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METHOD FOR ENCAPSULATING ELECTRICAL EQUIPMENT

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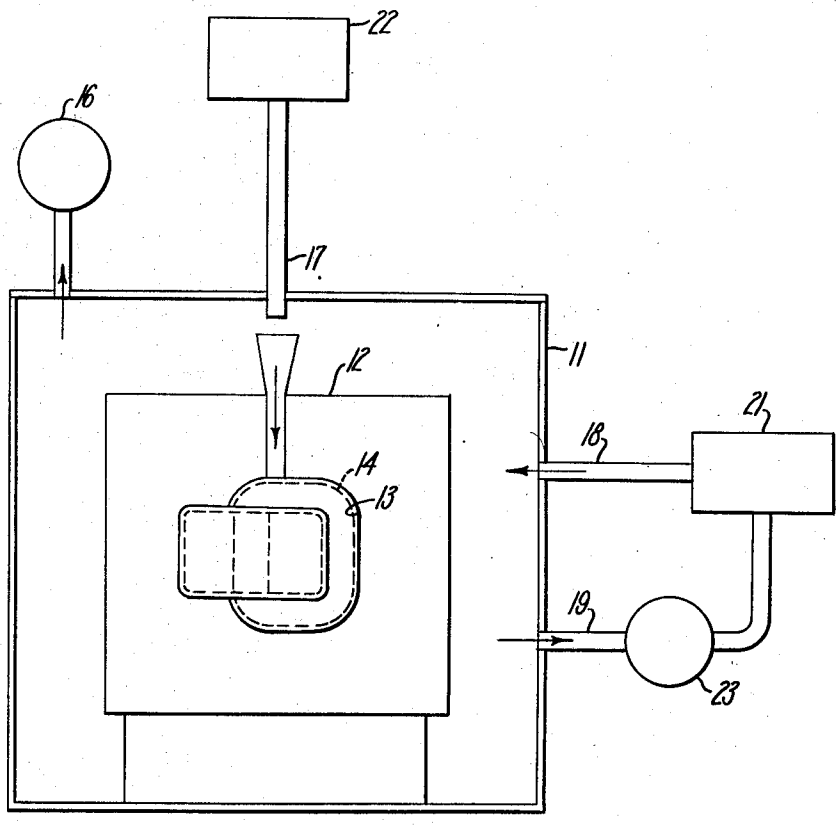

Inventor
William M. Terry Jr.
By Houston L. Anderson
Attorney

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METHOD FOR ENCAPSULATING ELECTRICAL EQUIPMENT

William M. Terry, Jr., Pittsburgh, Pa., assignor to Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

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2 Claims. (Cl. 18—59)

This invention relates to a method for encasing an electrical conducting member and more particularly to a new and improved method for encapsulating electrical apparatus.

One method in the art of encapsulating an electrical apparatus involves introducing a nonmetallic substance into a mold containing the electrical apparatus in such a manner that the final product is free of air gaps and thereby has high dielectric strength.

One way to encapsulate a transformer is to mold a casing of a solid setting electrical insulating compound, preferably a thermosetting or thermoplastic compound around it in normal atmosphere. This method results in entrapment of air bubbles in the compound of the molded transformer between current carrying parts. When there is excessive voltage stress on these bubbles ionization or flashover of the air will occur. This causes intense heat which may cause a breakdown of the insulation. This ionization also causes radio interference. To decrease this tendency of dielectric ionization or corona, the transformer is vibrated after it has been molded. This vibration of the transformer prior to the final curing of its molded insulating casing causes most of the air in the compound to be eliminated. Consequently, the insulation of the transformer has a high dielectric strength. However, all of the air is not always removed by this method and the high expense of the vibrating machines is also a disadvantage for this method. Transformers have also been encapsulated in a vacuum. However, this is an expensive and complex procedure, for filter equipment must be used to prevent the vacuum from lifting the catalyst out of the thermosetting compound thereby upsetting its formulation.

The present invention provides an economical and relatively simple method for making an improved transformer with insulation having a high dielectric strength. The transformer is placed in a closed tank containing a gas having a dielectric strength greater than that of air. Consequently, any bubbles entrapped in the insulating compound will have a high dielectric strength and will have a high resistance to flashover.

It is, therefore, one object of the present invention to provide a new and improved method for encapsulating transformers.

Another object of the invention is to provide a new and improved method for making a transformer which will have a decrease in corona and will have a high dielectric strength.

Another object of the invention is to provide a method for encapsulating a transformer which will have increased insulation life.

Another object of the invention is to provide a new and improved method for encapsulating transformers which will have a decrease in ionization and, therefore, will cause less interference with radios.

Objects and advantages other than those set forth above will be apparent from the following description

when read in connection with the accompanying drawing in which:

The figure is a diagrammatic vertical section of the encapsulating apparatus.

Referring more particularly to the drawing by characters of reference, the figure illustrates a preferred apparatus for encapsulating a transformer in which a vacuum chamber **11** is provided which is of sufficient size to adequately contain a mold **12** having a cavity **13** and a transformer **14**. The chamber **11** is provided with a pump **16** for evacuating the chamber, an inlet **17** through which the solid setting insulating compound may be poured into the mold **12** and an inlet **18** and outlet **19** for the gas. The chamber **11** must be sufficiently sealed in order that it may be evacuated.

After the transformer **14** has been assembled it is placed in the cavity **13** of the mold **12** and then the mold and transformer are put into the chamber. After the transformer **14** and mold **12** are placed into the chamber **11**, the chamber is tightly sealed and substantially evacuated of its air by means of the pump **16**. Upon attaining a near vacuum in the chamber, a gas having a dielectric strength greater than that of air is released from a supply tank **21** into the chamber and is exposed to the transformer. The pressure of the gas in the chamber is brought up to atmospheric pressure or slightly above.

The dielectric strength of air as determined by the voltage stress required to produce sparkover of a .001 inch sphere gap at standard atmospheric pressure is 330 volts per mil thickness. Thus, whenever the transformer is encapsulated in a gas having a dielectric strength greater than 330 a better transformer will be produced as compared to one encapsulated in air. However, to obtain any substantial and appreciable difference in results the gas should have a dielectric strength of at least 25% greater than that of air. A preferred gas is sulfur hexafluoride which under similar conditions as air has a dielectric strength value of 640 volts per mil, an increase of almost 100% over air. This is a considerable improvement in view of the fact that the dielectric strengths of most thermoplastic and thermosetting compounds used to encapsulate transformers are approximately 1000 volts per mil for a sample of 25 mils thickness. Therefore, through the use of sulfur hexafluoride gas instead of air the difference between the dielectric strengths of the encapsulating material and its captured gas bubbles is reduced by more than 50%.

After the chamber **11** has been filled with the dielectric gas the transformer **14** is ready to be encased or encapsulated. The insulating compound is released from a container **22** and poured through inlet **17** into the mold cavity **13** containing the transformer **14**. Inasmuch as the chamber **11** has been evacuated of substantially all air and now contains only the sulfur hexafluoride gas, any bubbles which form in the compound during the molding process will be composed of sulfur hexafluoride gas. Since the dielectric strength of this gas is closer than the dielectric strength of air to that of the compound the ability of the bubble to resist flashover is greatly increased, resulting in a transformer with improved insulation strength.

The gas is removed from the chamber by a pump **23** back to the supply tank **21** and the transformer **14** may now go through normal curing processes well known in the art. The resulting product is an encapsulated transformer which has increased dielectric strength. With this increased strength the transformer will be free of corona and have a longer insulation life since the tendency of ionization is decreased. With this decrease in ionization, the transformer will also cause less inter-

ference with radios and other wave length operation equipment.

Although only one embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made, without departing from the spirit of the invention or from the scope of the appended claims.

What is claimed is:

1. In a method of producing an insulated electrical conducting member the steps of placing said member in a mold placing said mold in a vacuum chamber, evacuating said chamber and said mold, introducing sulfur hexafluoride gas into the chamber and said mold, and introducing a solid setting electrical insulating compound into said mold.

2. In a method of producing an insulated electrical conducting member the steps of placing the member in a mold, placing said mold in a vacuum chamber, drawing a substantial vacuum in said chamber and said mold, introducing sulfur hexafluoride gas at substantially atmospheric pressure into said chamber and said mold, and encasing the member with a solid setting electrical insulating compound.

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