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TERMINAL ASSEMBLY FOR ENCAPSULATED ELECTRICAL DEVICES

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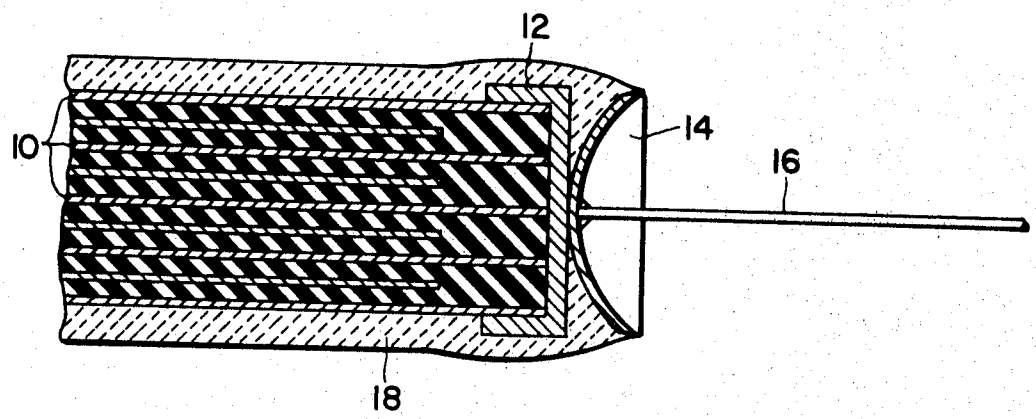


Fig. 1

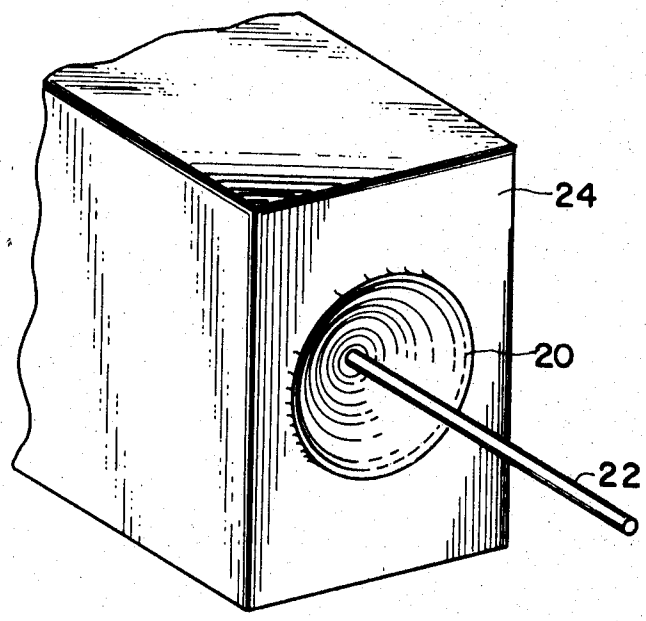


Fig. 2

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TERMINAL ASSEMBLY FOR ENCAPSULATED ELECTRICAL DEVICES

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5 Claims

ABSTRACT OF THE DISCLOSURE

An improved terminal assembly composed of a bowl shaped member of low electrical resistance and having a sharp edged rim. The sharp bowl rim provides a positive stop during the application of encapsulating material to the device, and prevents its flow across the bowl rim and around portions of the terminal lead wire.

Background of the invention

It is often desirable to provide a means for protection of electrical and electronic devices against the adverse effects of moisture, high temperature conditions, and the like. One means of accomplishing this purpose involves hermetically sealing the device in a suitable encapsulating material such as glass, ceramic material, or the like.

A difficulty encountered when encapsulating materials are applied is the tendency of the liquified material to flow over and beyond the body of the device and seal around the flexible terminal lead wires. When the material hardens, a portion of the lead wire near the body of the device is firmly embedded therein.

Twisting and flexure of the terminal lead wires, resulting from ordinary testing, handling, and installation of these devices, often produces stresses in the encapsulating material sufficient to fracture the hermetic seal. Once this seal is broken a path is provided through which moisture, gas, solids, and the like may penetrate into the internal elements of the device increasing the probability of failure as a result.

Brief summary of the invention

It is an object of the instant invention to eliminate fracture of the hermetic seal of encapsulated devices caused by the twisting and flexure of its terminal lead wires.

Briefly, in accordance with the instant invention, a bowl shaped member having suitably low electrical resistance and a substantially sharp edged rim is joined on its inside surface to one end of a lead wire of suitable length. The convex surface of the bowl is joined to the terminal electrode of the device to be encapsulated.

The device with its bowl shaped terminal assembly affixed is encapsulated by any suitable means well known in the art. The encapsulating material adheres to and seals against the convex surface of the bowl. The sharp edge of the bowl rim provides an abrupt discontinuity over which the encapsulating material will not harden, thus preventing formation of a single seal extending about the body of the device, across the bowl rim, and around a portion of the flexible lead wire. Consequently, twisting and flexure of the terminal lead wire may impart appreciable stress to the lead wire junction at the inside surface of the bowl. However, stresses so imparted to the encapsulating material forming the seal against the convex surface of the bowl are negligible. Propagation of cracks or breaks into the surface of the encapsulated body is thereby prevented.

Additional objects, features and advantages of the instant invention will become apparent, to those skilled in the art, from the following detailed description and attached drawings on which, by way of example, only the preferred embodiments of this invention are illustrated.

Brief description of the drawings

FIG. 1 is a sectional view of a hermetically sealed electrical capacitor illustrating one embodiment of this invention.

FIG. 2 is an oblique view of a portion of an electrical device showing another embodiment of this invention.

Description of preferred embodiments

Referring to the capacitor device illustrated in FIG. 1, alternate capacitor plates **10** composed of layers of electrically conducting material such as gold, silver, metals, metal alloys, or the like, electrically contact the surface of a three-sided clip **12** adapted to serve as a suitable terminal electrode for the device.

A bowl shaped member **14** having suitably low electrical resistance and a substantially sharp edged rim is joined on its inside surface to one end of a lead wire **16** by any suitable means such as welding, soldering, brazing or the like. Where the lead wire **16** and the bowl shaped member **14** are joined by these means, it may be desirable to protect and strengthen the joint by at least partially filling the bowl **14** with a suitable potting material having a higher melting point than the encapsulating material such as silver, brazing alloy compounds, or the like prior to glazing of the encapsulant. However, in depositing the potting material in the bowl **14**, the material should not be permitted to lap across the sharp edged rim. Otherwise, the capacity of the bowl rim to divide the liquified encapsulant may be diminished or lost, and unfavorable glass-to-metal seal combinations may be produced. Potting materials having melting points below that of the encapsulant, such as solder, organic compound, and the like may also be employed in a similar manner except that they should be applied after glazing is completed. In the alternative, one end of the terminal lead wire **16** may be fashioned, worked, upset, or blunted by any suitable means well known in the art so as to form the bowl shaped member **14** directly from a portion of the lead wire material. This has the advantage of eliminating a joint in the assembly and further reducing the probability of mechanical failure due to stresses set up by twisting and flexure of the lead wire **16**.

The bowl **14** is joined on its convex surface to the surface of the terminal electrode **12** by any suitable means such as welding, soldering, brazing, or the like. The device is hermetically sealed in a suitable encapsulating material **18** such as glass, ceramic material, or the like, by any means well known in the art.

During the encapsulating process, the encapsulating material **18** flows about the body of the device and adheres to and seals against the convex surface of the bowl **14**. Due to the surface tension characteristics ordinarily exhibited by liquified encapsulating materials during application and occasional subsequent heat treatments, the encapsulating material **18** draws back and away from the sharply defined rim of the bowl **14**. Thus, the sharp edged rim of the bowl **14** provides a positive stop over which the encapsulating material **18** will not ordinarily flow. In the event that some of the encapsulating material flows over the rim into the bowl **14** or otherwise surrounds a portion of the lead wire **16**, the sharp edged rim of the bowl **14** will segregate the material within the bowl from that portion forming the hermetic seal against the convex surface of the bowl **14**. This is again due to the surface tension characteristics of the liquified encapsulating material which causes the encapsulating material to draw back and away from the sharp discontinuity of the bowl rim. Flexure and twisting of

the lead wire **16** may chip away any residue of encapsulating material remaining within the bowl **14** but since such residue forms no part of the hermetic seal, the security of the seal is unaffected thereby.

FIG. 2 shows an oblique view of a portion of an encapsulated electrical device such as a resistor, capacitor, inductor, diode, electrical network, integrated microcircuit or the like, illustrating other embodiments of this invention. A bowl shaped member **20** having suitably low electrical resistance and a sharp edged rim provides shielding for a terminal lead wire **22**, during the application of encapsulating material **24**. The encapsulating material **24** adheres to the convex surface of the bowl **20** forming a hermetic seal thereabout. Twisting and flexure of the terminal lead wire **22** will not impart stresses to the hermetic seal.

Although the present invention is described with respect to specific details of certain embodiments thereof, it is not intended that such details be limitations upon the scope of the invention except insofar as set forth in the following claims.

We claim:

1. An article of manufacture comprising

an encapsulated electrical device having at least one terminal electrode,

a bowl shaped member, having low electrical resistance and a substantially sharp-edged rim, connected on a portion of its convex surface to said terminal electrode, and

a lead wire having one end connected to the inside surface of said bowl,

2. The article of manufacture of claim **1** wherein the volume within said bowl shaped member is at least partly filled with potting material in such manner as to preserve said sharp-edged rim.

3. A terminal assembly for an encapsulated electrical device having at least one terminal electrode comprising

a bowl shaped member, having low electrical resistance and a substantially sharp-edged rim, connectible on a portion of its convex surface to said terminal electrode, and

a lead wire having one end connected to the inside surface of said bowl.

4. The terminal assembly of claim **3** wherein the volume within said bowl shaped member is at least partly filled with potting material in such manner as to preserve said sharp-edged rim.

5. A terminal assembly for encapsulated electrical devices having at least one terminal electrode comprising

a terminal lead wire, one end of which is upset so as to form a bowl shaped portion having a substantially sharp-edged rim, the remaining portion of said terminal lead wire extending from the concave surface of said bowl, and

means for affixing said bowl shaped portion at its convex surface to said terminal electrode.

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