Aug. 7, 1934. C. H. SCHUTTLER 1,969,156

HEAT INSULATING MATERIAL

Filed June 8, 1930 3 Sheets-Sheet 1

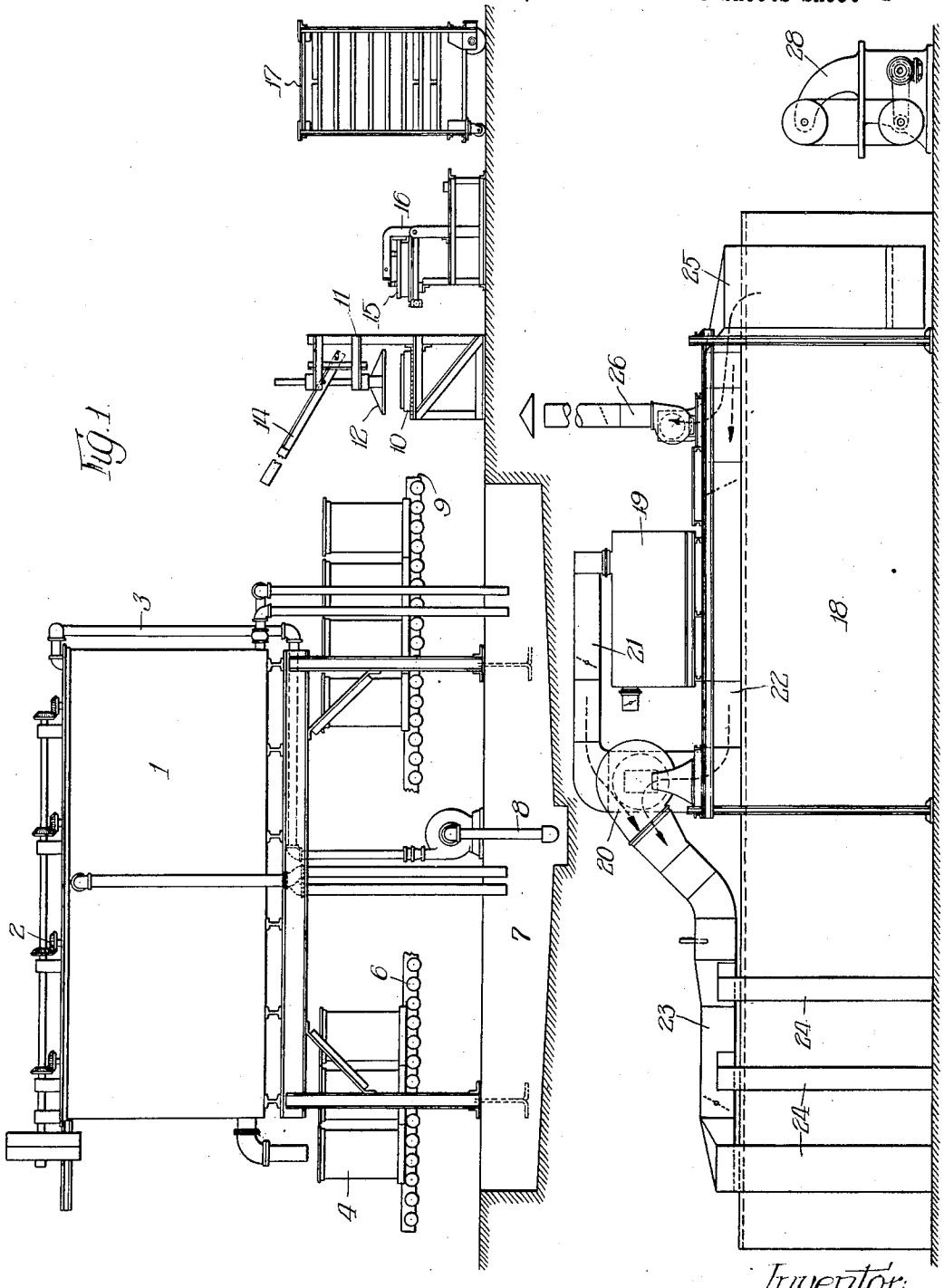


Fig. 1.

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HEAT INSULATING MATERIAL

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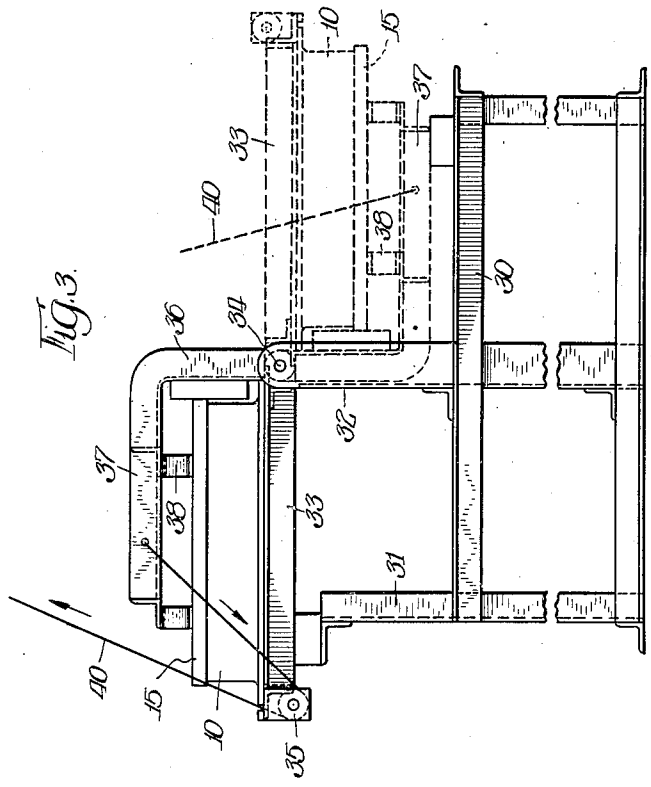


Fig. 3.

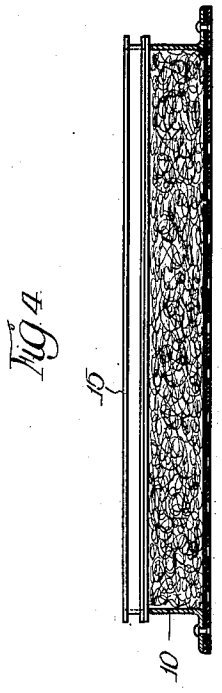


Fig. 4.

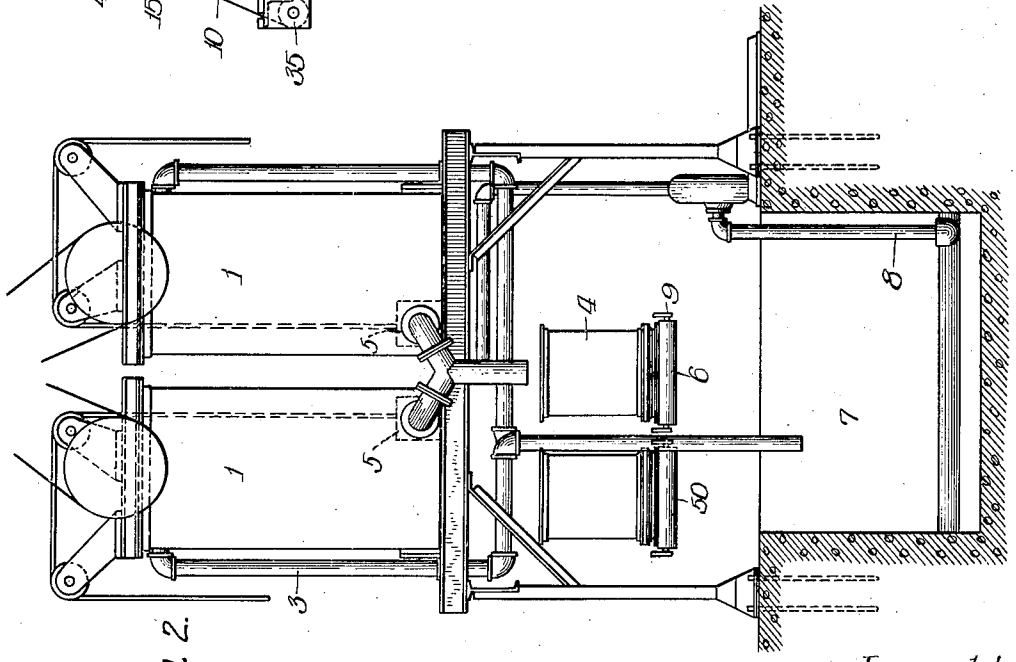


Fig. 2.

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HEAT INSULATING MATERIAL

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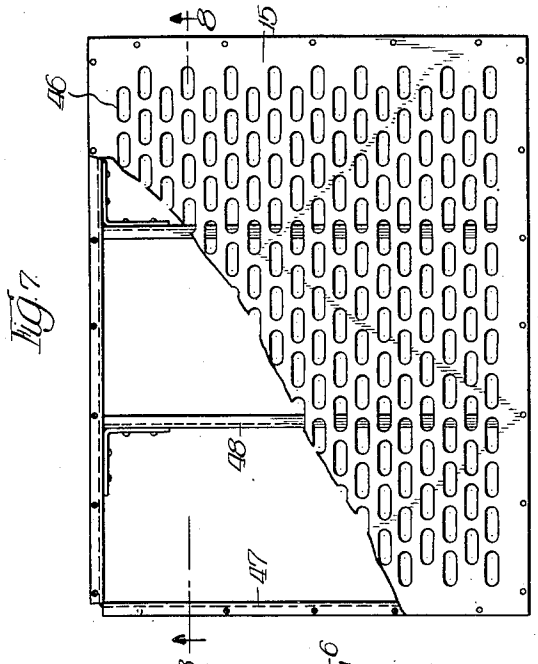


Fig. 7.

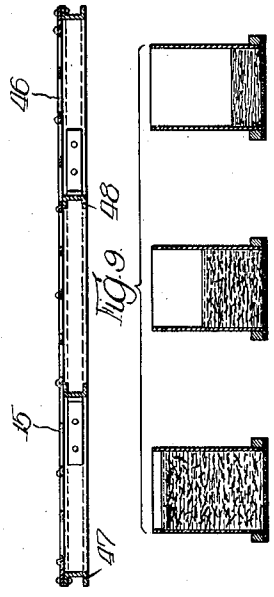


Fig. 8.

Fig. 9.

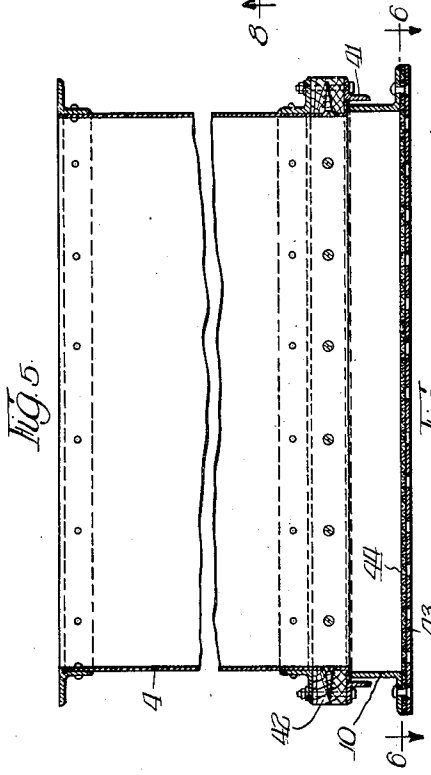


Fig. 5.

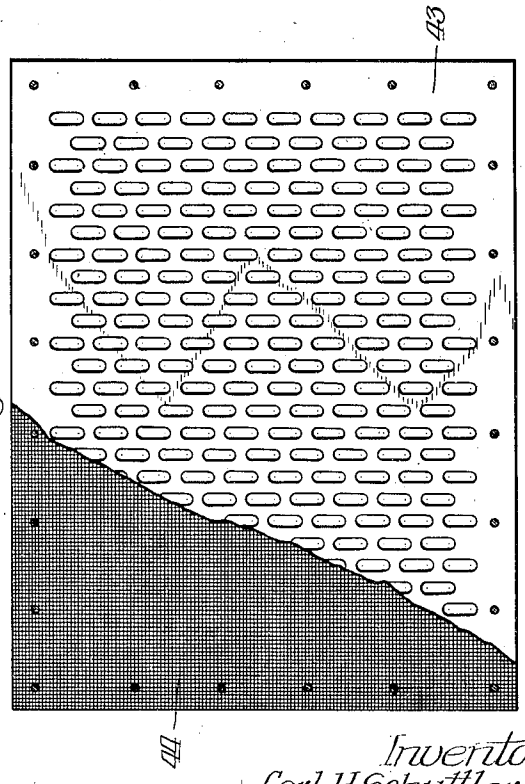


Fig. 6.

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UNITED STATES PATENT OFFICE

1,969,156

HEAT INSULATING MATERIAL

Carl H. Schuttler, Aurora, Ill.

Application January 8, 1930, Serial No. 419,246

12 Claims. (Cl. 92—21)

The invention relates to heat insulating material and more particularly to an improved process for making heat insulating blocks and a preferred form of apparatus for commercially carrying out the same.

One of the primary objects of the present invention is to provide a process for making insulating material which will result in a product having substantially an even distribution of the binder throughout and wherein any undesirable outer crust will be reduced to a minimum.

A further object of the present invention is to provide a process for making heat insulating blocks from mineral fibers, having the maximum heat insulating qualities, yet being light in weight and having strengh to resist moderate compression and shearing forces.

It is a yet further object to provide a novel form of apparatus for carrying out the above process which will be of simple construction and reliable and positive in operation.

With these and various other objects in view, the invention may consist of certain novel features of construction and operation, as will be more fully described and particularly pointed out in the specification, drawings and claims appended hereto.

In the drawings, which illustrate an embodiment of the device and wherein like reference characters are used to designate like parts—

Figure 1 is a complete lay-out of a plant showing the various apparatus required for carrying ing out the process constituting the present invention;

Figure 2 is an end elevation of the mixing tanks;

Figure 3 is a front elevation of the apparatus for depositing the contents of a can after settling has taken place upon the drying trays;

Figure 4 is a sectional view showing the removable bottom of a settling can with a drying tray forming the cover;

Figure 5 is a sectional view of the settling can showing the removable bottom in position;

Figure 6 is a sectional view taken on line 6—6 of Figure 5;

Figure 7 is a fragmentary sectional view of a drying tray;

Figure 8 is a sectional view on line 8—8 of Figure 7.

Figure 9 is a schematic illustration showing three stages during the settling of the contents within the cans.

The principal composition of heat insulating material is what is commonly known in the trade as mineral wool. Although the method of producing this wool is old and does not constitute any part of the present invention, it may be stated that commercially the wool is secured by melting down silicious slag or silicious rock and blowing a molten stream of the same by a blast of steam as it issues from an orifice. Extremely fine glass-like fibers are thus secured which, when cleaned to remove those undesirable particles known as shot, constitute mineral wool.

The first step in the present process is to mix a predetermined quantity of the mineral wool with a quantity of water solution in suitable mixing tanks such as 1, (see Figure 1) which tanks are provided with suitable agitators 2 and supply pipes 3. As a binding agent for securing the water solution for cementing the fibers together, various chemicals, either organic or inorganic may be used. Since organic matter carbonizes at high temperatures, its use in the production of heat insulating material is not satisfactory. The present invention contemplates the use of inorganic agents, and especially magnesium sulphate which produces a material resistant to extremely high temperatures. Water glass or sodium silicate furnishes a binder which is used when it is desired to secure a block having high crushing strength. Also, to secure the best results with insulating blocks when subject to the action of water, egg or blood albumin should be used as a binder, as this will produce a substantially water proof block.

The binder solution of proper density is prepared in advance and is stored in the sump tank. A sufficient quantity of the water solution is pumped from the sump tank to one of the mixing tanks, and then a proper quantity of the mineral wool fibers is added to the water solution. When the mineral wool fibers are added to the water solution, they are usually in a tangled condition. As the mixture is being agitated, the fibers have a tendency to open out to their natural degree of straightness and to separate into small tufts. If too much of the mineral wool is put into the mixing tank for one batch, then the individual fibers do not have enough space to open and separate as explained. Experience determines the proper amount of mineral wool to use in each mixing batch per cubic foot of water solution, so as to obtain the best mixing and settling results. Also, experience determines the quantity of soluble binder agent to be used per cubic foot of pure water, so as to give the proper degree of physical strength in the resulting mineral fiber block. When a batch is thoroughly mixed in the one

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mixing tank and is ready for pouring, then another batch is started in the second mixing tank.

The individual settling cans 4 are filled by operation of the valve 5. As each can is filled it is pushed along on the drain table 6 which is located above the sump tank 7 so that the excess water drains from the settling cans into the sump from which it is pumped by means of the pump as shown, into the mixing tanks through the pipe connections 8. When the cans 4 finally reach the end rollers as at 9, the excess water has substantially drained, leaving a plastic mixture of the wool in the bottom of the can. The upper part of the settling can is then removed leaving a bottom part 10 to be more fully described, which part is then placed upon the press 11 having press head 12 and lever 14. By operation of the press, the head 12 serves to remove still more of the water from the plastic mixture of wool, and also to press the mixture to a uniform density. The next operation is to remove the material from the bottom 10 and to deposit it upon the drying trays designated in their entirety at 15 (Figure 7), which operation is accomplished through a reversing machine 16 to be more fully described. In order to prevent the wet block from adhering to the drying tray, a sheet of heavy paper, preferably waxed or paraffined, is placed on the tray, which allows the block to be easily removed and entirely prevents the undesirable sticking of the material which generally takes place during the baking process.

To more fully appreciate the present process for making insulating blocks, it is necessary to understand the method of securing the stratified formation of the fibers, which results from the settling of the mixture in the cans. In Figure 9 the schematic diagram shows a can after it has been filled with the solution having the mineral wool in suspension from the tanks 1. The mineral fibers are shown in a diagrammatic way in the form of small bunches or tufts. As settling takes place and the solution drains, the tufts of fibers become more concentrated until at the end of the draining period the tufts of fibers are deposited one upon the other partly interlocked with each other to form the stratified formation that remains in the bottom of the cans. This layer-like building up of the wet mixture is found to give very desirable results to the insulating block, as the heat insulating qualities are increased by reason of the horizontal disposition of the fibrous material.

The elimination of the excessive outer crust and other desirable characteristics of the block produced by the present process results to a great extent from a carefully regulated method for driving off the moisture in the wet block and, at the same time, allowing an even distribution of the binder to take place. This drying process, as it is generally known, is conducted in an oven 18 of a size suitable for accommodating the drying trucks 17 containing a plurality of the trays 15 which have placed on them the wet blocks to be baked. The oven is provided with a heater 19 for maintaining a supply of heated air which is first supplied to the blower 20 through the conduit 21. This pressure blower draws a supply of hot air to mix with and heat the supply of moisture laden air coming from the conduit 22 to preferably a temperature of about 500° Fahrenheit and then forces the same through the conduit 23 and into the drying chamber by reason of the openings 24. The super-heated steam generated in this manner and the excess air in its passage through the chamber comes into direct contact with the wet blocks and passes out of the chamber through the conduit 25 reduced to a temperature slightly above 212° Fahrenheit. A certain amount of this saturated steam and air finds its way out through a ventilator 26 and is exhausted into the atmosphere. The remaining steam and air is again supplied to the pressure blower 20 through the conduit 22 where it is recharged with hot air from the heater 19. By reason of this continuous re-circulation and the fact that superheated steam with air is employed for drying the block in preference to heated dry air, results in the block being dried evenly with a consequent thorough distribution of the salt binder with a substantial elimination of the surface crust. The greatest disadvantage found in the use of heated dry air was that the surface of the block directly exposed was dried first, which resulted in the drawing of the solution from the interior to the surface with an excess deposit of the salt or other soluble matter and consequent formation of the undesirable crust.

The duration of the drying process, together with the regulation of the temperatures and steam air mixture must be determined by those familiar with the results that are desirable. The baking, however, is continued generally for a period determined by the desired results to be obtained, when the trucks are then taken from the oven and stored in the open to gradually cool. In shipping the blocks, various sizes are desired, and a conventional type of saw 28 is provided for cutting the large blocks into these desired sizes.

The reversing mechanism shown in detail in Figure 3 comprises a stand having a top 30 situated at the desired height above the floor. At the left side of the stand the supporting leg 31 extends above the top 30 to a height even with the main or central supporting member 32. A table member 33 is pivoted to the central support at 34 and is provided at its extreme outer end with a pulley 35. An upright arm 36 is also pivoted at 34 and has integrally connected thereto the horizontal arm 37. In order to understand the operation of the above mechanism, reference is made to Figure 4 wherein the bottom part 10 of the settling can is shown filled with the wet mixture of wool and covered with a drying tray. These trays are so constructed that the plate 15 having the perforations 46 therein is reinforced by the angle beams 47 extending around its periphery and by the interconnecting beams 48. As previously explained, a sheet of waxed paper is first placed over the mixture to facilitate subsequent removal of the block from the tray.

The bottom 10 having the tray 15 thereon is placed on the table 33 and the parts are maintained in contact by the horizontal arm 37 having the spring members 38 which engage the upper surface of the tray 15 when in the position shown in full lines in Figure 3. Tension is then applied to the rope 40 in the direction indicated by the arrow which serves to draw the horizontal arm 37 in firm contact with the tray and simultaneously serves to rotate the table 33 in a clockwise direction due to the engagement of the rope with the pulley 35. After the pulley 35 has reached the highest point in its arc, its engagement with the rope is discontinued and the tension of the rope is thereupon transferred directly to the arm 37. The various parts are still maintained in contact as the weight of the parts are directed downward and are supported solely by

the arm 37. After removal of the bottom part 10 the plastic mixture will rest upright upon the drying trays which are then sent along in the trucks 17 in readiness for the baking process. By reason of this novel form of mechanism the wet blocks are placed onto the trays 15 without danger of the contents slipping or becoming distorted.

Referring to Figures 5 and 6, the individual settling cans are shown as comprising a top part 4 and a removable bottom 10 interfitting with suitable angle members 41 secured to the base 42 of the tank. The removable bottoms 10 are provided with a perforated base member 43 for allowing the excess water to drain as described. To retain the wool mixture in the cans, however, a screen 44 is inserted between the parts 10 and 43 which is of a mesh fine enough to allow only the water to pass through. In order to separate the parts of the can it is only necessary to lift the top part 4 from the bottom portion since the members 41 and 10 have loose interfitting engagement for this purpose. This is accomplished by a suitable mechanical lifting device located adjacent the end of the drain table 6, so that the tops of the cans 4 are removed prior to the placing of the bottoms 10 upon the press 11. The tops of the cans and the empty bottoms are reassembled and placed upon the return roller table 50 upon which they roll by gravity to the front of the tanks 1. Another lifting device serves to remove both the top and bottom of the cans together and place the same on the drain table 6 where operation of filling is again repeated.

It is to be understood that I do not wish to be limited by the exact embodiment of the device shown, which is merely by way of illustration and not limitation, as various and other forms of the device will of course be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

I claim:

1. A process for making heat insulating material, which consists in suspending in a water bath mineral wool fibers, dissolving magnesium sulphate in the bath, allowing the solution to drain slowly whereby the fibers assume a stratified formation, and subjecting the remaining mixture to super-heated steam, whereby all free water is driven off and a cementing of the fibers results.

2. A process for making heat insulating material, which consists in suspending in a water bath mineral wool, dissolving magnesium sulphate in the bath, agitating the bath, allowing the solution to drain slowly whereby the fibers assume a stratified formation, forming the remaining plastic mixture into blocks, subjecting the blocks to the drying action of air and superheated steam, and cutting the dried blocks into desired sizes.

3. A process for making heat insulating material, which consists in mixing mineral wool in water, adding sodium silicate to the water, slowly draining the excess solution to deposit the fibers in layer formation and baking the resulting mixture to drive off any remaining free water.

4. A process for making heat insulating material, which consists in forming a bath by dissolving sodium silicate in water, adding mineral wool to the bath, agitating the bath, allowing the treated water to slowly drain to deposit the fibers in layer formation, and then drying the remaining mixture by subjecting the same to super-heated steam until a cementing of the mineral wool by the binding agent results.

5. A process for making heat insulating material, which consists in forming a bath by adding a mineral binding agent to water, adding a predetermined quantity of mineral wool to the bath, allowing the treated water to slowly drain so that the mineral wool will be left in a stratified formation, and then drying the remaining mixture until a cementing of the mineral wool by the binding agent results.

6. A process for making heat insulating material which consists in forming a bath by adding an inorganic binding agent to water, adding a predetermined quantity of mineral wool to the bath, allowing the treated water to drain gradually requiring a relatively long period of time so that the mineral wool will be left in a stratified formation, and then drying the remaining mixture until a cementing of the mineral wool by the binding agent results, said drying being effected by subjecting the material to the action of the super-heated steam.

7. A process of the character described, which consists in suspending mineral wool fibers in water, adding a mineral binding agent to the water, allowing the treated water to drain gradually requiring a relatively long period of time so that the fibers will be deposited in layer formation, and drying the remaining mixture by subjecting the same to heated air carrying moisture in the form of steam.

8. A process of the character described, which consists in suspending mineral wool in water, adding an inorganic binding agent to the bath, agitating the bath, draining the treated water from the mixture to produce blocks of wet mineral wool with the fibers in a stratified formation, subjecting the blocks to a circulating volume of heated air whereby the air takes up the remaining moisture, and reheating the moisture laden air before again supplying the same to the blocks.

9. A process of the character described, which consists in suspending mineral wool in water, adding an inorganic binding agent to the bath, agitating the bath, draining the treated water from the mixture to produce blocks of wet mineral wool with the fibers in a stratified formation, subjecting the blocks to a circulating volume of heated air whereby the air takes up the remaining moisture, and reheating the moisture laden air to a temperature of about 500 degrees Fahrenheit before again supplying the same to the blocks, whereby the moisture becomes superheated steam to moderate the drying effects of the heated air.

10. A process of the character described, which consists in suspending mineral wool in water, dissolving magnesium sulphate in the bath to provide a binding agent, agitating the bath, draining the treated water from the mixture to produce blocks of wet mineral wool with the fibers in a stratified formation, subjecting the blocks to a circulating volume of heated air whereby the air takes up the remaining moisture, and reheating the moisture laden air before again supplying the same to the blocks.

11. A process of the character described, which consists in suspending mineral wool in water, dissolving magnesium sulphate in the bath to provide a binding agent, agitating the bath, draining the treated water from the mixture to produce blocks of wet mineral wool with the fibers in a stratified formation, subjecting the

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blocks to a circulating volume of heated air whereby the air takes up the remaining moisture, and reheating the moisture laden air to a temperature of about 500 degrees Fahrenheit before again supplying the same to the blocks, whereby the moisture becomes super-heated steam to moderate the drying effects of the heated air.

12. A process for making insulating material which consists in forming a bath by adding an inorganic binding agent to the water, adding a predetermined quantity of mineral wool to the bath, slowly draining the treated water so that the mineral wool fibers will be left in a stratified formation, and then drying the remaining mixture until a cementing of the wool fibers results, said drying being effected by subjecting the material to a circulating volume of heated air whereby said air becomes moisture laden, and raising the temperature of the moisture laden air before again supplying the same to the material to change the moisture into super-heated steam.

CARL H. SCHUTTLER.