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2,681,439

INSULATED ELECTRICAL CONNECTOR

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Fig. 1.

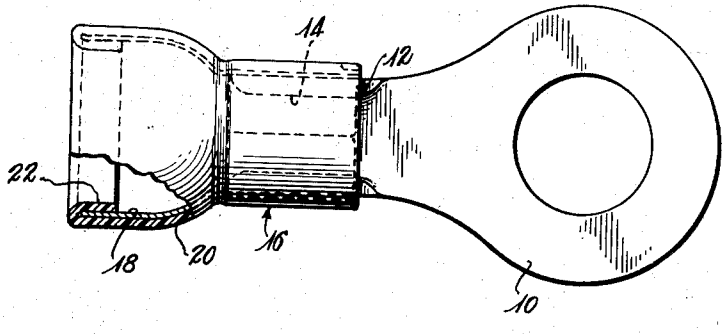


Fig. 2.

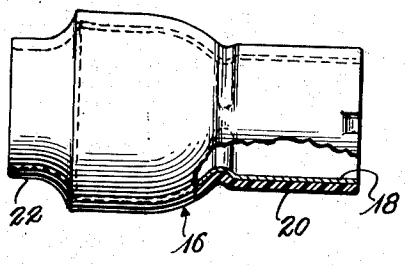
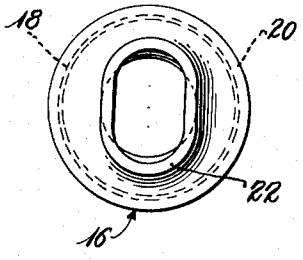


Fig. 3.



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INSULATED ELECTRICAL CONNECTOR

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5 Claims. (Cl. 339—213)

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This invention relates to an electrical connector and more particularly to electrical connectors having tough malleable insulation permanently secured on the portion which is connected to a wire and capable of transmitting radial pressure sufficient for forging an inner metal portion of the connector to the central conductor of the wire.

The present invention is an improvement on the insulated terminals of the type set forth in the patent of William S. Watts, No. 2,410,321 and on the copending application of Robert C. Swengel, Serial No. 523,004, filed February 19, 1944, now abandoned.

In the commercial manufacture of connectors of the type set forth in the said prior application and patent it has been customary to apply to the connector or to a thin metal ferrule, which is later secured on the connector to become essentially a part of its thicker ferrule, a short length of plastic tubing which is cemented either to the ferrule portion of the connector directly, or to thin metal ferrule which when applied onto the connector is to become a part of the ferrule. In cases where insulated wires with relatively thick insulation are to be used the portion of the sleeve which extends beyond the smaller connector ferrule is required to have substantially larger diameter than the ferrule portion which engages the bare end of the conductor wire and consequently the plastic tubing has to be substantially stretched in this larger insulation receiving portion. Ordinary tubing when thus applied has a greater portion of plasticizer, in order to facilitate manufacturing operations, than can properly be tolerated during the crimping of a connector onto a wire. After assembly, therefore, the plastic is subjected to a leaching or baking operation to remove the excess plasticizer. During this operation the plastic shrinks severely. Insofar as it is supported on a metal ferrule this shrinking merely gives it a tight engagement with the metal ferrule portions of the connector, but any part of the plastic sleeve which extends beyond the metal portion and which may have been substantially stretched may be so severely shrunken in this operation as to block off the mouth of the connector against proper entrance of the insulated portion of the wire. This has put a limit on the permissible extension of the plastic beyond the end of the metal sleeve or ferrule especially where the sleeve has had to be severely stretched to accommodate the insulation, and this in turn has prevented the use of this type of connector in certain applications where a relatively long spark-over distance or creepage distance is required between the outermost metal part and the nearest point on the exterior of the insulation.

Accordingly it is an object of the present invention to overcome the difficulties described

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above and to meet the requirements of such uses for a relatively long creepage distance or spark-over path. This I have accomplished according to the present invention by making a relatively long extension of the plastic material beyond the supporting metal sleeve. The long extension as set forth above tends to close in across the mouth of the terminal when it is subjected to steps for removal of excess plasticizer. After that treatment, however, I have now found that it is possible, even in the condition in which the plastic is left, to force the projecting portion of the insulation inwardly so that it is inverted into the ferrule inside of the metal and then to expand it radially so that it fits against the mouth.

This I accomplished advantageously by means of a round-nosed punch as set forth more in detail hereinafter.

In the accompanying drawings I have shown, Figure 1, in plan view a standard ring-tongue connector terminal embodying the present invention.

In Figure 2 I have shown in side elevation a metal sleeve covered with a plastic sleeve formed from extruded plastic tubing after shrinking onto the metal, and Figure 3 shows an end view taken from the outer or open end of the sleeve of Figure 2.

Referring to these drawings, the ring-tongue terminal body 10 includes a metal ferrule 12 which is shown in broken lines and having central bore 14, also shown in broken lines, for reception of the bared end of the central conductor of an insulated wire.

Onto the exterior ferrule 12 has been fitted a composite cover 16 composed of an inner thin metal ferrule 18, shown in broken lines, and exterior plastic sleeve 20. The outer end of the composite cover is enlarged as shown to a substantially greater diameter to receive and fit over the outside of an insulated portion of the wire. Both the insulation portion and the ferrule portion having smaller bore 14 are eventually pressure-forged together and together with a wire so as to form a secure and substantially perfect electrical connection.

As shown in broken lines at the left-hand end of Figure 1, the end 22 of the plastic sleeve 20 has been inverted into the open end of the thin metal ferrule portion 18 thus covering the latter and insulating it for a substantial distance.

Figure 2 shows the plastic sleeve 20 and the metal sleeve 18 in an intermediate stage of its manufacture. As shown the length of plastic tubing has been stretched and pushed over the metal sleeve with a substantial length projecting beyond the larger end of the metal sleeve 18. The insulated composite cover has then been subjected to a baking operation at a temperature and for a time sufficient to remove excess plastic-

izer and leave the plastic in an only slightly plasticized condition, rigid, tough and malleable. This process as shown, Figures 2 and 3, has shrunken the extended portions of the plastic so that it partially covers the open end of the sleeve 18. This sleeve as shown in Figures 2 and 3 is then further treated by pressing into it a round-nosed punch adapted to substantially fit the inside of the larger end of the sleeve as shown in Figure 1. This punch may be cold, but is preferably heated to a temperature at which the plastic is substantially softened. By this means the extended end 22 of the plastic sleeve as shown in Figures 2 and 3 is inverted and expanded to its position as shown in Figure 1.

The resulting structure has the primary advantage of insulating the end of the metal portions of the connector so as to give a desired creepage distance or sparkover path. In addition to this, however, it has the further advantage that when the enlarged portion 18—20 is crimped onto an insulated wire, the in-turned plastic tube is molded into the insulation on the wire and the insulation is forced up over its inner edge so as to give a stronger and more secure engagement than in the case of a straight plastic sleeve not in-turned in this manner. A further advantage is found also in the fact that the in-turned plastic if not heated beyond a critical temperature of flow during the punch molding operation retains "elastic memory" or trapped stress such that it tends very slowly to return toward the smaller diameter which it had as indicated in Figures 2 and 3, and this tendency may be released if the temperature is raised substantially. Any such recovery which occurs increases the pressure against the wire and thus gives a more secure connection.

What I claim is:

1. An electrical connector of the type comprising a metal ferrule and a covering sleeve of tough, malleable plastic material capable of transmitting sufficient radial pressure for cold forging the ferrule onto a wire, which is characterized by an end of the plastic sleeve being folded back into the end of the metal ferrule, said sleeve insulating the outer end of said ferrule inside and outside completely around its periphery and for a substantial distance from said periphery back along the inside and outside of said ferrule, said sleeve end being at least semirigid and strongly resistant to collapse or compression by forces applied thereto along lines parallel to the axis of the sleeve and ferrule whereby when said sleeve and ferrule ends have been compacted upon an end portion of an insulation sheath on a wire said sleeve end cannot readily be slipped bodily out of said ferrule end.

2. An electrical connector of the type comprising a metal ferrule and a covering sleeve of tough, malleable plastic material capable of transmitting sufficient radial pressure for cold forging the ferrule onto a wire, which is characterized by an end of the plastic sleeve being folded back into the end of the metal ferrule, fitting closely in said metal ferrule and having elastic memory of a smaller circumference, said sleeve insulating the outer end of said ferrule inside and outside completely around its periphery and for a substantial distance from said periphery back along the inside and outside of said ferrule, said sleeve end being at least semirigid and strongly resistant to collapse or compression by forces applied thereto along lines

parallel to the axis of the sleeve and ferrule whereby when said sleeve and ferrule ends have been compacted upon an end portion of an insulation sheath on a wire said sleeve end cannot readily be slipped bodily out of said ferrule end.

3. An electrical connector having a metal ferrule portion adapted to receive the stripped end of the central conductor of an insulated wire, an insulation support portion of greater internal diameter than the first-named ferrule portion and extending beyond said ferrule portion to receive the insulation on said wire, and a tube of tough malleable plastic covering the exterior and the end of said insulation support portion and extending back for a substantial distance entirely throughout its periphery in intimate contact with both the inner and outer walls of said insulation support, said tube being at least semirigid and strongly resistant to forces of compression applied thereto along lines parallel to the axis of the connector whereby when said insulation support portion is compressed upon an insulation sheath on a wire the portion of said tube between said insulation support portion and such insulation sheath cannot readily be slipped bodily out of said insulation support portion.

4. The method of insulating an electrical connector ferrule which comprises applying onto said ferrule a sleeve of tough malleable plastic insulation material which is substantially longer than the ferrule and leaving a substantial length of said sleeve projecting beyond the end of the ferrule, shrinking the sleeve onto the ferrule, pushing back into the open end of the ferrule and expanding the in-turned portion of the sleeve to fit against the inside of the end portion of the ferrule.

5. An electrical connector having a metal ferrule portion adapted to be cold forged into electrical contact with the center conductor of an insulated wire, a metal insulation supporting portion secured to and extending from said ferrule portion and adapted to surround and be cold forged into gripping relationship with the insulation covering of said wire, and a continuous integral tube of deformable insulating material circumferentially covering and being in intimate contact with the outer surface, one end, and a substantial annular portion adjoining said end on the interior of said insulation supporting portion, said insulating tube being of such tough malleable material as to transmit the radial pressure by which said insulation supporting portion is cold forged onto the insulation covering of said wire said tube being at least semirigid and strongly resistant to forces of compression applied thereto along lines parallel to the axis of the connector whereby when said tube and supporting portion are compressed upon an end portion of the insulation covering on the wire the end of the tube cannot readily be pulled bodily out of the interior of said insulation supporting portion.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,175,583	White	Oct. 10, 1939
2,206,662	Conradi et al.	July 2, 1940
2,338,316	Buzzell	Jan. 4, 1944
2,405,111	Carlson et al.	Aug. 6, 1946
2,410,321	Watts	Oct. 29, 1946
2,464,405	Knauf, Jr.	Mar. 15, 1949
2,533,200	Rogoff	Dec. 5, 1950