July 20, 1948. H. R. ANDERSON 2,445,415

INSULATING BOARD AND METHOD OF MAKING THE SAME

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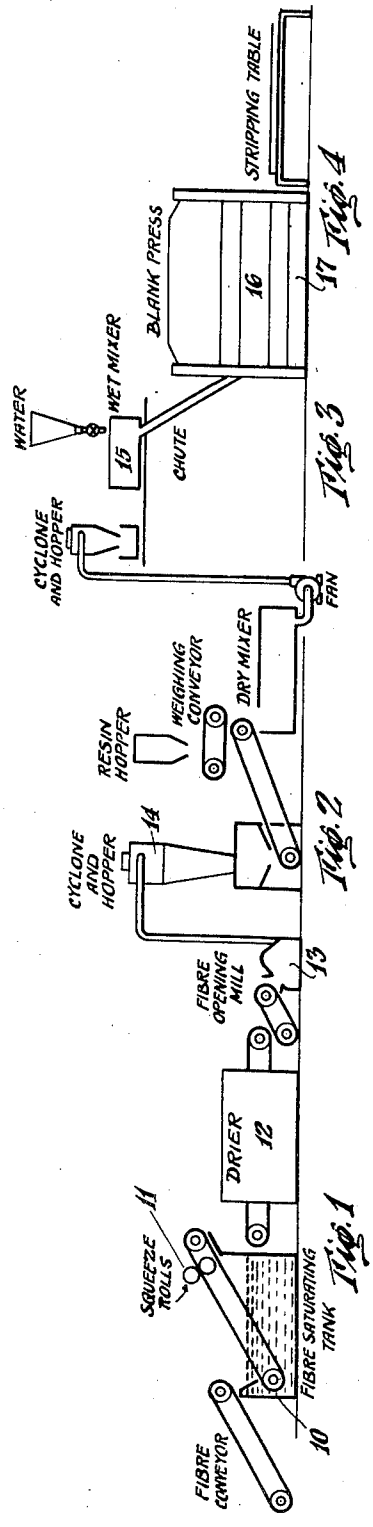


Fig. 1

Fig. 2

Fig. 3

Fig. 4

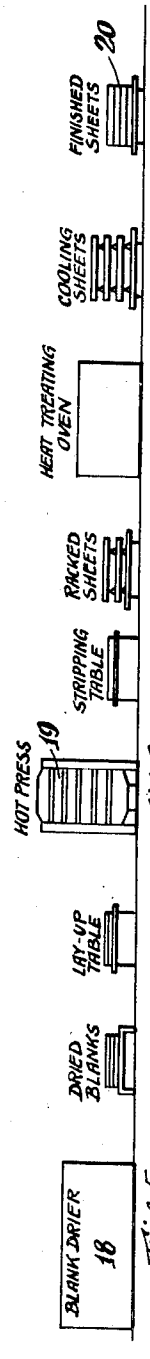


Fig. 6

Fig. 5

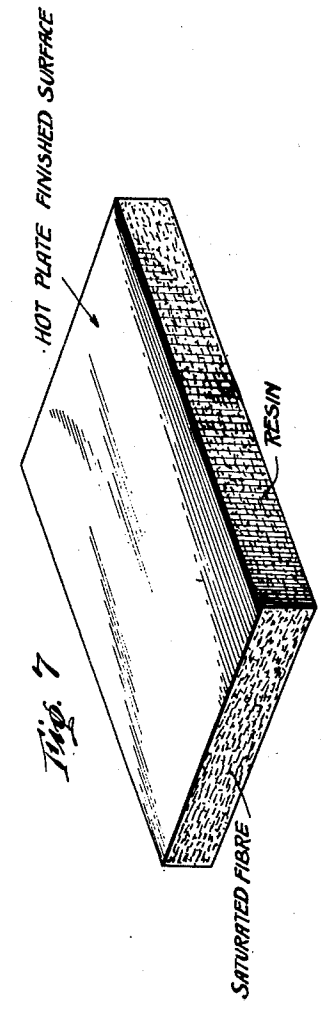


Fig. 7

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INSULATING BOARD AND METHOD OF MAKING THE SAME

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This invention relates to panel boards and particularly to panel boards for electrical apparatus.

The object of this invention is to provide a homogeneous electrical insulation board of economical manufacture, low water absorption, high dielectric strength, high impact strength and high transverse strength.

A further object of the invention is the provision of a resin bonded composition such that it may be formed in large blanks and then cured by hot pressing without the use of a special die or mold and under relatively low pressures.

Figs. 1 to 6 are diagrams illustrating successive steps in the process of formation of the insulation board of this invention; and

Fig. 7 is a perspective view of the board.

In carrying out this process inorganic fibres, preferably asbestos fibres of the chrysotile, crocidolite or amosite variety are used. Chrysotile fibres give good results and are therefore preferred. Different lengths and grades may be used, but I prefer a medium grade such as 4K. This fibre is opened by passing through an Ammann mill or other fiberizing equipment and then over a magnetic separator to remove from the fibre magnetic iron or iron of contamination. The fibre thus opened is saturated with a waterproofing agent such as a cut-back bitumen 10 as illustrated in Fig. 1 to waterproof the fibre. This is preferably done by passing the fibre through a bath 10 of cut-back and then removing the excess cut-back by passing the soaked fibre between squeeze rolls 11.

A cut-back composed of 140 degree Fahrenheit ring and ball melting point unblown petroleum asphalt is preferred and a mineral solvent in the ratio of one pound of asphalt to five gallons of solvent. The cut-back retained by the fibre is preferably such that 10 to 12 pounds of asphalt per 100 pounds of fibre remain. Waterproofing materials other than asphalts may be used for waterproofing and also for the purpose of increasing the electrical characteristics of the finished board.

The solvent to be used for the cut-back depends on the ease with which it is desired to later remove the solvent from the saturated fibre. For instance, if fire hazards will not be too great for the saturating and drying operations, a solvent with an end point of 200 degrees Fahrenheit would be desirable. This treated fibre is then dried by any suitable means that will substantially remove the solvent preferably in a vacuum drier 12 (Fig. 1) at about 28 inches of vacuum and a temperature of about 30 pounds of

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steam since such drying provides good recovery of the solvent as well as rapid drying. This treated and dried fibre is then passed through a mill to open or fluff the fibre without substantially reducing the length.

The treated fibre thus fluffed is then dry mixed with a powdered thermosetting resin, as for example a phenol formaldehyde resin such as Bakelite Resinoid BR8789 or Bakelite XR13672 in proportions of 10 to 30 parts of resin to 70 to 90 parts of treated fibre on the weight basis. The proportions used will be based on the fibre length and the particular physical properties desired in the finished board. The treated fibre and resin are thoroughly dry mixed by passing through a paddle mixer 13 (Fig. 2) and then through a fan 14 with both ingredients in the dry state. This dry mix, in an amount sufficient to give the desired quantity of material in the finished board, is then mixed with water, containing a small amount of wetting agent such as Aerosol OS, to a slurry in a paddle mixer 15 (Fig. 3) until all fibres have been made wet, the water being, for instance, in proportion of ten to one by weight. This slurry is then pressed to a solid blank form in a mold 16 (Fig. 4) having its lower surface of a screen or perforated sheet material 17 to permit the water to be substantially removed under pressure of 1000 to 3000 pounds per square inch.

The blank is then removed from the mold and placed in a drier, preferably a vacuum drier 18 (Fig. 5) at a temperature of 120 to 130 degrees Fahrenheit and about 28 inches of vacuum to remove any remaining water. It is essential that the blank be dried at a low temperature to prevent the resin from setting prior to hot pressing. The blank is then hot pressed in a platen press (Fig. 6) between polished cauls 19 at a temperature of 320 to 340 degrees Fahrenheit at 500 to 1500 pounds per square inch, preferably at about 750 pounds per square inch, with the time of hot pressing being dependent on the thickness of the finished board. No die or mold is required for hot pressing and the hot pressing may be carried out at the relatively low pressures above referred to. Heat for the hot pressing may be supplied by the use of high frequency electrical heating methods.

By controlling the amount of materials placed in the blank, and the hot pressing temperature and pressure, the section removed from the hot press will be substantially of the desired thickness. Where the blank mold is not of sufficient slurry capacity to give a blank which will hot press to the desired thickness, thicker sheets may

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be made from two or more blanks by dusting the blanks slightly with powdered resin, placing together between polished cauls and hot pressing. It will be understood that considerable compacting and increase in density occurs during the process of hot pressing.

Following the hot pressing it is desirable to place the boards in an oven for further heating to complete the curing of the resin and to remove any entrapped vapors or gases such as may be given off during the setting of the resin or that may not have been completely removed from the treated fibre. For instance, I prefer to heat the board in an oven at 300 to 325 degrees Fahrenheit for 4 to 5 hours. The electrical properties of the board are considerably improved by this heating. The boards are then removed from the oven and are allowed to cool.

The edges of the sheet are then trimmed dry or if the edges are to be trimmed on a wet saw, the trimming is preferably done before the sheets receive the heat treatment. Since the sheets are substantially of the desired thickness as removed from the hot press, no further finishing operations are required unless a substantially black sheet is desired. Such a finish may be obtained by lightly sanding, glazing, polishing and lacquering with a material such as switchboard lacquer.

Physical characteristics of a board 20 (Fig. 7) made by this process having 20 per cent resin and 80 per cent treated asbestos fibre were as follows:

Charpy impact—unnotched—foot pounds per inch of width	8
Transverse strength — pounds per square inch	12,000
Water absorption—3 by ½ by ½ inch sample 48 hour immersion at 72 degrees Fahrenheit, per cent	0.50
Density—pounds per cubic inch	0.068
Dielectric strength—½ inch thick sample. Parallel to direction of molding—volts per mil	75
Perpendicular to direction of molding—volts per mil	50

Usually a single thickness of the panel without combining thicknesses after pressing will be in the neighborhood of ⅛ inch to one inch, and these thicknesses may be built up to desired accumulation, to thicknesses as much for instance as 4 inches. The material is homogeneous with a very thorough impregnation of the fibres with the resinous binder and with a very strong bond between the fibres consolidating the mass which is uniform and strong in all directions.

A standard impact test specimen of the resulting board withstands 15,000 to 20,000 blows of 2.67 foot-pounds each and it is believed that the asbestos fibre thus treated with a waterproofing agent gives a thorough meshing and interlocking of the individual fibres in the compressed mass and that the contact of the fibres in the hot pressed board is so intimate and uniform as to build up a very high resistance to impact. The preimpregnation of the fibres provides a very tightly knit product free of voids and homogeneous and of equal strength and resistance throughout.

The insulating panel of this invention is therefore advantageous in being strong, durable and of high dielectric strength. The thickness may be accurately predetermined and controlled and thin laminated structures are dispensed with, thus avoiding weakness in direction parallel with such laminations.

While the invention has been described in connection with a specific example, it is not limited thereto, but is intended to cover such variations as are equivalent in structure and function.

I claim:

1. The method of forming an insulating board or slab comprising the steps of opening asbestos fibers, permeating said opened asbestos fibers with a water-proofing agent in a solvent bath, drying said permeated asbestos fibers to remove said solvent and leave thin water-proofing films encasing the fibrils of said fibers, mixing said encased water-proofed fibers with dry thermosetting resin particles, working said mixture into a water slurry emulsion employing an excess of water, then pressing the slurry with the resin particles dispersed through the fibers to a solid blank form in a mold to substantially remove excess water and then drying said blank so molded in final form, and then pressing and heating said dried blank to give a substantially finished board.

2. A method of forming an insulating board or slab as set forth in claim 1 in which the asbestos fibers are water-proofed by saturating them in asphalt in a solvent and then drying the saturated fibers to remove the solvent.

3. An insulating board or slab produced by the method as set forth in claim 1 and composed of 55–85% asbestos fibers individually impregnated with 5–15% waterproofing agent permeating said fibers so as to form a thin coat on the individual fibrils of said fibers and 10–30% thermosetting resin intermixed with the impregnated fibers as a deposit over the waterproof coatings and set in this form to bind the mass into a solid, strong body having a Charpy impact resistance of the order of 8 foot-pounds or more per inch of width and a water absorption of the order of 1% or less.

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