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IMPREGNATION OF INSULATING MATERIALS

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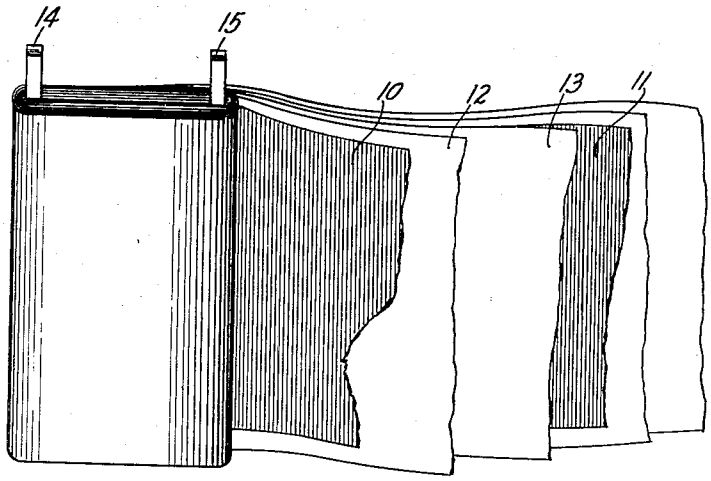

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IMPREGNATION OF INSULATING MATERIALS

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4 Claims. (Cl. 91—70)

This invention relates to insulating materials and more particularly to a process for impregnating insulating materials to improve their electrical characteristics.

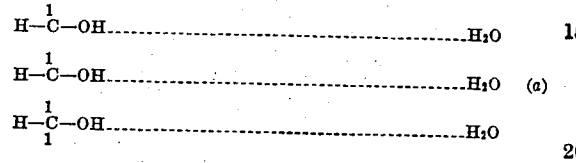
When a cellulose material such as paper is used for insulating purposes as for example in condensers or in electric cables, it is customary to impregnate the paper with a suitable insulating compound to improve its electrical characteristics. Heretofore it has been a common practice to remove the moisture from the paper immediately before impregnation as for example by subjecting the paper to a high temperature. In certain instances, however, it was found that the dielectric strength of paper treated in this manner was not sufficiently high.

The object of the present invention is to improve the electrical characteristics of cellulose insulating materials such as paper.

In accordance with the present invention this object is attained by impregnating such materials with an insulated compound composed in substantial part of suitable polar molecules while the cellulose molecules of the paper are in an active condition.

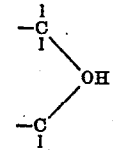
For a clearer understanding of this invention reference may be had to the following detailed description and accompanying drawing showing a condenser which is a piece of apparatus to which this invention is particularly applicable.

As shown by the drawing this condenser consists of two sheets 10 and 11 of metal foil separated from each other by sheets 12 and 13 of a suitable insulating material such as paper. Metallic terminals 14 and 15 secured to sheets 10 and 11 respectively serve to make external electrical connection. In the preferred embodiment of this invention these sheets are wound and the unit thus formed is subjected to a preliminary pressing to obtain the desired shape after which the unit is subjected to vapors such as the vapors of water or alcohol at temperatures which may vary between 50° and 150° C. and it is then immediately placed in a suitable vacuum tank containing an impregnating compound which is maintained at substantially the same temperature as the vapors and which consists in a substantial part of polar molecules. Chlorinated naphthalene commonly known as halowax has been found suitable and is preferably employed as the impregnating compound in this process. After the unit is submerged in the impregnating compound the vapor molecules are removed and the active forces which result attract the polar molecules thus producing a firm bond between the cellulose molecules and the impregnating compound. After impregnation the unit is removed from the tank and again pressed to remove the excess impregnating compound after which it is sealed in a suitable container by any of the standard potting compounds. The theory as to how a firm bond is established between the cellulose molecules and the impregnating compound is believed to be as follows: The cellulose molecules of the pulp from which the paper is made contain several hydroxyl groups, a few of which may be represented as follows for the purpose of illustration:



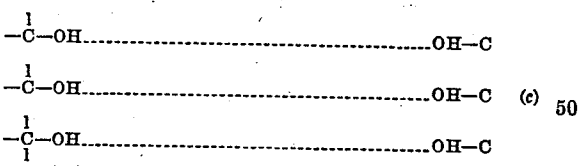
(a)

Residual forces, shown by the dotted lines, are associated with these hydroxyl groups and serve to hold a part of the absorbed moisture. During the manufacture of the paper, for example, when the pulp is rolled into sheets, the cellulose molecules are subjected to high temperatures and the absorbed moisture is thus removed. Under such conditions the cellulose molecules rearrange themselves due to their high mobility at high temperatures and during this rearrangement these residual forces satisfy one another. This rearrangement for the purpose of illustration may be as represented at (b) where the hydroxyl groups are near one another;



(b)

or as at (c) where the hydroxyl groups are farthest away from one another and form a part of a second molecule;



(c)

If the paper, while the molecules are in form (b) or (c), is placed, as is ordinarily the practice in

a vacuum tank in the presence of the impregnating compound, there would be no residual or active forces available hence the impregnating compound would be loosely held in the pores and on the surface of the paper. However, when the paper is exposed to the vapors at temperatures which may vary from 50° C. to 150° C. in accordance with the present invention, the cellulose molecules are reconverted to form (*a*), hence, when the unit is placed in the vacuum tank in the presence of the impregnating compound and the absorbed vapors are removed, there are residual or active forces available which attract the polar molecules thus producing a firm bond between the paper and the impregnating compound.

In another embodiment of this invention the unit after the preliminary pressing is exposed to similar vapors at temperatures which may be between 50° C. and 150° C. and the vapor is then removed at relatively low temperatures after which the unit is immersed in a bath of a similar impregnating compound. After impregnation the unit is again pressed to remove the excess impregnating compound and then sealed in a container. In this embodiment when the unit is exposed to the vapors at these elevated temperatures the molecules which are ordinarily in form (*b*) or (*c*) are reconverted to form (*a*). When the vapor is then removed from the cellulose molecules at relatively low temperatures the molecules are not sufficiently mobile for a rearrangement to take place, hence the residual forces remain active. This for the purpose of illustration may be represented as:

C—OH----------
C—OH---------- (*d*)
C—OH----------

When the unit is placed in an impregnating bath of chlorinated naphthalene its residual or active forces attract the polar molecules thus producing a firm bond between the paper and the impregnating compound.

While this invention has been described in connection with condensers, it is to be understood that it is equally applicable to other types of apparatus such as electric cables, transformers, etc.

What is claimed is:

1. The method of improving the electrical characteristics of a cellulose insulating material which consists in exposing said material to moisture at elevated temperatures within the range of 50° to 150° C., immediately immersing said material in a bath of chlorinated naphthalene, and then removing said moisture from said material at an elevated temperature.

2. The method of improving the insulating characteristics of a cellulose insulating material which consists in treating said material at a temperature of from 50 to 150° C. in the presence of moisture until the cellulose molecules thereof are in an unsatisfied condition and then placing said material in a bath of chlorinated naphthalene.

3. The method of improving the insulating characteristics of a cellulose insulating material which consists in treating said material at a temperature of from 50 to 150° C. in the presence of moisture until the cellulose molecules thereof are in an unsatisfied condition and then immediately impregnating said material with an insulating compound a substantial part of which comprises polar molecules.

4. The method of improving the electrical characteristics of a paper insulating material which consists in exposing said material to moisture in the form of alcohol vapors at temperatures of from 50 to 150° C., immediately immersing said material in a bath of chlorinated naphthalene, and then removing said moisture from said material by heating at said temperatures.

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