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METHOD FOR THE PRODUCTION OF HIGH-VOLTAGE INSULATION, AND INSULATION PRODUCED BY THIS METHOD

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Fig. 2.

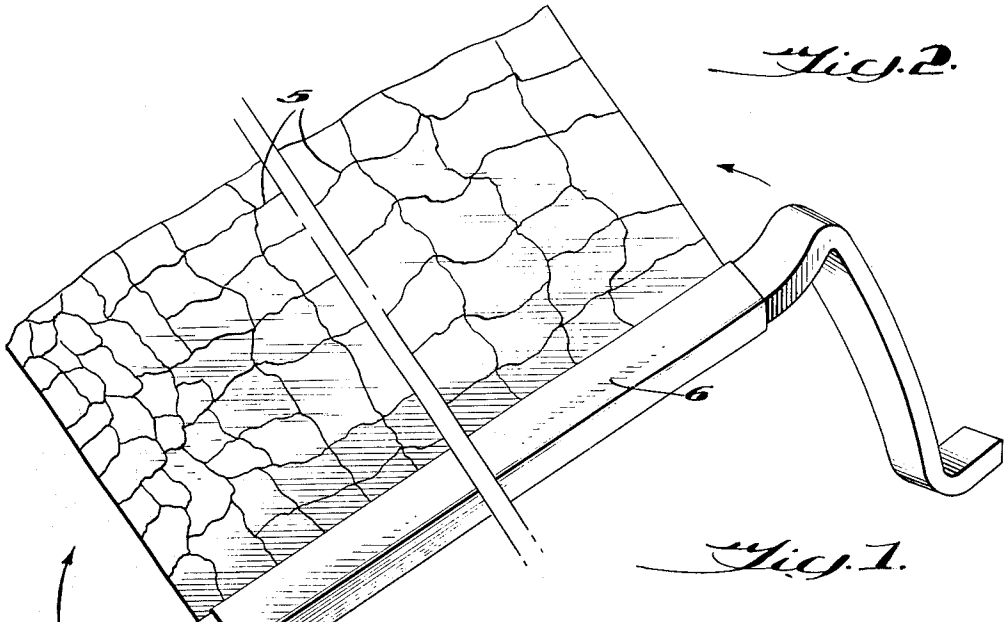
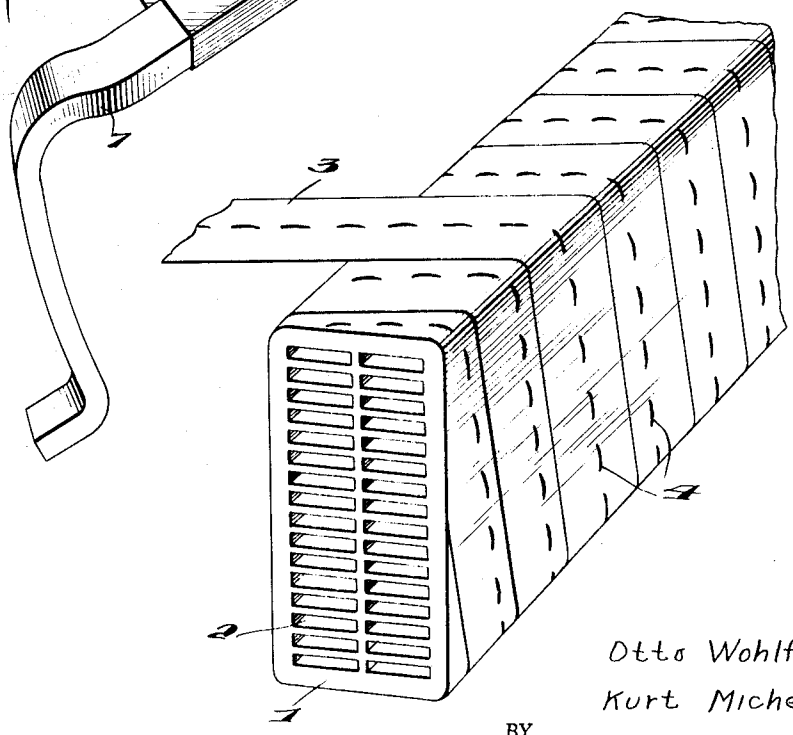


Fig. 1.



INVENTORS

Otto Wohlfahrt

Kurt Michel

BY

Pierce, Scheffler & Parker

ATTORNEYS

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METHOD FOR THE PRODUCTION OF HIGH-VOLTAGE INSULATION, AND INSULATION PRODUCED BY THIS METHOD

Otto Wohlfahrt, Zurich, and Kurt Michel, Neuenhof, Switzerland, assignors to Aktiengesellschaft Brown, Boveri & Cie, Baden, Switzerland, a joint-stock company

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1 Claim. (Cl. 154—2.27)

The invention relates to a method for the production of a high-voltage insulation, in particular for the windings of electric machines, and a high-voltage insulation produced by this method.

For the electrical insulation of coils and windings there is often used the so-called press-around method, wherein a mica foil, i.e. a sheet-like insulating material consisting of a paper support and a laid-on mica foil with shellac or asphalt as binder, is wrapped on the conductor to be insulated and is pressed on in the heated state. Another common method consists in that mica ribbons, which consist of a fiber material support and glued-on mica foils, are wrapped on the conductor. The conductor wrapped with several layers of mica ribbon is impregnated with hot asphalt. By repeated wrapping with mica ribbon and subsequent impregnating, the insulation is gradually built up to the desired thickness. As compared with the press-around method, this latter method is more complicated and expensive due to the gradual building up of the insulating lap.

Due to advancing development, the demands on the insulation of conductors carrying high voltage, in particular the windings of high-voltage generators, are becoming greater and greater, and this not only with respect to the dielectric properties, but often also because of increased thermal and mechanical stresses. In the endeavor to improve the quality of the insulation accordingly, there have recently been used also high-voltage insulations in which the insulating lap, obtained from mica ribbons, is impregnated under vacuum with synthetic resins hardenable by polymerization. When a thermosetting synthetic resin is used as binding agent in the ribbon, this results in a stiffening of the ribbon which renders the processing thereof difficult. The insulations produced in this way have the advantage, however, that the binder exhibits a high mechanical quality even at elevated temperatures, while with the use of thermoplastic binding or impregnating agents, as for example asphalt or shellac, these become soft at temperatures above about 100° C. or may sweat out of the coils.

Although high-voltage insulations of the last-named kind with thermosetting synthetic resin binders and a synthetic resin impregnation are advantageous in mechanical and thermal respect, it has been found that during their production the binder renders the complete penetration of the insulation with the impregnating agent very difficult and consequently there is danger of air inclusions. To be able, therefore, to produce an insulation which will be satisfactory also with respect to the dielectric properties, further precautions are necessary to eliminate this disadvantageous effect of the binder. A known method consists in that an easily removable binder is used, which is caused for example to evaporate or is thermally decomposed. Another possibility is to use a binder which dissolves in the impregnating agent and thereby favors the penetration thereof.

All these methods for the removal of the binder, however, are complicated, raise the cost of the product, and

in part interfere with the impregnation. Moreover, the choice of support material and binder is very limited. Disadvantageous is further the fact that the insulating material must be kept in closed containers when readily volatile binders are used.

The subject-matter of the present invention is a method for the production of high-voltage insulations, in particular for the windings of electric machines, consisting of mica and a sheet-like support, as well as an impregnating agent, in which the disadvantages of the mentioned methods are to be avoided and at the same time a high-grade insulation is obtained in extremely simple manner.

According to the invention this is achieved in that on the element to be insulated, a lap consisting of mica and a support layer is produced, which is permeable to the impregnating agent to be introduced subsequently and which is impregnated under vacuum with a solvent-free impregnating agent in such manner that the finished insulation exhibits no cavities. A high-voltage insulation produced by the method of the invention exhibits no binder layer inhibiting the impregnation and at the same time the ductility and flexibility of the support required for pressing around and wrapping is not impaired.

A procedure for carrying out the method according to the invention is, for example, the following method:

An insulating ribbon consisting of mica sewed onto a paper layer is wrapped on the conductor to be insulated, e.g. a coil or a winding bar. The lap thus produced is then impregnated under vacuum by means of a solvent-free impregnating agent, e.g. a synthetic resin hardenable by polymerization. Owing to the fact that the mica is joined with the paper ribbon only by a few seams, i.e. the mica is secured only in spots or spotwise to the paper ribbon, the impregnating agent can penetrate through all layers of mica and its paper support, so that all cavities are filled with impregnating agent. Instead of paper, of course, substances such as glass fabrics, synthetic fibers, plastic foils, etc. may also be used as support material. As synthetic resins hardenable by polymerization for the impregnation there are used preferably such known resins as polyester resins, ethoxylin resins, and the like. However, such impregnating agents as waxes and asphalts which become liquid under the action of heat and which solidify as a solid body upon cooling may also be used, provided the finished insulation does not have to be exposed to excessively high temperatures.

Attachment of the mica on the support material can be effected also by spotwise gluing instead of sewing. It is further possible also simply to lay the mica onto the support material in suitable manner and to wrap it together therewith without any binding agent on the conductor, whereupon the insulating lap thus produced is impregnated.

The insulating material used for the production of a high-voltage insulation according to the new method is a sheet-like material consisting of mica and a sheet-like support, and if the mica is joined to the support in a spotwise manner, i.e. by sewing or spotwise gluing, the insulating material is made as a ribbon or web and can be used as needed for the production of an insulating lap. The insulating material can also be stored indefinitely without special precautions, so that keeping it in stock is very simple.

Examples of the insulation according to the invention are illustrated in the accompanying drawing, where Fig. 1 is a fragmentary view in perspective of part of a conductor bar for a turbo-generator stator and Fig. 2 a similar view of part of an electric generator coil provided with the new insulation.

In Fig. 1 the copper conductor bar **1**, which is provided with cooling channels **2**, is insulated by means of mica flakes which are sewn on to a backing of paper ribbon **3**

and wrapped around the bar, as shown. The seams where the mica flakes are secured to the backing is indicated by reference numeral 4.

In Fig. 2 the insulation material consists of mica flakes 5 which are spot-glued to a web of support material 6, e.g. a paper backing. The necessary insulation lap is achieved in this case by rotating the coil 7 in the direction indicated by the arrow.

We claim:

The method for the production of high voltage insulation for the winding elements of electric machines which comprises the steps of forming on said winding element to be insulated a lap comprising mica sewn to a sheet-like support therefor and which lap is permeable to an impregnating agent, and applying to said lap, under vacuum, a solvent-free impregnating agent in such manner that the finished insulation contains no cavities.

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