planes which intersect at a point in said plane perpendicular to the length of the slot.

7. A connector in accordance with any one preceding claim, wherein the sheet material has a relatively high ratio of yield stress to Young's modulus such that the prongs may be flexed without any permanent deformation of the material thereby allowing repeated insertions of a conductor into the connector.

8. A connector in accordance with claim 3, wherein said first and second chisel-like cutting edges are oriented at between 20 and 45 degrees with respect to a plane perpendicular to an axis of symmetry of the connector.

9. A connector substantially as herebefore described with reference to Figures 1, 2, 3 and 4 or to Figure 5 of the accompanying drawings.

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1587453 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

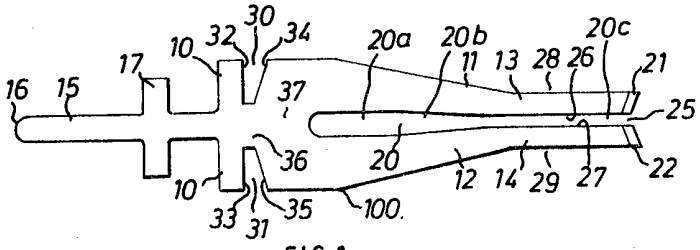

FIG.1

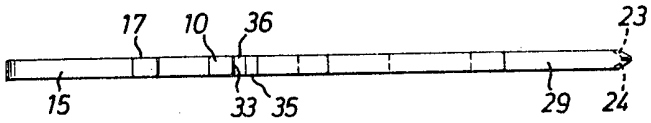

FIG.2

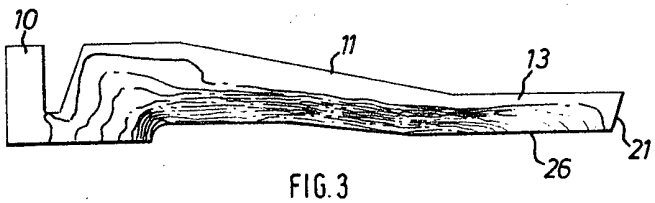

FIG.3

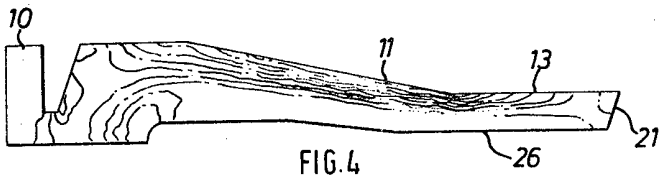

FIG.4

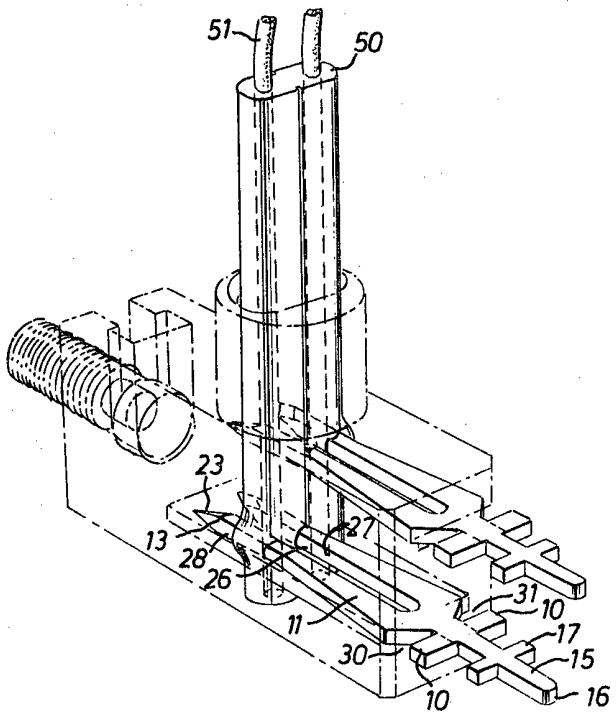

FIG. 5