Sept. 25, 1945. M. OMANSKY 2,385,460

METHOD OF INSULATING ELECTRICAL APPARATUS

Filed Feb. 15, 1943

Fig. 1

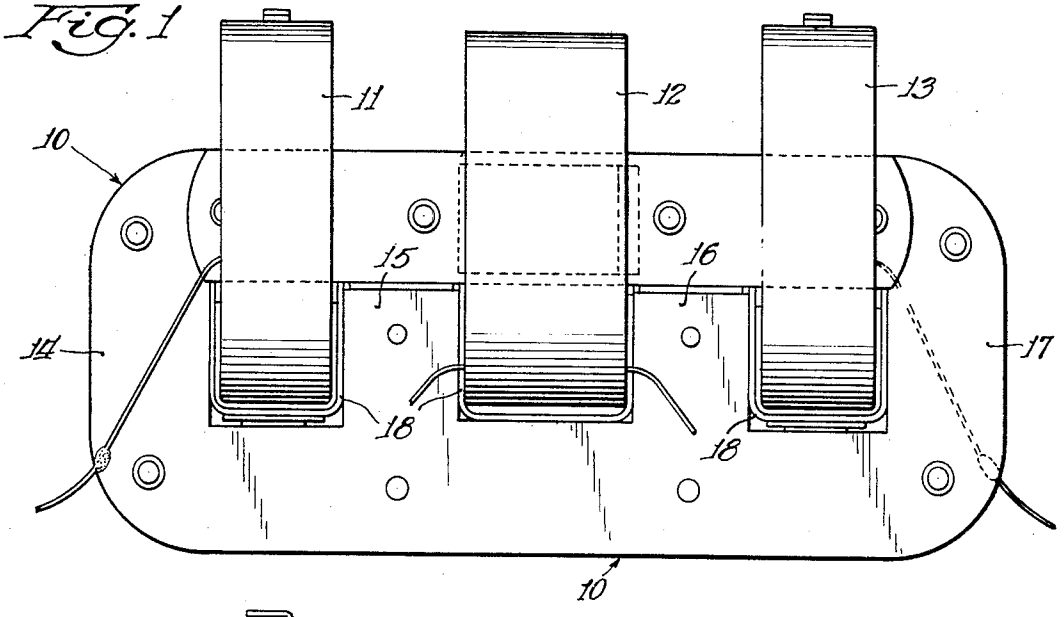


Fig. 2

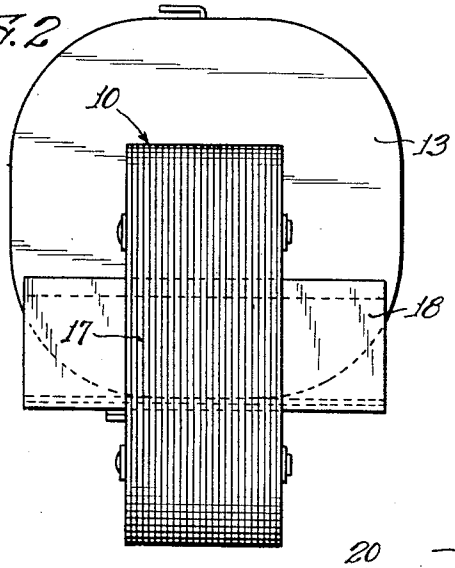


Fig. 3

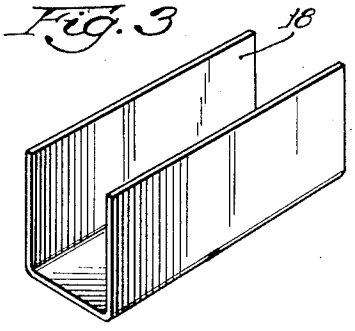
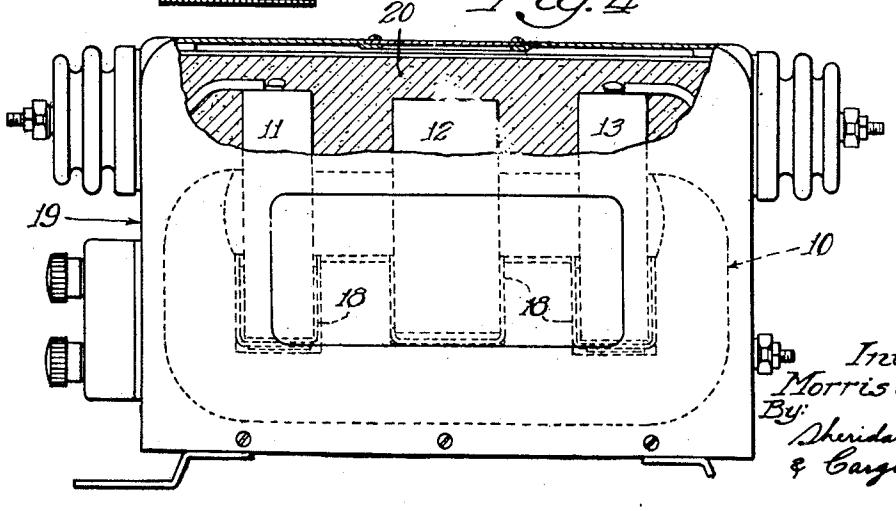


Fig. 4



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METHOD OF INSULATING ELECTRICAL APPARATUS

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Application February 15, 1943, Serial No. 475,942

3 Claims. (Cl. 18—59)

This invention relates to an improved method of insulating electrical apparatus.

In electrical apparatus, such as, for example, transformers and high tension apparatus, it has been customary to separate and insulate the parts, such as windings, through the use of mica sheets or shields. The mica used for this purpose is customarily built up into sheets from smaller pieces or flakes of mica held together by a binder such as shellac. There are difficulties and disadvantages connected with the use of such sheet mica insulation, among which is its tendency to delaminate and deteriorate under the influences of heat or moisture, and the tendency to crack or break when bent.

An object of this invention is to provide a method of insulating electrical apparatus by means of insulating material that can be placed in position while in a pliable state and then hardened or cured in place.

Another object of the invention is to provide an improved method of insulating electrical apparatus by means of an initially plastic insulating material that may be sheeted or shaped to a particular form required and semi-cured to facilitate handling prior to positioning in or around the apparatus to be insulated and thereafter curing the insulation in situ to a firm or relatively hard final condition.

An additional object of the invention is to provide a method of insulating electrical parts whereby the insulators can be flexed or shaped readily to fit or conform to the parts as desired and are thereafter finally cured in situ by the application of heat such as the heat of a potting compound where such is employed.

Other objects and advantages of the invention will be apparent from a consideration of the following specification and accompanying drawing of a transformer selected for the purpose of illustrating the principles of the invention.

In the drawing, Figure 1 is a side elevational view of a laminated core and coil structure of a transformer having improved semi-cured insulating forms or strips in position between certain of the coils and core portions;

Fig. 2 is an end elevational view of the apparatus shown in Fig. 1;

Fig. 3 is a detached perspective view of an insulating shape formed in accordance with the present improvements;

Fig. 4 is a broken side elevational view of a condenser casing containing the apparatus shown in Fig. 1.

In the drawing, for the purpose of illustrating the principles of the present invention, an electrical condenser is shown comprising a laminated core structure indicated generally by the numeral 10 and three coils 11, 12 and 13. The particular form or shape of the core, or the form or number of coils is not pertinent to the present improvements and is to be considered as shown for illustrative purposes only.

In the manufacture of condensers, insulating material generally is inserted between certain parts of the condenser such as between the coils and the adjacent portions of core legs 14, 15, 16 and 17. The insulating material generally heretofore employed is laminated sheet mica, the sheets being formed generally of flakes or smaller portions cemented together as by shellac. When subjected to unfavorable conditions such as moisture or a relatively high degree of heat, especially where the sheets are under stress as when flexed around a part to be insulated, delamination frequently occurs which impairs the insulating properties and often results in impaired functioning or breakdown of the electrical apparatus with which such insulation is employed.

Laminated mica sheet, while flexible, can not readily be bent or shaped without fracture to fit closely around numerous parts which it sometimes is desirable to insulate and hence in the present improvements the high insulating character of mica is utilized in the formation of flexible sheets or forms which can be shaped as desired without fracturing and which are thereafter cured or treated to harden or permantize the shape thereof after the sheets or forms are placed in position in or around the part or parts to be insulated.

In carrying out the present improvements a plastic composition is prepared including ground mica, the particles thereof being distributed throughout the mass. A composition which is suitable comprises principally mica and a rubber base compound, including conventional fillers, vulcanizing agents and accelerators. An example of a suitable composition is as follows:

	Parts by weight
Rubber (smoked sheets)	100
Sulfur	45
Stearic acid	1
Paraffin	3
Zinc oxide	1
du Pont 808 accelerator	2
Ground mica	150
	302

The above illustrative composition is one which can be vulcanized to provide a hard final product.

The mica employed preferably is of fine particle size, from 100 mesh to 325 mesh, for example, has been found to be satisfactory. The selected materials are mixed in suitable mixers or in a rubber mill in accordance with known rubber manufacturing procedure and thereafter the mass preferably is aged for about twenty-four hours before use. The mass may then be sheeted out to the desired thickness, or it can be given other required shapes, depending on the particular parts to be insulated. The sheets or forms are then given a partial cure, preferably to the point where they are no longer tacky or adherent one to another to facilitate handling and placement in their positions of use. Such partially cured shapes, that is, sheets or other special forms, are pliable and can be readily bent, without fracturing, into close contact with numerous parts to be insulated and under conditions where use of laminated mica sheets, fiber and other materials have presented difficulties.

As shown in Fig. 3 of the drawing, such a semi-cured sheet can be given a channel form and is adapted to be inserted between one of the coils of the condenser and the adjacent leg portions of the laminated core as illustrated in Figs. 1 and 2. In Fig. 1, numeral 18 indicates several of such partially cured insulators.

In position, semi-cured insulators of suitable shapes and sizes may be provided for other parts or portions of transformers or other electrical apparatus, as will be appreciated.

After the semi-cured insulators are in position in the apparatus, they preferably are treated to further or completely cure or vulcanize the same to harden them suitably to resist deformation or alteration during use and increase their dielectric strength.

In accordance with the present improvements, the final hardening or vulcanizing of the insulators is effected by the application of heat to the insulators in situ. Where the insulated apparatus is a transformer or like device which is generally filled with a hot potting compound after assembly of the device within its casing, the final stage of vulcanization of the semi-cured insulators can be affected generally by the heat of the potting compound. In Fig. 4 of the drawing, an assembled transformer is shown in position in a casing 19 which has been filled with a potting compound 20. Potting compounds commonly used are asphaltic base material which is poured while hot into the casing to enclose the parts after the latter are positioned within the casing.

Where the potting compound is heated to 400–450° F. the heat is sufficient generally to effect the final vulcanization of the insulators to a suitable degree of hardness where the insulators are of the composition above mentioned. Additional heat may, of course, be supplied where necessary to effect the vulcanization, but preferably the composition of the insulator is such that an adequate degree of hardness is imparted to the insulators by the heat of the potting compound.

The present improvements facilitate the shaping and placement of the insulators in close contact with or around the parts to be insulated and when the insulators are finally cured sufficiently to a hard or rigid condition, their dielectric values are such as to give satisfactory service in use with relatively high voltage apparatus. For example, fully cured insulators of the illustrative composition mentioned above compare favorably in dielectric strength with laminated mica sheets of substantially equal thickness, but since the hot potting compounds generally employed in certain electrical apparatus frequently cause the binder of the mica laminations to swell and the sheets to delaminate with resulting reduction in their dielectric strength (such reduction sometimes being as much as fifty per cent) the present improvements are of advantage since no delamination of the insulators occurs and the dielectric strength thereof is increased by increasing the curing temperature up to that required for maximum hardness.

While an embodiment of the improvement is disclosed for illustrative purposes, it will be apparent that variations thereof may be made use of within the scope and spirit of the invention.

I claim:

1. The method of insulating electrical apparatus having a casing and parts therein adapted to be separated by insulating material which comprises the steps of placing between said parts insulators of curable and pliable rubber base insulating material, and pouring into said casing around said parts and insulators a molten potting compound having a temperature sufficiently high to effect the curing of the insulators.

2. The method of insulating electrical elements which comprises forming insulators of heat-curable plastic insulating material, partially curing the insulators to render the same manipulable and non-tacky, placing the partially cured insulators in insulating positions on or about the elements to be insulated, and thereafter applying to the insulators to finally cure the same in situ a potting compound at a temperature sufficiently high to effect said curing.

3. The method of insulating parts of electrical apparatus which comprises inserting a partially cured shape of hardenable rubber base compound in position with respect to the part to be insulated, and thereafter finally heat-curing the shape to hardness by pouring therearound a potting compound at a curing temperature.

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