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METHOD FOR MAKING HIGH VOLTAGE HIGH ALTITUDE BUSHING

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With reference to FIGURE 6, numeral 1 designates the casing of a sealed electrical unit through which the bushing of the invention passes for the purpose of an external lead 3 with the lead 5 connected to the electrical components of the unit, not shown. The bushing includes a cylindrical hollow body portion 7 of a suitable dielectric material, preferably of a type which can be threaded, molded in plastic, and subjected to the wide range of temperatures encountered in high altitude applications and bonding operations, e.g., soldering, without cracking, such as a laminated phenolic-base resin, steatite ceramic and the like. The dielectric material selected will, however, depend to some extent on the method employed to seal the electrical unit. For example, if the unit is encased in a metal can for hermetic sealing, steatite ceramic laminated to provide a surface 9 extending circumferentially of portion 7 which is solderable to casing 1 thereby to achieve a fluid-tight seal preventing seepage of oil around the bushing. Alternatively, a laminated phenolic suffices where the electrical unit is embedded, or potted, in plastic.

To effect the electrical coupling of leads 3 and 5 within body portion 7, there is provided a separable contact assembly, preferably of the receptacle and mating pin type, which includes plug 11 having at one end a contact pin 13 and at the other end a solder well 15 in which lead 5 is soldered. Plug 11 is rigidly maintained, as by soldering or brazing, in the aperture 17 of a disc-like contact retainer 19 which snugly fits within the internally enlarged end 21 of body portion 7. To perfect the sealing of the bushing, relative to inside of casing 1, end 21 is metalized in a conventional manner whereby contact retainer 19 may be soldered in place thus rigidly disposing pin 13 in mating position coaxially in the bushing.

The receptacle portion 23 of the contact assembly includes at one end a socket 25 having a cylindrical bore for receiving pin 13 and at the other end a solder well 27 in which the wire core of external lead 3 is soldered. Serving to secure lead 3 within and to seal the outer end 29 of the bushing is a flaring which includes a retaining O ring 31 of a size to fit tightly about the insulation of lead 3, and a cap 33, of a dielectric material similar to body portion 7, cap 35 having a central aperture 37 through which lead 3 may be inserted and being internally threaded for cooperation with external threads cut on end 29 of body portion 7.

Ring 31 is slipped back along the insulation of lead 3 until it will abut end face 37 of body portion 7 as pin 13 becomes fully seated in socket 25. Tightening cap 33 on threaded end 29 serves to compress and flatten ring 31 against face 27, the consequent radial extrusion of ring 31 into the insulation of lead 3 effecting a fluid-tight seal at outside end of body portion 7.

To assure maximum protection against arcing it is preferred that body portion 7 be filled as completely as possible with solid dielectric encompassing the metallic elements of the contact assembly, and with any remaining air space being replaced by any suitable viscous dielectric material chemically non-reactive with dielectrics forming the bushing structure. To this end, the inside diameter of body portion 7 is only sufficiently larger than the insulation diameter of lead 3 to admit the lead without difficulty so that with an insulating jacket covering receptacle 23 to the mouth of socket 25, substantially all of the air space within the bushing will be occupied with dielectric material. Preferably the insulation jacketing receptacle 23 comprises the unbonded insulation covering of lead 3, which insulation is slipped over the receptacle by any suitable method according to the type of materials employed. By way of example, typical insulating materials utilized for high voltage leads are silicone-rubber or natural rubber
3,163,692 compositions which expand upon soaking in temporary liquid plasticisers, such as the aromatic liquids toluene, benzene, or their derivatives. Accordingly, after stripping the end of lead 3 of insulation to expose the wire core for soldering in well 27, expanding the remaining insulation, as by soaking a silicone-rubber composition in toluene, permits the insulation to be easily pulled along the wire core and over receptacle 23. Upon evaporation of the toluene, the insulation composition shrinks to its original diameter into tight engagement with the wire core and contact receptacle as shown. Alternatively, for short lead lengths the insulation may simply be forced mechanically along the wire after soldering receptacle 23 to the wire core. Where a silicone-rubber composition is employed as the insulation for lead 3, a silicone grease is suitable for filling any voids remaining upon assembly of the bushing.

With reference to FIGURE 7, for lead insulation materials which are not conveniently movable relative to the associated wire core, an insulating jacket for receptacle 23 may be built up with sleeves 39 and 41 of suitable plastic material maintained in place by a force-fit engagement with the parts. For example, sleeves 39 and 41 may be vinyl-base plastics shrunk into place after expansion by soaking in a suitable plasticiser as is conventional in the art, sleeve 39 providing the main insulation jacket surrounding receptacle 23 and part of lead 3 and sleeve 41 serving as a filler to increase the effective diameter of receptacle 23 to substantially the lead insulation diameter.

In the alternative embodiment shown in FIGURE 7, where increased dielectric strength and resistance to charring is desired, body portion 7 may be formed of glass. To provide surfaces on which bonding operations, such as soldering, may be performed, circumferential bands 43, 45 and 47 of the glass body are fired with silver by conventional techniques, bands 43, 45 and 47 respectively providing surfaces for bonding the bushing to casing 1, threaded metallic ferrule 49 to the outer end of body portion 7, and contact retainer 51 to the inside end of body portion 7. Contact retainer 51 supports plug 11 and the threads on ferrule 49 serve as the means by which cap 33 is attached to the bushing.

Sleeve 39 extends sufficiently far back along the lead to provide a stop for cap 33 which during assembly of the bushing abuts the end of sleeve 39 before the threads on ferrule 49 are exhausted. Further tightening of cap 33 jams sleeve 39 into forceful engagement with body portion 7 thereby effecting a fluid-tight seal at the cap end of the bushing. The bonding at bands 43, 45 and 47 render the bushing completely sealed against penetration of any foreign matter.

We claim:

1. The method of insulating a contact assembly having mating elements including the steps of exposing the end of the wire core of an insulated lead, affixing the wire end to the contact element having exposed surfaces upon joining the contact assembly in mating relationship, loosening the insulation of the lead relative to the wire core, and moving the insulation along the wire core to cover substantially the exposed surfaces of the contact element and wire core with insulation continuous with the insulation of the lead.

2. In the forming of an insulated contact assembly including mating contact elements, the method of insulating the contact element having the exposed surfaces upon joining the elements in mating relationship including the steps of exposing the end of the wire core of a lead insulating with a plastic material, affixing the wire end to the contact element, soaking the insulation of the lead in a temporary plasticiser to expand and loosen the insulation relative to the wire core, moving the expanded insulation along the wire core to cover substantially the exposed surfaces of the contact element and wire core with insulation continuous with the insulation of the lead, and evaporating the plasticiser to shrink the insulation into tight engagement with the contact element and wire core.

3. The method of insulating a contact assembly having elongated mating contact elements including the steps of stripping off the end segment of insulation of an insulated lead wire to expose the wire core, affixing the exposed wire core to the contact element having exposed surfaces upon joining the contact assembly in mating relationship, loosening the remainder of the insulation of the lead wire relative to the wire core, and moving the loosened insulation bodily along the wire core to cover and tightly to embrace the exposed surfaces of the elongated contact element and wire core with continuous insulation.

4. The method of insulating a pin and socket contact assembly including the steps of stripping off the end segment of insulation of an insulated lead wire to expose the wire core, affixing the exposed wire core to the socket contact, dilating the remainder of the insulation of the lead wire relative to the wire core, moving the dilated insulation bodily along the wire core to cover the socket contact with insulation continuous with the lead wire insulation, and contracting the insulation tightly about the socket contact and wire core.

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