METHOD OF FILLING AND ENCAPSULATING ELECTRICAL ELEMENTS

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1 Claim. (Cl. 18—59)

The object of the present invention is to disclose a grease filling and encapsulating process for a casing containing electrical contact members which process will make the outer surface of the casing and the contact member impervious to any volatile gaseous ingredients that may be present in the atmosphere surrounding the casing.

Variable potentiometers, electrical switches, resistors, relay toggle switches and other electrical contact members customarily are sold in non-airtight cases. When these encased electrical contact members have to be used in areas in which a contaminating and/or volatile gas is present, such as in an oil refinery, it has heretofore been necessary to provide a thick walled explosion proof metal enclosure about such encased members. Furthermore to make such members readily accessible for repair it has often been necessary to provide explosion proof doors in one of the walls of such an enclosure. Experience has shown that even though the walls of such an enclosure is made relatively thick there will always be a certain small amount of the aforementioned gas which will be able to seep through the encased wall due to the porous nature of such a wall and due to the fact that the aforementioned doors are often times opened to inspect the parts that are within the enclosure. When such a gas seepage occurs there is then present the danger that a sparking of the electrical contact members may occur and ignite this gas and/or the possibility that this gas contains certain ingredients that will cause corrosion to occur on the surface of the contact members.

It is thus still another object of the present invention to disclose a grease filling and encapsulating process for encased electrical contact members which process will eliminate the need of these bulky, expensive enclosures and, also will eliminate the possible danger that a gas, of the aforementioned type, will get into contact with these members to cause either an explosion or the corrosion of the electrical contact members to take place.

To this end it is therefore a more specific object of the present invention to disclose a unique fast, economical process by which a thin gas-proof layer of an epoxy resin may be applied to the outer surface of a non-airtight case of a variable potentiometer and at the same time be prevented from going through any opening in its case onto the movable electrical contact members of the potentiometer.

Still another object of the present invention is to provide a process of the aforementioned type which requires only a few inexpensive parts.

In the drawing:

Fig. 1 shows a variable potentiometer immersed in a grease filled vessel and a means for evacuating an enclosure surrounding the vessel;

Fig. 2 shows the way in which the grease filled potentiometer is placed in a mold for encapsulating;

Fig. 3 shows the liquid epoxy resin occupying the space between the mold and the casing of the potentiometer and

Fig. 4 shows the potentiometer casing covered with a thin layer of solid epoxy resin.

The operation of the invention will be described in connection with a grease filling and encapsulating process for a commercially available encased variable potentiometer but it will be obvious that this same process may be used with equal success for encapsulating any other type of encased unit having electrical contact members such as electrical switches, resistors, relay toggle switches, etc.

It should further be understood that while this process is shown being used to produce a single encapsulating potentiometer it is obvious that by providing a plurality of holes such as the ones shown in Fig. 3 of the drawing a plurality of potentiometers could be simultaneously encapsulated by this process if mass production techniques are desired.

The potentiometer shown in Fig. 1 comprises the conventional elements such as, a base 2 of phenolic molding material having one electrical contact member 3 in the form of a carbon resistive track and another electrical contact member in the form of a rotatable resilient metal wiper 4. The potentiometer shown, also consists of a rotatable shaft 5 which when rotated will move the wiper 4 attached thereto along the resistive track 3. Fittedly attached to the right side of the base 2 there is shown a threaded sleeve portion 6.

Although it is not shown in the drawing, the space between the inner wall of the sleeve 6 and the outer peripheral of the shaft 5 is sealed off from the atmosphere surrounding the potentiometer by means of an O-ring. Terminals 7, 8 and 9 of a well known variety are shown projecting in an upper direction beyond the extension of the potentiometer 1 as can best be seen in Fig. 4 of the drawing. Fig. 1 of the drawing also shows a non-airtight casing 11 connected at its periphery to the periphery of the base 2 to form a non-airtight casing about the electrical contacting members 3 and 4. It should also be noted that there exists at least two depressed portions forming a visible opening in the casing 11, namely the portions 12 and 13 as can best be seen in Fig. 2 of the drawing. The aforementioned potentiometer 1 is shown immersed in a non-conductive, non-corrosive grease such as a silicone compound or thixotropic grease with a pH of seven that is retained within an open vessel 15 that is supported by the stationary member 16. Surrounding and spaced from the vessel 15 there is shown an inverted vessel 17 whose lower open end bears against the stationary member 16 to form an enclosure. Connected to this chamber by way of the aperture 18 in the member 16 there is shown a vacuum pump 19 having an exhaust conduit 21.

Fig. 2 of the drawing shows a flat rectangular shaped molding part 22 and a second molding part 23 that has an aperture 25 formed in one of its wall portions 26. Fig. 2 also shows how a clamp such as the C-clamp 27 shown may be used to force the molding plates 22 and 23 into contact with one another as shown in Fig. 3. Fig. 3 also shows the position that a liquid epoxy resin 28 will occupy between the inner surface of the molding plate 23 and the inner surface 31 of the molding plate 22 when it has been poured into the mold.

Fig. 4 of the drawing shows the potentiometer with the molding parts 22, 23 removed and a relatively thin protective layer of the now solidified epoxy resin 28 surrounding same.

The first step in this grease filling and encapsulating process is to fill all cavities of the potentiometer 1 with a silicone grease 14 to prevent the epoxy resin from getting into the working parts of the potentiometer. To
accomplish this feat the encased potentiometer 1 is first placed in the grease 14 retained in the vessel 15 as shown in Fig. 1. An inverted vessel 17 is then placed over the grease filled vessel 15 as shown in Fig. 1 and is brought into substantially airtight relationship with the stationary member 16. The enclosure formed by the inverted vessel and the stationary member 16 is then evacuated by permitting the vacuum pump 19 to be cut in for a ten minute period then the vacuum released and finally cut in again for a ten minute period. As the vacuum pump is evacuating the enclosed chamber 16, 17 in this manner, the grease 14 in the vessel 15 will be pulled through the depressed open portions 12, 13 and any other openings that may be present in the casing 11 into the interior of the potentiometer to fill the interior portion of the casing in which the electric contact members 3 and 4 are located.

After the interior of the potentiometer 1 has been completely filled with grease in the aforementioned manner and all of the grease adhering to the outer surface of the casing is removed by rubbing the outer surface of the encased potentiometer with a cloth saturated with a suitable cutting compound, and the external surface of the potentiometer 1 is dried, the potentiometer is then in a condition to be placed in the mold 22, 23, and to be clamped into the Fig. 3 position by the clamp 27 that is shown in Fig. 2.

With the potentiometer 1 in this Fig. 3 position, an evacuated room temperature cured type of epoxy resin 28 that has been freed of excess air bubbles is then poured into the space formed by the molding parts 22, 23 and the external surface of the encased potentiometer 1.

It is important at this point to note that since the interior of the encased potentiometer is filled with grease in the manner previously referred to, no epoxy resin will therefore be allowed to enter any of the openings such as the openings 12 and 13. This epoxy resin is of a commercially available variety known as Scotchcast epoxy-type resin number two that is manufactured by Minnesota Mining and Manufacturing Company.

When this type of epoxy resin solidifies under room temperature conditions it will provide an outer surface covering for the encased potentiometer 1 which is impervious to volatile or corrosive gases that may be present in the atmosphere surrounding the potentiometer as well as providing an outer covering for the potentiometer that is resistant to shock and vibration.

The aforementioned grease filling and encapsulating process disclosed in this application thus provides a unique process by which a coating of epoxy resin that is impervious to corrosive and volatile gases may be applied to the external surface of a variable potentiometer without permitting the epoxy resin to flow into the interior of the potentiometer while it is in a liquid state where such a resin would adversely affect the operation of the electrical movable parts contained therein.

What is claimed is:

The process of protecting from corrosive gases a plurality of movable electrical switch elements contained within a perforated casing wherein at least one of said switch elements is adjustable by an actuating member extending through and out of said casing, without substantially interfering with the motion desired to take place between said switch elements, said process comprising the steps of immersing said casing containing said switch elements in a non-corrosive, non-conductive grease in an open vessel, placing said vessel in an enclosure, intermittently exhausting the air from said enclosure and from the interior of said casing to pull said grease through said perforated casing to substantially fill the interior of said casing, thereafter placing said casing in a mold with said actuating member extending through said mold and pouring liquid epoxy resin into said mold to form a solid epoxy resin coating around said casing.

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