The present invention relates to electrical insulating material, and to the manufacture thereof.

The search for new and improved electrical insulating materials is a ceaseless one and while materials of progressively improved insulating characteristics are constantly being developed, there is still room for improvement.

It has already been suggested to use acetylated cotton fabrics as a base in laminated electrical materials, but according to the present invention it has now been found that by using fibrous acetylated sheets, like acetylated paper, instead, an improvement of the dielectric properties of the laminate formed with thermo-setting resins is achieved.

It has further been proposed to realize the desirable paper-like structure of electrical insulation by using acetylated paper in lieu of acetylated cotton fabric for this purpose. Moreover, in order further to enhance the dielectric properties of the acetylated paper, it has been proposed to impregnate the latter with thermoplastic resins, such for example as polyethylene or these insulating materials still leave something to be desired.

A primary object of the present invention is the embodiment of an improved insulating material on a paper basis. A further object of the invention is the embodiment of an improved insulating material in the form of a laminate having a paper basis. Still another object of the invention is the embodiment of a resin-impregnated insulating structure of enhanced electrical insulating properties.

It has been found that the foregoing and other objects and advantages of the invention, as will be evident from the following detailed description thereof, are attained by the combination of acetylated paper with a thermo-setting resin.

The acetylated paper can be prepared from fibrous acetylated cellulose, as described for example in British Patent No. 525,265, or from ordinary pre-formed paper, as described for instance in British Patent No. 525,265.

Thermo-setting resins which can advantageously be used for impregnation of the acetylated paper, according to the present invention, are for example phenol-formaldehyde, cresol-formaldehyde, etc.

Laminates formed according to the present invention, by the heat-and-pressure curing of a number of layers of acetylated paper impregnated with thermo-setting resin, have an enhanced electrical insulation resistance, a reduced moisture absorption as compared with ordinary paper-base laminates, and undergo a greatly reduced swelling in water.

Not only is the acetylated paper, which is employed for the purposes of the present invention, cheaper and simpler to produce than, for instance, the acetylated cotton fabrics, but in addition it can be manufactured in thicknesses as small as 0.01 mm., which are of course not realizable with cotton fabrics. Furthermore, the physical properties and texture of the acetylated paper can be easily modified—to an extent which is not possible with acetylated cotton fabrics—in such a way that optimum bonding with the thermo-setting resin is achieved, with resultant production of laminates with exceptionally good dielectric properties.

The following example further explains and exemplifies the invention which, however, is not intended to be restricted thereto. The parts are by weight unless otherwise indicated, and the relationship between parts by weight and parts by volume is the same as that which exists between the kilogram and liter.

Example—100 parts by weight of cresol (45-55% meta); 90 parts by weight of formaldehyde (38%) and 4.5 parts of ammonia (25%) are heated together at 100° C. for 30 minutes. Vacuum distillation (25 mm. Hg) is then carried out until a temperature of 85° C. is reached.

A 60% solution in alcohol of the resin so formed is made and fibrous sheets acetylated to a combined acetic acid content of 35%, prepared from unbleached kraft paper, not calendered and with a density of 0.54 and a thickness of 4–5 mils, are coated in such a way that after drying at 115–120° C., they contain 55–50% resin.

Laminated electrical insulating materials are produced therefrom by treating a certain number of stacked coated sheets at 150° C. with a pressure of 150–300 atm. The electrical insulation resistance of such laminates is 100,000 MΩ whereas only 1000 MΩ are found for similar boards prepared from ordinary kraft paper.

It is manifest from the foregoing that “acetylated paper,” in the sense of the present invention, is paper consisting of cellulosic fibers which have been acetylated with retention of their physical structure.

Having thus disclosed the invention, what is claimed is:

1. Electrical insulating material consisting essentially of a heat-and-pressure consolidated laminate made up of a plurality of superposed sheets of acetylated paper, of which the original physical structure of the fibers has been retained,
3. Impregnated with and bonded together by a cured thermo-setting resin selected from the class consisting of phenol-formaldehyde resin and cresol-formaldehyde resin.

2. Electrical insulating material consisting essentially of a heat-and-pressure consolidated laminate made up of a plurality of superposed sheets of acetylated paper, of which the original physical structure of the fibers has been retained, impregnated with and bonded together by cured phenol-formaldehyde resin.

3. Electrical insulating material consisting essentially of a heat-and-pressure consolidated laminate made up of a plurality of superposed sheets of acetylated paper, of which the original physical structure of the fibers has been retained, impregnated with and bonded together by cured cresol-formaldehyde resin.

4. Electrical insulating material consisting essentially of a heat-and-pressure consolidated laminate made up of a plurality of superposed sheets of acetylated paper, of which the original physical structure of the fibers has been retained, impregnated with and bonded together by a cured thermo-setting resin selected from the class consisting of phenol-formaldehyde resin and cresol-formaldehyde resin, the said sheets being of a thickness of approximately 0.01 mm.

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WERNER HAGENBUCHE.

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