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IMPREGNATED FIBROUS MATERIAL AND COMPOSITION SUITABLE FOR IMPREGNATING SUCH MATERIAL

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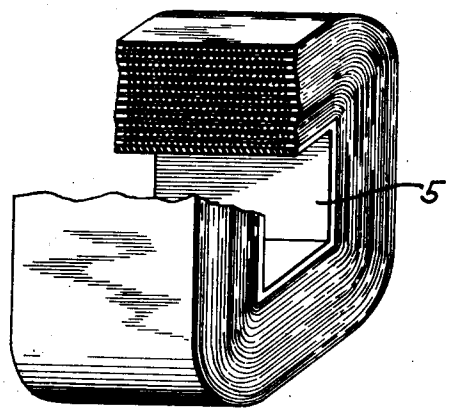


FIG. 1

FIG. 2

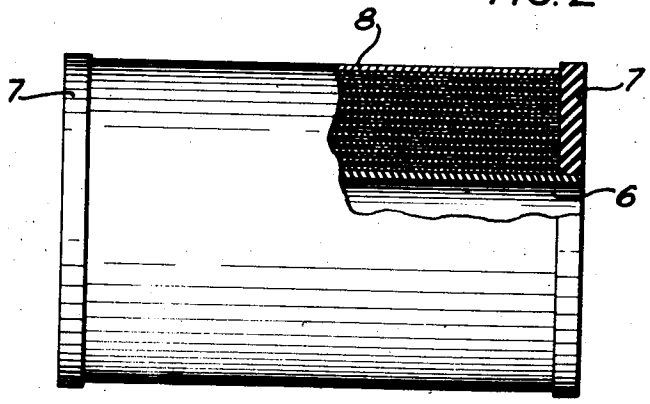
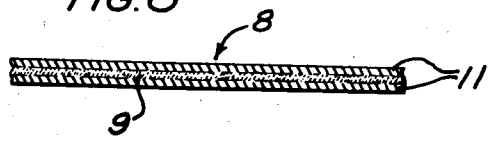


FIG. 3



INVENTOR
R. P. LUTZ
BY H. A. Whitehorn
ATTORNEY

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IMPREGNATED FIBROUS MATERIAL AND COMPOSITION SUITABLE FOR IMPREGNATING SUCH MATERIAL

Raymond P. Lutz, Oak Park, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

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6 Claims. (Cl. 154—2.6)

This invention relates to impregnated fibrous materials and compositions suitable for impregnating such materials and to methods of impregnating fibrous materials, and is a continuation in part of my copending applications, Serial No. 713,866, filed March 3, 1934, and Serial No. 752,467, filed November 10, 1934.

Objects of the invention are to provide materials having good non-hygroscopic and insulating properties for use in electrical apparatus and to provide improved compositions and methods for impregnating fibrous materials.

In accordance with one embodiment of the invention, a fibrous material suitable for filling or encasing electrical coils is impregnated with an abietic acid derivative or a solution of an oxidized abietic acid and cellulose derivatives to insulate the coil and prevent corrosion of the electrical conductors.

Other objects and advantages will appear as the description proceeds.

A complete understanding of the invention may be had by reference to the following description taken in conjunction with the accompanying drawing, in which

Fig. 1 is a perspective view, partly in section, of a coil embodying the invention;

Fig. 2 is a modified form of coil embodying the invention; and

Fig. 3 is a fragmentary detail view of the covering for the coil shown in Fig. 2.

Referring now more particularly to Fig. 1, the coil may be provided with a rectangular core 5 of fibrous material or the core may be made of a phenol condensation product, of cellulose acetate, or of a phenol condensation product faced with cellulose acetate. The convolutions of wire are wound in layers on the core and each layer is separated by a fibrous sheet of paper, cloth, or the like and a similar sheet is wrapped around the outer layer of wire. The wire may be bare, if suitably spaced, but preferably comprises enameled wire or wire having a fibrous insulation.

After the coil is wound, it may be immersed in a solution of highly oxidized abietic acid of the type sold on the market under the trade-name of "Vinsol" by the Hercules Powder Company. "Vinsol" is a hard dark-colored resinous material consisting chiefly of highly oxidized abietic and other resin acids, along with smaller amounts of polyphenols, unoxidized abietic acid, and unidentified products, probably ligneous in character. Wherever the terms "oxidized abietic acid" or "abietic acid derivatives" are used in the specification or appended claims, it is intended to mean a material consisting chiefly of highly oxidized abietic acid and which may or may not contain other highly oxidized resin acids, smaller amounts of polyphenols and other products.

A solution of the oxidized abietic acid may be made by dissolving a quantity of this material in the proportion of 100 parts of the material to 75 parts by weight of acetone. The amount of solvent used is not critical, but excess solvent should be avoided as uneconomical. Such a solution has been found to have a high penetrating power and will thoroughly impregnate the fibrous material in the coil. Tests made on coils made in this manner have been found to have a very low hygroscopicity and high corrosion resistance and due to the high insulation resistance and low dielectric constant of the impregnated fibrous material, the material is excellently suited for insulating coils. For some purposes a coil made as described above may be dipped in a solution of cellulose acetate and oxidized abietic acid to provide a more elastic covering for the outside of the coil or it may be dipped in such a solution without previously dipping it in a solution of the oxidized abietic acid. It has been found that a solution of cellulose acetate in acetone by itself has poor impregnating properties since it in effect coats only the surface of the accessible fibers of the fibrous material However, when the cellulose acetate is mixed with a solution of an oxidized abietic acid in acetone, the cellulose acetate is dissolved, and the oxidized abietic acid serves as a carrier to carry the cellulose acetate into the fiber. The addition of the cellulose acetate to the oxidized abietic acid raises the melting point of the composition over that of the oxidized abietic acid alone and the composition containing the two ingredients is, therefore, more suitable for coils which are operated at high temperatures.

In preparing a solution of cellulose acetate and oxidized abietic acid, 100 parts of the oxidized abietic acid may be first dissolved in about 75 parts of acetone and 100 parts of cellulose acetate may be dissolved in 400 parts of acetone and the materials then mixed together, or an oxidized abietic acid may be added directly to a solution of cellulose acetate in acetone.

Preferably the cellulose acetate may constitute an amount equal to the amount of oxidized abietic acid, although these materials are soluble in all proportions. It appears that when less than 3% of oxidized abietic acid is used, the property of causing the cellulose acetate to penetrate fiber becomes negligible and when more than 95% of

oxidized abietic acid is used, the product becomes brittle and tends to flake.

Oxidized abietic acid alone is quite brittle and tends to become powdery when dry. However, a solution of this material with a cellulose ester makes a more plastic or less brittle material for many uses. This composition is thermoplastic and can be formed into sheets or articles in a mold under heat and pressure. The material can be prepared for molding by dissolving the ingredients in acetone, as previously described, evaporating the solvent, and pulverizing the residue into particles of suitable size. In preparing this material, a relatively viscous solution can be used to reduce the quantity of acetone required for the impregnating solution. It is also feasible to reduce this solution to sheets or molding slugs by evaporating the solvent from solution contained in forms of the proper contour. For other applications the cellulose ester and oxidized abietic acid may be mixed in powdered form, placed in a mold, and subjected to heat and pressure to consolidate the material and form a solid solution.

The oxidized abietic acid is characterized by its insolubility in petroleum hydrocarbons and turpentines; and, therefore, coils made as described above may be used where they come in contact with lubricating oils or transformer cooling oils without impairing the effectiveness of the insulation.

Fig. 2 illustrates a coil having a core 6 comprised of cellulose acetate or a phenol fiber condensation product faced with cellulose acetate. The coil is wound on the core in layers and the layers are separated from each other by sheets of fibrous material. After the coil has been wound, it is impregnated with a solution of oxidized abietic acid or the coil may be impregnated with a solution of oxidized abietic acid and cellulose acetate. After the coil is impregnated, heads 7 of cellulose acetate or phenol fiber faced with cellulose acetate are adhered to the core by applying a solution of cellulose acetate in acetone to the ends of the core and pressing the head against the core until the solvent dries. If it is desired to have a hermetically sealed coil, an outer sheet 8 may be applied to the coil. This sheet is made by impregnating a fibrous sheet 9 with an oxidized abietic acid or a solution of an oxidized abietic acid and cellulose acetate and then applying a sheet 11 of cellulose acetate to each face of the impregnated sheet 9. The cellulose acetate sheets may be adhered to the impregnated sheet 9 by subjecting the composite sheet to heat and pressure to plasticize the cellulose acetate and mold it integral with the impregnated fibrous sheet. This procedure insures thorough impregnation of the fibrous material so that when the sheet is cut, it will not expose the raw or unimpregnated fiber. In covering a coil, as shown in Fig. 2, a piece of this composite sheet is cut so that its edges will overlap when wound about the coil and the ends will abut the heads 7. A solution of cellulose acetate in acetone may then be applied between the overlapping edges and along the ends where they abut the heads to completely and hermetically seal the coil.

While the invention has been described in connection with particular embodiments thereof, it will be understood that many changes and modifications may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. An insulating material comprising a fibrous sheet impregnated with a composition of a cellulose derivative and an oxidized abietic acid, having a sheet of cellulose derivative adhered to one face thereof to form a composite sheet.

2. An insulating material comprising a fibrous sheet impregnated with a composition of cellulose acetate and oxidized abietic acid, having a sheet of cellulose acetate adhered to one face thereof to form a composite sheet.

3. A method of making an insulating material which comprises impregnating a fibrous material with an abietic acid derivative and a cellulose derivative, applying a sheet of cellulose derivative to one face of the impregnated fibrous material, and adhering the cellulose derivative to the fibrous material with heat and pressure.

4. A method of making an insulating material which comprises impregnating a fibrous material with oxidized abietic acid and cellulose acetate, assembling a sheet of cellulose acetate to one face of the impregnated material, and applying heat and pressure to the assembly to form the cellulose acetate and impregnated material into a composite sheet.

5. An insulating material comprising a fibrous sheet impregnated with a cellulose derivative and an abietic acid derivative, and a sheet of cellulose derivative adhered to one face thereof to form a composite sheet.

6. An insulating material comprising a fibrous sheet impregnated with cellulose acetate and an abietic acid derivative, and a sheet of cellulose acetate adhered to one face thereof to form a composite sheet.

RAYMOND P. LUTZ.