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MANUFACTURE OF INSULATING MATERIAL

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1 Claim. (Cl. 25—156)

This invention relates to the manufacture of micaceous insulating materials of the kind which are formed by mixing low fusing point vitreous material with powdered mica and heating the mixture so that the mica is bonded to the vitreous material at a temperature below the point of total dehydration. Such materials and their manufacture are described, for example, in U. S. Patents Nos. 1,795,200, granted Mar. 3, 1931, and 2,032,239, granted Feb. 25, 1936, and they are at present denoted by the registered trade-mark "Mycalex."

The object of the present invention is to provide improvements in the process of manufacturing insulating materials of the kind above referred to, such improvements being designed to ensure a product wherein the structure and physical characteristics are uniform throughout each unit manufactured.

According to the invention a method of manufacturing a vitreous insulating material is provided which consists in mixing ground mica with ground ceramic materials, in cold pressing the mixture, in drying the pressed sheets or blocks, in subjecting the dried sheets or blocks to a gradual rise in temperature in a furnace and in cooling or moulding the heat treated material.

In carrying the invention into effect and in the preferred manner, the ceramic ingredients employed in the manufacture of the improved vitreous material consist of cryolite, barium carbonate, potassium carbonate, soda ash and boric acid, the preferred proportions being by weight as follows:

	Per cent
Cryolite, $3\text{NaF} \cdot \text{AlF}_3$	20
Barium carbonate, BaCO_3	10
Potassium carbonate, K_2CO_3	13
Soda ash, Na_2CO_3	9
Boric acid, H_3BO_3	48

Alternatively the above ingredients may be varied by including a small proportion of felspar, not exceeding 5% by weight.

These materials are first ground to a fine powder, and after grinding and thoroughly mixing, these materials are passed through a drying furnace in which a temperature of 500°C . is maintained until a white glass frit is formed.

The mica product is ground, care being taken in grinding that the particle size is consistent and whilst the ground product should be capable of passing a mesh of 100×100 per square inch, the particles should not be smaller than this, as otherwise the finished product is apt to dis-

integrate under heat, with a corresponding loss in di-electric properties. The frit is also ground to the same degree as the mica and both are then mixed with a quantity of heat treated "Mycalex" the preferred proportions of the mixture being as follows:

	Per cent
Mica	52
Frit	35
Mycalex	13

These materials in a cold dry state are mixed for about five minutes, followed by a further period of mixing of about 10 minutes, during which 8% by volume of water is sprayed upon the powders being mixed.

When the mixing machine is emptied, the resulting mixture is found to be warm whilst small balls of one or other of the ingredients are found to form during the mixing process. In order to break down these balls and form a homogeneous mixture the mixed powders are pressed through a sieve of .5 mm. mesh and the mixture is also allowed to cool by this procedure in readiness for the pressing operation which follows.

The pressing of the mixture of mica, Mycalex and frit is carried out as a cold process, the mould cavity being filled with the desired amount of powder according to the size and thickness of the billet or other article to be pressed.

In order that air pockets do not remain after the pressing operation, the operator kneads and stirs the powder in the mould cavity with extended fingers until satisfied that the powder is evenly distributed over the area of the said cavity. The base of the mould cavity and the top of the charge of powder are preferably covered, before pressure is applied, with sheets of paper in order to overcome the suction effect produced when the platens of the press are parted, thereby preventing the laminae of the completed billet being drawn apart. Pressure is applied to the powder at approximately $1\frac{1}{2}$ tons per square inch and produces solid billets which are placed in racks to dry over a period up to seven days, this drying period being essential, as if placed in a furnace while still in a damp condition, blisters are liable to form on the surfaces of the billet as the result of the heat treatment which blisters crack and open to expose the laminae to oxidation instead of forming a homogeneous mass.

The operation of cold pressing is carried out slowly so as to expel air gradually from the mass of powder being pressed and it has been found

in practice that a pressure dwell is desirable of from 3-4 minutes for each quarter inch in thickness of the completed pressed billet.

The dried billets are finally passed through a furnace in which they are subjected to a gradual rise in temperature. In dealing with billets of from $\frac{1}{4}$ inch-2 inches in thickness, these are caused to travel slowly through the furnace in which the temperature gradually increases from the inlet over a travel of about 60 ft. up to 600° C. This slow increase of heat is necessary as when the frit is made, only a proportion of the volatiles contained in the original ingredients is driven off and in forming the final product these gases must escape before the outside edges and surfaces of the billet become sealed with an impervious glazing. It is essential, moreover, that these volatile constituents shall escape as otherwise blow holes are formed which, in the finished product, would interfere seriously with its mechanical strength and would prevent it being accurately worked into the variety of products which are made from this material.

The product of the heat treatment is subjected as it passes from the furnace to a final pressing operation but owing to the homogeneous nature of the articles produced by the cold pressing operation above described, the final pressing can now be effected at a lower pressure than formerly. For a sheet of half-an-inch in thickness, for example, the final hot pressing is carried out at a pressure of half a ton per square inch. In carrying out this hot pressing operation the pressure is applied to the billet and immediately released but the billet is allowed to cool in the mould with the upper ram of the press merely resting upon it so as to prevent buckling or distortion of the billet as it cools.

It is to be understood that the elements formed by cold pressing and completed by heat treatment have been referred to above as "billets" for

convenience only, as articles of any required shape can be preformed by the cold pressing operation. Further, the product of the heat treatment being in a plastic state can be cut into rods or bars or moulded into shape by the final hot pressing operation.

The method of manufacturing a vitreous insulating material above described ensures uniformity throughout each finished article to a far greater degree than has been possible hitherto. In the method according to the present invention the consistency obtained in the particle size of the ground materials, the breaking up of ball formations after the wet mixing operation, the steps described to prevent the formation of air pockets and of blisters or blow holes and finally the long drying period after the cold pressing operation are all factors which contribute towards a finished product which possesses throughout a uniform composition, texture and density. These properties enhance the usefulness of the vitreous material which can be applied wherever constancy in physical strength or in dielectric properties is essential.

I claim:

The method of manufacturing a vitreous insulating material which consists in mixing ground mica and ground ceramic materials, screening and cooling the mixture, kneading the mixture to prevent formation of air pockets, cold pressing the mixture by gradual application of pressure to expel air, drying the pressed product for a period prolonged sufficiently to remove dampness, subjecting the pressed and dried product to a gradually rising temperature to drive off volatiles before glazing of the product, hot pressing the resulting product by applying and immediately releasing the pressure, and allowing the product to cool while confined to prevent buckling or distortion thereof.

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