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Jan. 17, 1933. A. M. HERBSMAN 1,894,400

METHOD OF MAKING A MOLDED ARTICLE

Filed June 6, 1931

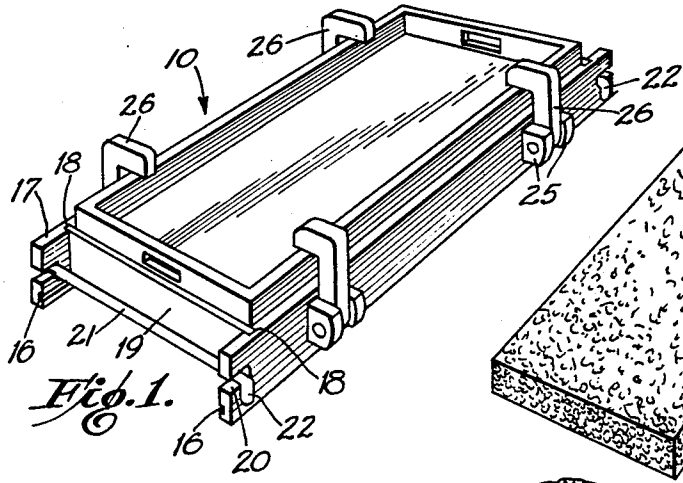


Fig. 1.

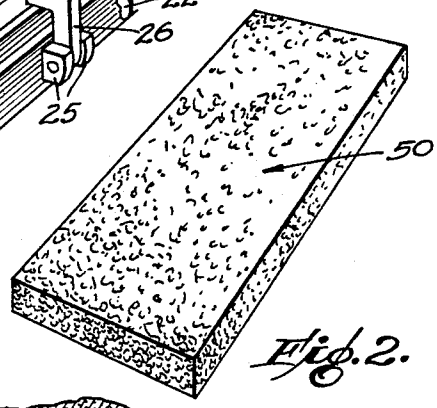


Fig. 2.

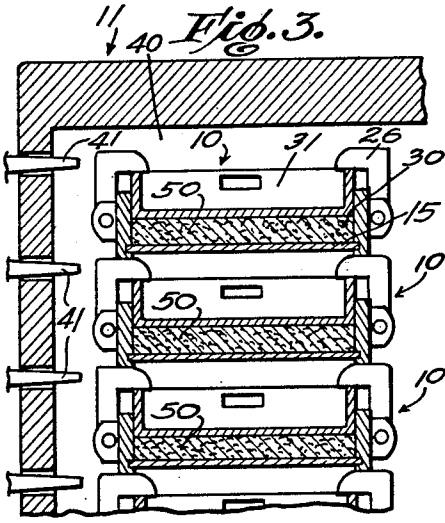


Fig. 3.

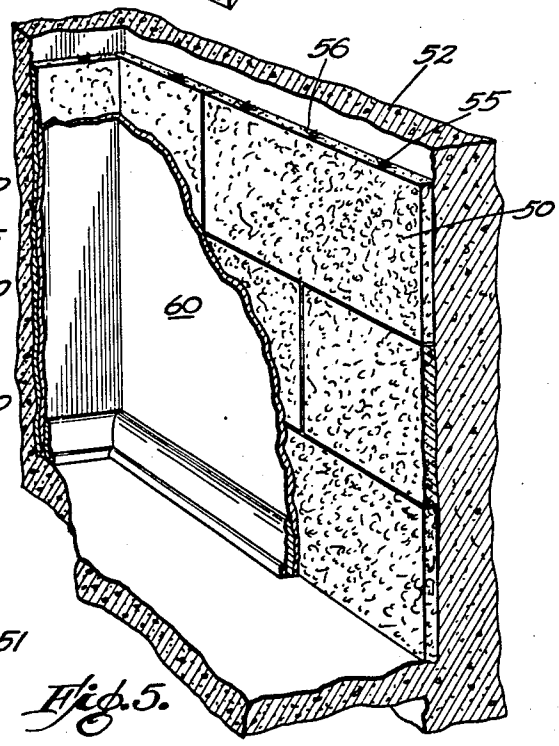


Fig. 5.

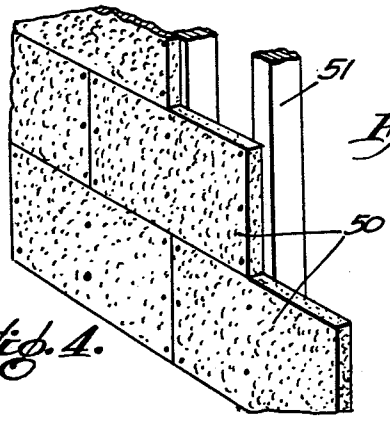


Fig. 4.

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UNITED STATES PATENT OFFICE

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METHOD OF MAKING A MOLDED ARTICLE

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This invention relates in general to molded articles and to methods of manufacturing these. Particularly, the invention relates to such articles as include a relatively non-adhesive aggregate, and a binder, which causes adjacent particles of the aggregate to adhere together. The invention also relates to methods of producing such a binder.

In molding articles of certain kinds of aggregate it has in the past been found difficult to form a binder which will hold fast in the presence of moisture.

It is accordingly an object of my invention to provide a binder having a broad application and which is water-proof.

There is a very large demand for materials having the qualities of insulating against electricity, heat, sound, or a combination of these. In a large measure this demand is met by insulating materials manufactured from minerals, and principally mica, asbestos and exfoliated vermiculite, the latter being known in the trade as Zonolite. These insulating materials are manufactured in various shapes by breaking up the mineral from which they are formed into small pieces or particles, mixing these pieces with a suitable binder, molding the mixture and permitting it to dry so that it will retain the shape given it in the mold. The binder most commonly used with these minerals has been sodium silicate, and one of the greatest difficulties with this binder has been that in the presence of moisture it loosens up and allows the insulating material to disentegrate.

It is accordingly another object of my invention to provide a suitable binder for use in the forming of insulating materials from natural insulating minerals, such as mica, asbestos and zonolite, which will be moisture-proof and accordingly cause these materials to retain their shape in the presence of water.

The recent development of the sound film industry has brought out the necessity for eliminating all extraneous sounds from the sound studios where the pictures are produced. To date one of the best sound insulating materials tried out for effecting this purpose has been slabs of zonolite which consist of an aggregate of exfoliated zonolite fragments held together in slab formation by a suitable binder. Hitherto no binder has been produced which will hold the zonolite together in the presence of moisture and yet give the maximum sound insulating effect which is possible with the zonolite. As much of this insulating material must be used in open air studios the need for such a binder has been pressing.

It is accordingly a further object of my invention to provide a method of binding zonolite particles together to form insulating material which will be moisture-proof and yet will not appreciably impair the insulating qualties of the zonolite.

The manner of accomplishing the foregoing objects, as well as further objects and advantages, will be made manifest in the following description, together with the accompanying drawing, in which:

Fig. 1 is a perspective view of a suitable mold for use in carrying out the method of my invention.

Fig. 2 is a perspective view of an insulating slab which the mold in Fig. 1 is adapted to form.

Fig. 3 is a diagrammatic fragmentary cross sectional view through a furnace used in carrying out the method of my invention.

Fig. 4 is a diagrammatic fragmentary perspective view illustrating the manner in which the wall of insulating slabs may be formed by nailing zonolite slabs shown in Fig. 2 onto wooden studs.

Fig. 5 is a fragmentary diagramatic perspective view illustrating the manner in which zonolite slabs, formed according to my invention, may be used as furring in a solid concrete wall construction.

Referring specifically to the drawing, the apparatus used in carrying out the method of my invention comprises a series of molds 10 and a furnace 11. Each of the molds 10 includes a bottom plate 15 which fits into a groove 16 formed in inner faces of side plates 17. The side plates also have grooves 18 which receive mold end plates 19. Formed in extending ends of the side bars 17 are bayonet slots 20 which are adapted to receive bars 21 having bent ends 22 which retain the

bottom plate, side bars and end bars of the mold in assembled relation. Formed outwardly on the side plates 17 are lugs 25 which hingedly carry top latches 26. When the parts thus described of the mold 10 are assembled together a molding chamber 30 is provided, side and end walls of which are disposed parallel. Adapted to extend down into the chamber 30 and make a reasonably tight fit therewith is a top 31. This top is adapted to be engaged by the latches 26 as shown in Fig. 1 so as to compress a body of material in the chamber 30.

The furnace 11 may be of any desired construction and provides a furnace chamber 40 into which a series of burners 41 inject burning fuel so as to maintain a temperature therein which is controllable. As shown in Fig. 3, the molds 10 are adapted to be stacked one upon another in the furnace 11 to be heated.

The method

While the method of my invention is adapted to be applied to the binding together of particles of any material which is sufficiently heat resistant to go through a heating process without change of form or composition, it is particularly adapted for the binding together of zonolite fragments in the forming of insulating materials. Accordingly, the following description of the method will cover the use of the method for this purpose.

Broadly stated, my method might be said to consist in the formation of an insoluble silicate in the open spaces between fragments of zonolite, pressed together, so that this silicate will adhere to the surfaces of the zonolite and cause the particles of the latter to be bound together in a unitary mass which will keep its form unimpaired by the presence of moisture. The method may be carried out by the use of several different combinations of chemicals, but the preferred manner of carrying out the method for the formation of zonolite slabs is as follows:

First, a mixture is made of the following ingredients:

	Parts by weight
Silicate of soda, 40° Bé	750
Iron or aluminum hydrate	25
Borax	100

This mixture may be termed the "binder mix" and is in turn mixed with 500 parts by weight of zonolite. Such a quantity of this final mix is put into each of the molds 10 as will form a slab 50 of zonolite when the top 31 of the mold is pressed downward thereon and locked in place by throwing the latches 26 upwardly. I have found that the best results are obtained when the quantity of final mix placed in the mold is such that when the top has thus been pressed down and latched a pressure of approximately one pound per square inch is placed on the mix.

When the molds have thus been filled they are stacked in the furnace 11 as shown in Fig. 3 and heated to a temperature of 700° to 900° F. for a period of about eight hours. At the end of this time the molds are removed from the furnace, allowed to cool, and then knocked down and the slabs 50 removed therefrom. The heating process through which the mixture is put, in forming the slabs 50, causes a chemical reaction between the silicate of soda and iron or aluminum hydrate so that an insoluble iron or aluminum silicate is formed which securely binds the particles of zonolite in the slab 50 together and which is not affected by water. The borax acts as a flux and facilitates the flowing of the insoluble silicate into intimate relation with the particles of zonolite, thus causing the zonolite particles to adhere tenaciously to each other.

Furthermore, the slab thus formed not only holds its form in the presence of water, but can be sawed and nailed incidental to building operations. In case an iron hydrate is used in the binder mix, the resulting binder has a chemical composition of a double compound of iron silicate and a boro iron silicate. Both of these compounds are insoluble in water.

While I prefer to use sodium silicate in the binder mix, it is to be understood that any soluble silicate may be used in this mix with an oxide or hydroxide or carbonate of manganese, iron or aluminum, as the essential result of the process, that is, the formation of suitable insoluble silicates, may be obtained by the substitute chemicals suggested as well as by those set forth in the preferred form of the method. In fact, it is not desired to be limited even to the substitute chemicals named above, as a certain measure of satisfactory results can be obtained by the use of many mineral oxides, hydrates or carbonates with a water soluble silicate in such a manner as to form an insoluble silicate binding the particles of zonolite into a solid mass.

It is to be understood that the proportions given and the conditions for carrying out the method of my invention are illustrative only, and various changes might be made in these without departing from the spirit of the invention or the scope of the appended claims.

For the purpose of illustrating the use of the slabs 50 I have shown in Fig. 4 a series of slabs 50 nailed onto studding 51 so as to serve as an acoustic insulating wall in a studio or serving as a general insulation and plaster base for a wall in a building.

Fig. 5 shows the use of slabs 50 as a furring for a concrete wall 52. In the example shown, the slabs 50 are provided with nails 55 which are secured as by wires 56 to the wall 52. When thus secured in place, the

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slabs 50 form an excellent furring against which plaster 60 may be applied, the plaster adhering tenaciously to the surface of the slabs 50 owing to the rough character of their faces.

It is to be noted that while certain uses of the insulating material produced by the method of my invention are illustrated in the drawing, this insulating material has wide application in industry. For instance, this material might be used in slabs, such as the slabs 50, or in special shapes molded for a particular purpose, to insulate refrigerators, refrigerating cars, or as a covering for hot water and steam pipes or for boiler surfaces and the like.

It is also desired to point out that this material might be manufactured in solid cakes and made into slabs or wall board by sawing, and the material thus formed could be trimmed down to shape by a planer in a similar manner as wood is shaped.

Another manner in which the mixture of zonolite and binder might be applied is where it is desired to make an unbroken cover of insulating material around an element such as a refrigerator or boiler, in which case the element to be covered would have the mixture of aggregate and binder plastered against the outer surface thereof. After the desired coating has been thus built up, it is heated in an oven, or by flame applied to its outer surface as by a blow torch, for a sufficient length of time to transform the binder mix into an insoluble silicate and thus complete performance of my method.

In the formation of continuous insulation in this manner it is sometimes advantageous to slag the outer surface of the insulating material by application of an acetylene torch thereto, which forms a black, hard coating over the entire outer surface of the insulating material.

From the foregoing description of a preferred form of the method of my invention, as well as a number of variations therein included in the invention, it will readily be seen that the term "molding" when used in defining the method of my invention is to be broadly construed so as to cover and include any application of force to the mass of aggregate to be bound together which will cause one or more surfaces of said mass to assume a desired conformation. It will be readily seen that this force may consist of the force of gravity of the mass itself which naturally causes it to conform to a surface upon which the mass is resting.

What I claim is:

1. A method of making a molded article which consists in mixing an aggregate of refractory material with a water soluble silicate, and a material capable of uniting with said soluble silicate to form an insoluble silicate, molding said mixture to a given shape, and heating the article thus molded to form said insoluble silicate and fuse this to unite the particles of said aggregate.

2. A method of making a molded article which consists in mixing an aggregate of refractory material with a flux, a water soluble silicate, and a compound capable of uniting with said soluble silicate to form an insoluble silicate, molding said mixture to a given shape, and heating the article thus molded to form said insoluble silicate and fuse this to unite the particles of said aggregate.

3. A method of making a molded article which consists in mixing an aggregate of refractory material with an alkali silicate, a water insoluble, oxide or hydroxide, and a flux, molding said mixture to a given shape, and heating the article thus molded to cause a combination between said silicate and said oxide or hydroxide to form an insoluble silicate which will bind the particles of said aggregate together.

4. A method as in claim 3 in which said alkali silacate is sodium silicate.

5. A method of making a molded article which consists in mixing an aggregate of refractory material with borax, a water soluble silicate, and a compound capable of uniting with said soluble silicate to form an insoluble silicate, molding said mixture to a given shape, and heating the article thus molded to form said insoluble silicate and fuse this to unite the particles of said aggregate.

6. A combination as in claim 3 in which borax is used as a flux.

7. A combination as in claim 3 in which said alkali silicate is sodium silicate and in which borax is used as a flux.

8. A method of making a molded article which consists in molding an aggregate under pressure and while said aggregate is thus molded producing in the interstices between adjacent particles of said aggregate a double compound of metallic silicate and a boro-metallic silicate so that these compounds adhere to said aggregate and bind the particles thereof together.

9. A method of making a molded article which consists in molding an aggregate under pressure and while said aggregate is thus molded producing in the interstices between adjacent particles of said aggregate a double compound of iron or aluminum silicate and a boro-metallic silicate so that these compounds adhere to said aggregate and bind the particles thereof together.

10. The method of making a molded article which consists in molding zonolite particles, and while said zonolite is thus molded, producing in the interstices between adjacent particles an insoluble silicate.

11. The method of making a molded article which consists in molding zonolite particles, and while said zonolite is thus molded,

producing in the interstices between adjacent particles an insoluble silicate and fusing said silicate so that this adheres to the various particles.

12. A method of making a molded article which consists in molding a mass of particles of a refractory material and producing among said particles a fused insoluble silicate.

13. A method of making a molded article which consists in molding a mass of particles of a refractory material and providing among said particles an insoluble silicate, the melting point of which is lower than that of said refractory material, and fusing said silicate.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 29th day of May, 1931.

ABRAHAM M. HERBSMAN.