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SMALL ELECTRICAL UNIT WITH MOLDED CERAMIC COATING

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Fig. 1.

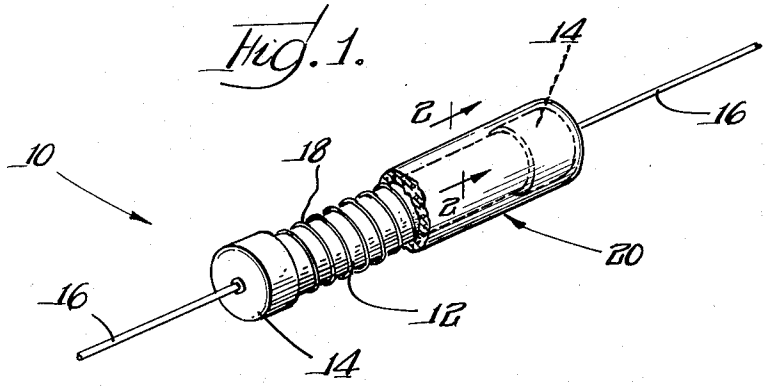
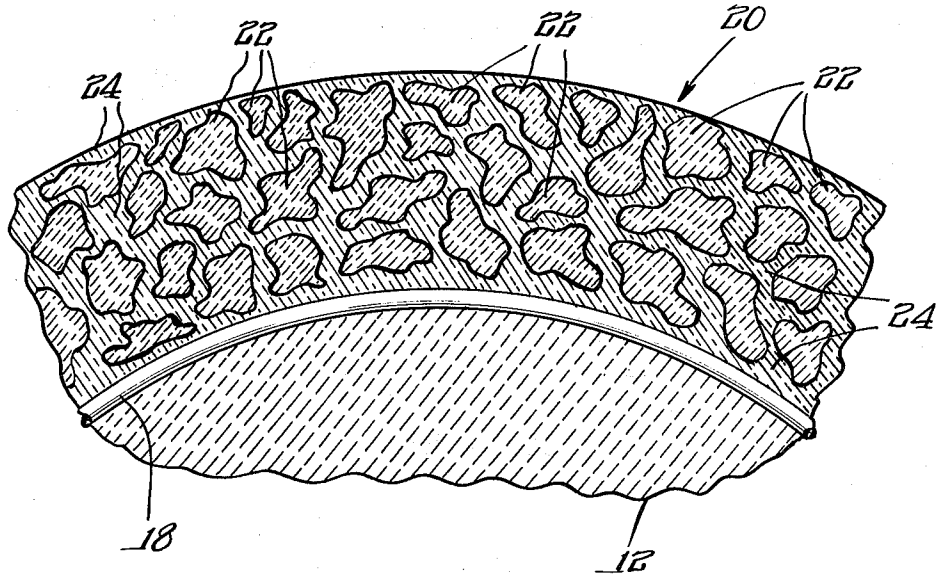


Fig. 2.



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SMALL ELECTRICAL UNIT WITH MOLDED CERAMIC COATING

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This invention relates generally to small electrical units and especially to insulating coatings for such units.

According to modern practice, numerous types of small electrical units are fabricated to comprise a relatively rigid core, an electrical element disposed on the core for support, and an insulating coating covering the electrical element and the core. The three most common types of insulating coverings are (1) resinous plastic materials, including varnishes and molded bodies, (2) glass sleeves or tubes, and (3) vitreous enamel coatings applied by either the dip or the spray process. While resinous plastic coatings possess certain advantages, the principal difficulty with these coatings resides in their inflammability, actual ignition being capable of occurring as upon a momentary, high overload of the electrical unit. When glass sleeves or tubes are employed as external insulation, on the other hand, damage to the seal at the electrical lead exposes the entire electrical element to the atmosphere, not just a small part of it. Furthermore, glass sleeves or tubes must be arranged to fit loosely over the core and over the electrical unit in order to facilitate assembly; and the resultant air space prevents good heat dissipation from the unit in use whereby to require a lower wattage rating to be applied to the unit than might otherwise be necessary.

Although vitreous enamel coatings do not possess the above-described disadvantages, the proper application of coatings of this nature require numerous manufacturing operations including substantial amounts of hand labor. There is a need for much careful inspection, reworking and cleaning; and the units are commonly rotated in the firing furnace in order to reduce run-off of the enamel in its fluid state. Furthermore, the electrical elements can move due to flow of the enamel during firing; and there is the problem of the coating burning through at thin spots. In addition, the fluidity of the enamel during the firing step prevents controlling of the gross shape of the unit with any degree of precision. Moreover, when the enamel slip is applied by spraying rather than by dipping, the overspray must be recovered and reprocessed in order to make the operation economical.

Therefore, a general object of the present invention is to provide a new and improved electrical unit which overcomes the limitations of the prior art.

Another object of the invention is to provide an electrical unit which possesses a precisely controlled overall shape and which is completely non-flammable.

Still another object of the invention is to provide incombustible electrical units having a highly uniform insulation value from unit to unit.

And still another object of the invention is to provide an electrical unit which achieves rapid dissipation of heat.

A further object of the invention is to provide an electrical unit which is amenable to automated assembly into electrical systems and circuitry.

Additional objects and features of the invention pertain to the particular structure, materials and arrangements whereby the above objects are attained.

An electrical unit in accord with the invention includes a ceramic core; a metallic wire element wound on the core; and a molded, vitreous body of ceramic material coating the exposed portions of the surface of the core and of the element, the body of ceramic material comprising both glassy and non-glassy particles, the glassy particles being fused together at contacting surfaces whereby the body forms a monolithic envelope.

In order that the principle of the invention may be readily understood, a single embodiment thereof applied to an axial lead resistor, but to which the application is not to be restricted, is shown in the accompanying drawing wherein:

FIG. 1 is a perspective view of an axial lead resistor incorporating an insulating coating in accord with the invention; and

FIG. 2 is an enlarged view taken through the section 2—2 of FIG. 1 and illustrating the character of the insulating coating.

Referring now in detail to the drawing, an electrical unit indicated generally by the numeral **10** will be seen to comprise an axial lead resistor. However, the unit **10** could as well comprise a rheostat or other electrical unit for purposes of the present application. The electrical unit **10** specifically includes a rigid, ceramic core **12**; and in one specific embodiment of the invention, the core **12** has been fashioned from the mineral substance known as statite. When the electrical unit of the invention takes the form of an axial lead resistor, the core **12** is fabricated as a cylinder and conductive metal end caps **14** are assembled to the core **12** in a friction fit. In accordance with conventional practice, lead wires **16** are mechanically and electrically connected to the end caps **14** to extend along the axis of the cylindrical core **12**.

The electrical unit **10** additionally includes an electrical element **18** disposed on the core **12**; and conventionally, the element **18** takes the form of a metallic wire element which is helically wound on the core between the end caps and which is both mechanically and electrically connected to the end caps. When the electrical element **18** is so disposed on the core **12**, portions of the surface of the core are covered with the electrical element and other portions are left exposed.

In compliance with an important feature of the present invention, a vitreous body **20** of ceramic material is applied to the electrical unit as a coating. This coating is, in accordance with the invention, molded; and during the process of its manufacture, the electrical unit is subjected to temperatures sufficiently high to cause the glassy ceramic materials contained within the body **20** to fuse, the body **20** thereby forming a monolithic envelope completely covering both the end caps **14** and the exposed portions of the surfaces of core **12** and electrical element **18**.

With reference to FIG. 2, the body **20** of ceramic material will be seen to comprise particles of non-glassy ceramic material **22** bound up in a matrix of fused glassy ceramic material **24**. The glassy ceramic material originally exists as separate particles intermixed with the particles of non-glassy ceramic material; and upon subjection to appropriate temperatures, the particles of glassy ceramic material fuse together at contacting interfaces whereby to form the glassy matrix **24**.

Because the vitreous body **20** is molded, the external shape and dimension of the electrical unit **10** can be precisely controlled, thus insuring uniform insulation value from one unit to the next and thus permitting automation of assembly of the unit **10** with other components in an electrical device or appliance. Moreover, molding of the vitreous body **20** insures intimate contact between the body and the exposed surfaces of both the core **12** and the electrical element **18** whereby to insure positive positioning of the electrical element relative to the core and whereby to insure rapid dissipation of heat generated by the unit in use.

The specific example herein shown and described should be considered as illustrative only. Various changes may occur to those skilled in the art; and such changes are to be understood as forming a part of this invention insofar as they fall within the true spirit and scope of the appended claim.

The invention is claimed as follows:

An electrical unit comprising a relatively rigid core, an electrical element carried by said core, terminals connected to the ends of the electrical element, and a molded vitreous body of ceramic material covering the core and the electrical element, said molded vitreous body including initially substantial amounts of both glassy and non-glassy ceramic particles with the glassy particles fused together as a glassy material envelope for the electrical unit having the non-glassy particles remaining embedded in the fused glassy material, said envelope being in intimate contact with exposed portions of said core and said electrical element.

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