106. COMPOSITIONS,
COATING OR PLASTIC

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ELECTRICAL INSULATION MATERIAL

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The present invention relates to electrical insulation material. It is concerned more particularly with the preparation of an arc- and moisture-resistant asbestos board which may be drilled and machined without damage to the tool and with practically no chipping or cracking of the board.

Asbestos board consists largely of asbestos bonded with a suitable inorganic binder such, for example, as Portland cement. Such a board, in the form of sheets ranging from about ⅛ to 2 inches in thickness, has wide use in the electrical industry, where it is employed chiefly as a switchboard panel material. Numerous holes must be drilled in these panels for wiring the switchboard. It is therefore highly desirable that the asbestos board permit ready drilling without excessive wear of the drill and with little or no chipping around the holes. Further, the board must withstand moisture and the action of an electrical arc.

Heretofore in making an arc- and moisture-resisting asbestos board, it has been common practice to impregnate the hardened board by immersion in a suitable oily or waxy impregnating agent, such as a hot mixture of carnauba and paraffin waxes, for from 2 to 4 days or more. Such a method is described more fully in, for instance, Groten Patent No. 2,049,370, which is assigned to the same assignee as the present invention. Asbestos boards impregnated in accordance with the Groten method have been satisfactory from the standpoint of arc and moisture resistance, but have not been wholly satisfactory with respect to drilling and machinability. Further, the method had the objection of requiring considerable time for impregnating the board with the wax mixture.

I have discovered that a dense, arc- and moisture-resistant high dielectric strength asbestos board, which is adapted to be readily and efficiently drilled, can be obtained by forming and hardening the board in the presence of, that is while intimately associated with, a high melting waxy or wax-like substance such, for example, as montan wax, carnauba wax, ozokerite, or similar material having a melting point of at least 150° F., and preferably melting above 160° F. More particularly it may be stated that I incorporate such a waxy material or mixture of waxes into a mass comprising hydraulic cement, asbestos and water. Thereafter a large part of the excess water is removed coincidentally with the shaping of the plastic mass, after which the shaped mass containing the dispersed wax is hardened. The cured or hardened product is sanded smooth. It may be used directly, or after being suitably painted or varnished, but in no case does it require immersion for a prolonged period in an impregnating agent as heretofore has been necessary.

In order that those skilled in the art better may understand how to carry the present invention into effect, the following more detailed description of the manufacture of a switchboard panel is given:

Suitable proportions of an inorganic fibrous material such as asbestos, hydraulic cement such as Portland cement, a wax of high melting point, preferably montan wax, and water are thoroughly mixed in a suitable mixing apparatus until a homogeneous mass has been obtained. Advantageously there is also incorporated into the mixture colloidal clay such as bentonite or colloidal kaolin. The addition of the colloidal material provides a denser asbestos board. It also has been found to be advantageous to add a small amount of graphite to the mixture. The graphite acts as a lubricant and facilitates molding of the material. Further, it improves the arc resistance and other electrical properties of the board. A convenient mixing technique is to mix thoroughly the cement, clay, wax and water, for instance for about 15 minutes. The asbestos is added and the whole mixed for an additional 15 minutes. Sufficient water is used so that a slurry-type mass results.

More particularly it may be stated that best results have been obtained with the use of the following components within the approximate limits stated:

	Parts by weight
Portland cement	12 to 18
Asbestos, preferably long fibre asbestos	7 to 11
High melting wax, preferably 100/up mesh montan wax	¼ to 2
Colloidal clay	Up to 7
Graphite	Up to 1
Water sufficient to form a slurry.	

Preferably colloidal clay is used within the limits of 3 to 7 parts and graphite, within the limits of 0.5 to 1 part.

In molding the mixed ingredients a screen of approximately 20 mesh size is placed in the bottom of the mold, the material is flowed thereon, and another screen of approximately the same size is placed on top of the wet mass. Upon the application of pressure the water is freed from the mass, flowing out from a suitable opening in

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the bottom of the mold, and also from the top of the mold between the punch and the jacket. By using screens in the manner described, the larger part of the excess water is readily removed from the mass. If water be allowed to remain in the panel, the finished board has poor impact and flexural strength characteristics. On the other hand, it is very desirable to have an excess of water in the mix as it is introduced into the mold. By so doing, the asbestos fibres are not knotted or broken during the molding operation. Instead, they form an interwoven mass which has been found to be essential in obtaining optimum mechanical strength.

The molded parts are air-dried for a suitable period, for instance for about 4 to 5 hours. Thereafter they are placed in an oven in which steam is constantly introduced. The panels are cured in this oven for a suitable period, for example for about 24 hours. After the steam cure they are immersed in warm water (100° to 140° F.) for another suitable interval, for instance for about 24 hours. Following this treatment the panels are baked in a suitable oven, such for example as an electrical oven, at a gradually rising temperature up to approximately 500° F. over a period of, for instance, about 12 hours. All the uncombined water is removed from the panels by this baking treatment, and the components are bonded together to form a hard, rigid mass. The baked panels are sanded to a smooth finish, after which they usually are sprayed or otherwise coated with a suitable lacquer or varnish.

By incorporating a high melting wax such as montan wax or the like into an asbestos-cement composition in the manner described, the wax does not melt until the cement has more completely reacted (set up) in the steam-curing oven. During curing, the dispersed wax melts and coats the individual particles of the mass with a wax film. Thorough coating of the particles with the wax is further assured by the oven-baking treatment. The ultimate result of this wax coating of the particles is to improve the water resistance of the finished board. In addition, the presence of the wax surprisingly improves the drilling and machining properties of the finished panel. For example, when effort was made to drill a wax-free board with an ordinary ¼-inch drill, the drill was rounded over at the point and was completely worn out without drilling through the board. In contrast therewith, an asbestos board containing approximately 4 per cent, by weight of the whole, of montan wax could be readily drilled without burning or otherwise injuring the drill and with practically no chipping around the drilled holes. The finished panels, in general, have a dielectric strength of the order of 45 to 55 volts per mil. Further, the material shows no surface carbonization under the influence of an electrical arc, so that during service use there is no material depreciation of its insulation value. Representative samples of panels (2" x 2" x 1") absorbed only about 0.5 to 1.1 per cent water when immersed in water for 24 hours, and only about 0.9 to 1.5 per cent when immersed for 48 hours. The average Brinell hardness, under a 500 kilogram load applied for 10 seconds, generally ranges from about 20 to 27. The average transverse strength usually is about 4000 to 5000 pounds, or more, per square inch.

While I have described my invention with particular reference to the formation and hardening of an asbestos-cement composition in the presence of a high melting waxy or wax-like material, it is to be understood that other equivalent materials may be used. For example, in lieu of all or a part of such high melting waxes, natural gums or resins, or synthetic resins, capable of improving the drilling and machining properties of an asbestos-cement composition in cured state, may be employed.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electrical insulation material having dispersed therethrough a waxy substance having a melting point of at least 150° F., said insulation material consisting of the pressed and hardened product of a mass comprising asbestos, hydraulic cement, water and the said waxy substance dispersed throughout the said mass, said dispersed waxy substance serving to render the said insulation material capable of being drilled without chipping.

2. A moisture-resisting switch-board panel capable of being drilled without chipping and having dispersed therethrough a wax having a melting point of at least 150° F., said panel comprising the product obtained by dehydrating and hardening a slurry comprising water carrying particles of asbestos, Portland cement, a colloidal clay and a wax having a melting point of at least 150° F. dispersed throughout the said slurry.

3. A moisture- and arc-resistant electrical insulation material especially adapted to be drilled without chipping around the resulting hole, said material having montan wax dispersed therethrough and being the pressed and hardened product of

	Parts by weight
Portland cement	12 to 18
Asbestos	7 to 11
Montan wax	¼ to 2
Colloidal clay	Up to 7
Graphite	Up to 1

Water sufficient to form a slurry.

4. The method of improving the drilling and machining characteristics of an electrical insulation material consisting of a shaped, hardened mass comprising asbestos bonded with hydraulic cement which consists in bonding the said materials while a wax having a melting point of at least 150° F. is dispersed throughout the plastic mass comprising asbestos and hydraulic cement.

5. A method as in claim 4 wherein the wax is montan wax.

6. The method of preparing a high dielectric strength, moisture-resisting insulating material capable of being drilled without chipping, said method comprising forming a mixture of

	Parts by weight
Portland cement	12 to 18
Asbestos	7 to 11
Montan wax	¼ to 2
Colloidal clay	Up to 7
Graphite	Up to 1

Water sufficient to form a slurry,

removing the larger part of the water from the said mixture coincidentally with the shaping of the mass, air-drying the shaped mass, steam-curing the air-dried mass, soaking the steam-cured mass in warm water, and baking the water-soaked mass at a gradually rising temperature up to approximately 500° F. until substantially all the uncombined water has been removed and the components have been bonded together into a hard, rigid mass.

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