April 21, 1942. E. M. JENKINS ET AL 2,280,488

METHOD AND APPARATUS FOR MAKING A STONE-LIKE UNIT

Filed Feb. 20, 1939 2 Sheets-Sheet 1

Fig. 1.

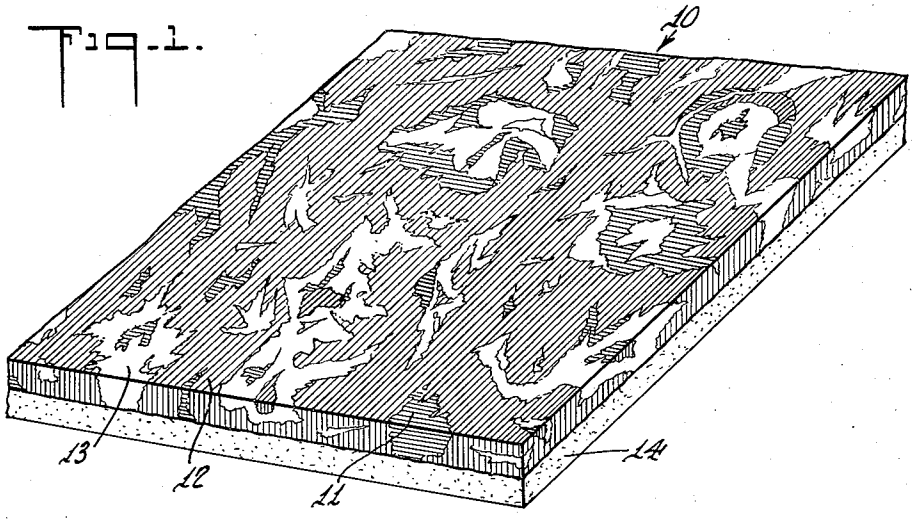
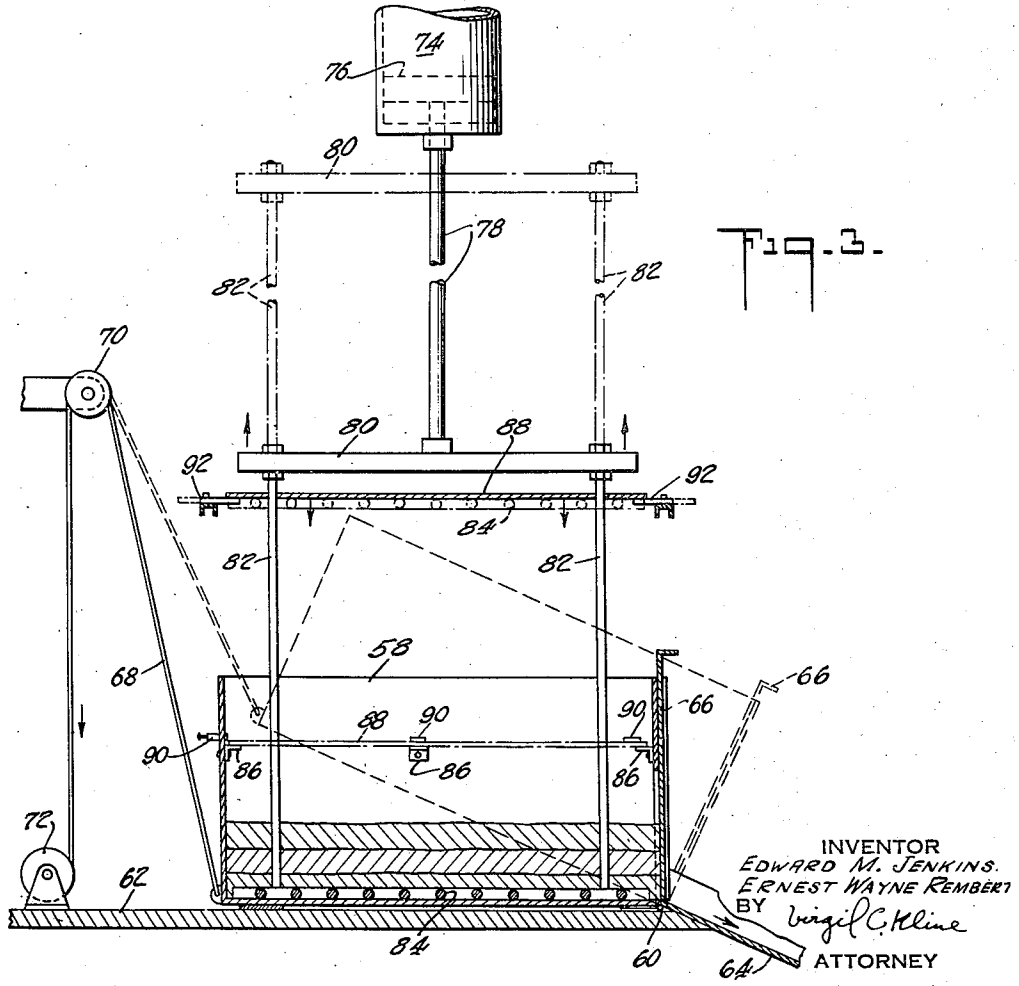


Fig. 3.



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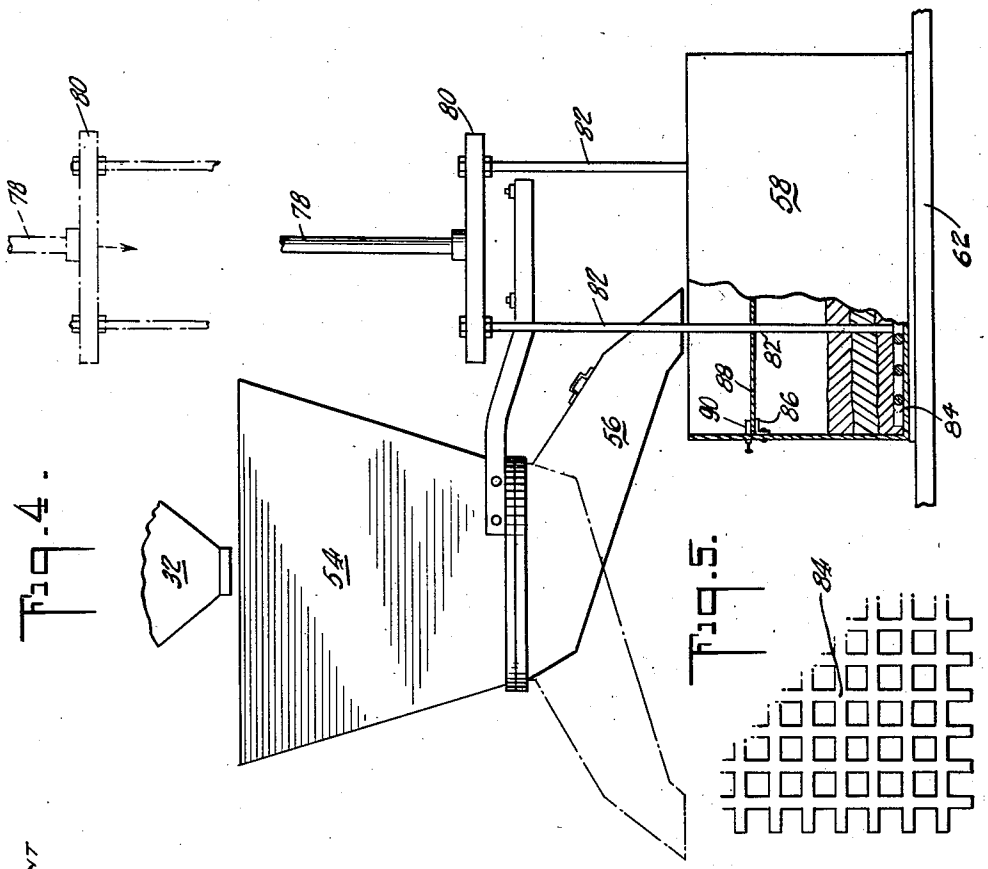


Fig. 4.

Fig. 5.

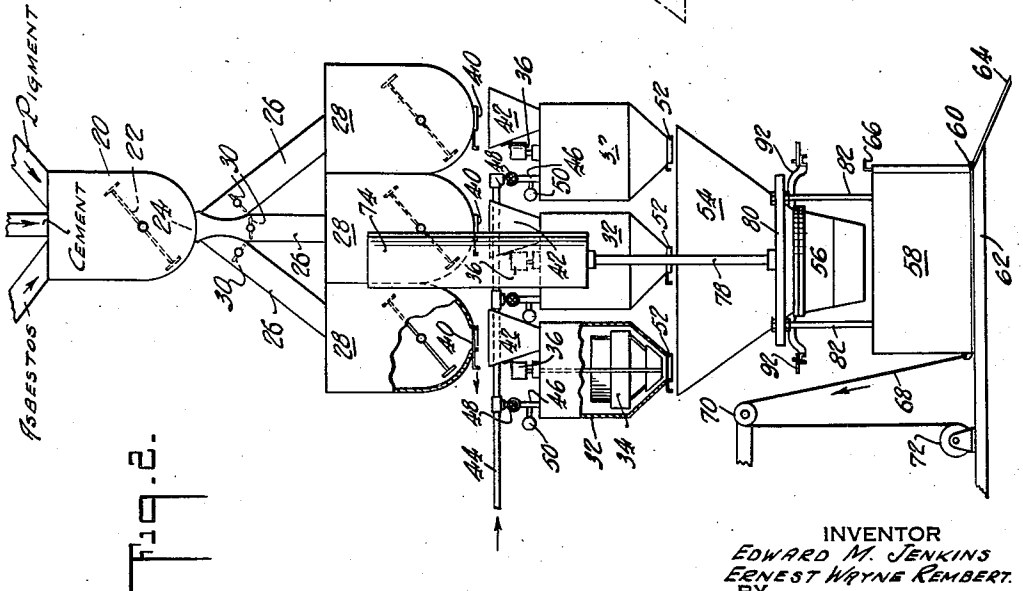


Fig. 2.

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METHOD AND APPARATUS FOR MAKING STONELIKE UNITS

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Application February 20, 1939, Serial No. 257,402

12 Claims. (Cl. 18—60)

The present invention relates to improved facing units, particularly to stone-like units having a mottled or decorative appearance, and to the method of making the same.

At the present time, a material employed in large quantities for the facing of walls, floors, and the like comprises sheets or units formed from a hydraulic cementitious material in hardened condition with reinforcing fibres, preferably asbestos fibres, distributed therethroughout. Heretofore, it has been proposed to provide such sheets or units with a mottled or other decorative surface appearance. Such proposals have included the application of pyroxylin or oil compositions or the like over a face of the sheet which has been surface colored uniformly or in any desired variegated design. However, such products do not exhibit the desired homogeneity and otherwise fail to provide true simulation of natural stone or the like. The instant invention is particularly concerned with, and has for its principal object, the provision of a stone-like unit of an asbestos-cement composition in which the desired mottled or stone-like appearance results from the composition of the body of the unit itself, rather than from surface decoration.

Another object of the invention is the provision of a unit as referred to above which may have a surface appearance to simulate natural stone, marble, or the like, and which is substantially homogeneous throughout.

Another object of the invention is the provision of a unit of the type referred to which may be in the form of a large relatively thin sheet.

A further object of the invention is the provision of a practical method of producing the units referred to above.

Briefly stated, the invention is embodied in a sheet unit including a hydraulic cementitious material in hardened condition and reinforcing fibres distributed therethroughout, alternating portions of the unit being differently colored and integrally united together by means including reinforcing fibres extending across the zones of contact between said portions. The invention also comprises a method of making such unit which includes the formation of an imperfect mixture of a plurality of differently colored, paste-like, asbestos-cement pigment compositions, strongly compressing and densifying the mixture in a filtering press to cause flow of water therethrough and removal of excess water therefrom, and the hardening of the cementitious material.

Our invention will be more fully understood and further objects and advantages thereof will become apparent when reference is made to the more detailed description thereof which is to follow and to the accompanying drawings in which—

Fig. 1 is a perspective view of a unit embodying the instant invention;

Fig. 2 is a diagrammatic side elevational view of an apparatus suitably employed in the practice of the method of the present invention;

Fig. 3 is a view on an enlarged scale of a portion of the apparatus of Fig. 2;

Fig. 4 is an end elevational view of the apparatus of Fig. 3; and

Fig. 5 is a fragmentary view of an element of the apparatus.

Referring now to the drawings, and particularly to Fig. 1, there is depicted a sheet 10 comprising a suitable asbestos-cement composition and containing alternating portions 11, 12, and 13 of different colors arranged in simulation of natural stone or the like. The portions of different color may extend through or substantially through the sheet and are integrally united by asbestos reinforcing fibres extending individually across the planes of contact between said zones, whereby a substantially homogeneous sheet of varied-surface coloration results. The sheet 10 may be made up entirely of the mottled composition, or suitably as shown, may be integrally united to a base or backing layer 14, which suitably comprises conventional asbestos-cement material with the pigment omitted.

The binder material employed in the units of the instant invention is a hydraulic cement, of which Portland cement and calcium aluminate cement are preferred examples. In the event that white surface areas are desired, white Portland cement may be employed in part. The fibre reinforcement, which is associated with the cement and distributed approximately uniformly therethroughout, preferably comprises asbestos fibres, such as fibres of chrysotile, crocidolite, amosite, or the like The relatively short-fibered Canadian chrysotile asbestos, as for instance, a fibre that in the standard asbestos screening test shows about half by weight retained on a 10-mesh screen, has been employed to advantage. The proportion of reinforcing fibres to cementitious material is preferably, say, 15 to 30 parts by weight of the fibres to 85 to 70 parts by weight of the cementitious material. The pigments employed to provide the desired variations of color may be any of those conventionally employed in the art, for example, yellow

ochre, burnt umber, manganese dioxide, and the like.

In the preparation of the product disclosed in Fig. 1, an apparatus of the type illustrated diagrammatically in Figs. 2–5, inclusive, is preferably employed. Suitably, the apparatus comprises a dry material mixer **20** of any suitable type, for example, a "Day" mixer, having a rotatable mixing blade or blades **22**. The mixer **20** has a valved outlet **24** in communication with a plurality of chutes **26** leading to a plurality of storage mixers **28**. Each of the storage mixers **28** is preferably of similar type to the mixer **20**. The mixing blades of the mixers **20** and **28** are driven in any suitable manner and from any suitable power source (not shown). The chutes **26** are each suitably provided with valves **30** of any conventional type, whereby material contained in mixer **20** may be directed through any one of the chutes and into one of the mixers **28**. In lieu of the individual valves **30**, a single valve, for example, a swing valve operable to close off any two of the chutes, may be employed.

Below the storage mixers **28** are supported a similar number of wet mixers **32**, each of which includes rotatable mixing paddles **34** driven in any suitable way, as for example, by motors **36** individually mounted on each unit, as illustrated. Storage mixers **28** each includes a valved outlet **40** arranged to discharge the contents of the mixer into a weighing hopper **42** supported over the corresponding wet mixer **32**. The weighing hoppers may be of any conventional type, whereby a predetermined quantity of the contents of the storage mixers **28** may be discharged into the wet mixers **32**. A water supply line **44** is provided adjacent the wet mixers, the water line including branches **46** opening into the mixers **32**. The branches are each suitably provided with a valve **48** and a water measuring device, as for example, a meter **50**.

Wet mixers **32** are each provided with a valved outlet **52** for discharge of their contents into a hopper **54** supported therebelow. The hopper includes a rotatable or otherwise movable discharge nozzle **56** (see particularly Fig. 4) adapted to be swung from a position remote from the box, as shown in dot and dash lines in Fig. 4, into position to discharge the contents of the hopper into a blending box or tank **58**, as shown in full lines in Fig. 4. Although a simple swingable connection has been diagrammatically illustrated for the nozzle **56**, it will be understood that any other type of means may be substituted therefor which will permit the discharge of the contents of the hopper into the blending box and removal of the nozzle from the vicinity of the box.

The blending box comprises an open-topped container hingedly supported at **60** on a platform **62** adjacent a discharge chute **64**. The end of the box adjacent the chute comprises, or has incorporated therein, a gate or valve **66** of suitable construction to permit the substantial complete opening of the end of the box for discharge of the contents thereof down the chute **64**. A tilting arrangement is provided for the box which may comprise, for example, a cable **68** secured to a lower edge of the box and extending over a pulley **70** and to a drum **72** which may be driven in any suitable manner and under any desired means of control to tilt the box at the desired time in the operation of the apparatus.

Supported above the box is a hydraulic or other lifting device suitably comprising a cylinder **74** and piston **76**, the latter being secured to a piston rod **78**, which, in turn, carries a cross frame **80**. The cross frame has extending legs **82**, which carry a grid **84**. The grid is of substantially the same length and width as the interior of the box and suitably comprises intercrossed steel rods, each of a diameter of, say ¼ to ½ inch (see Fig. 5). The walls of the box carry a plurality of abutments **86** (see particularly Figs. 3 and 4) adapted to support a restraining plate **88** of substantially the length and width of the interior of the box, the plate including openings to permit the ready passage of the rods **82** therethrough. Dogs **90** are provided to retain the plate **88** against the abutments **86**, the dogs being arranged for advance to and withdrawal from operative position by either manual or automatic means.

In the carrying out of the method of the instant invention, in conjunction with the apparatus described above, a dry mix is first made of asbestos fibre, cement, and a selected pigment if color is desired for the particular mix, in the dry mixer **20** and the same is discharged through a chute **26** into any one or more of the storage mixers **28**. A similar dry mix is then made in the mixer **20** including a pigment of another color and similarly discharged into another one or more of the storage mixers **28**, this operation being repeated until each of said storage mixers contains a quantity of a mix, preferably differing in color from the mixes in the other storage mixers. Suitably, the mixes may comprise from 15 to 30 parts by weight of asbestos fibre to 85 to 70 parts by weight of hydraulic cement. The proportion of the coloring pigment may be suitably determined to provide the desired intensity of color in the finished product. The material in each of the storage mixers **28** is then discharged through valve **40** into measuring device **42**, from whence it is discharged in a measured quantity into wet mixer **32**. The relative amounts of the different colored mixes discharged into the several wet mixers will depend upon the desired relative predominance of the colors in the product. Thus, for example, a comparatively large quantity of the mix which includes the background color for the product will be measured out.

Water in measured quantities is added to the material in the wet mixers **32**. The proportion of water added should be largely in excess of the amount required to hydrate the cement and preferably is such that when the compositions are compressed in a filter press, an excess of water will flow throughout the compressed composition and therefrom. At the same time, the proportion of water must not be so great that undesired diffusion of the pigments takes place during the blending operation, later described, or that the composition loses its desired paste-like consistency. The proportion of water required to secure the above conditions will vary with the asbestos content of the mixes. Thus, the asbestos, in addition to serving as a reinforcement in the product, allows a greater proportion of water to be employed than would otherwise be permitted. This is due to the high water retention property of the fibres. However, it has been determined that for the preferred mix, employing from 15 to 30 parts asbestos fibre and 85 to 70 parts cement, there should be used say, 61 to 77 parts of water.

The operation of the mixers **32** is continued until a homogeneous mixture is obtained and the batches in the mixers are then discharged

successively through the hopper **54** into the blending box **58**. Prior to the discharge into the blending box, the hydraulic lift is manipulated to place the grid **84** at the bottom of the box, the plate **88** being held above the box and adjacent the frame **80** (see the full line position of the plate in Fig. 3) by any suitable means, for example, by the supports indicated at **92**. The nozzle **56** is then swung into position to have its mouth overlie the box.

The discharge of the batches from mixers **32** in succession results in the formation of a plurality of layers of differently colored mixes in the box **58**. Preferably, each layer is roughly leveled, as by means of a rake or the like, before the next batch is dumped thereon. Any suitable number of the layers may be provided, depending upon the number of different colors desired and the number of mixers employed. It will be understood that although but three mixers have been shown, any number may be used. After the several layers of the wet asbestos-cement-pigment composition are in the box **58**, the nozzle **56** is swung from the full line position of Fig. 4 to the dot and dash line position and the plate **88** is lowered to the position shown in Fig. 4 and secured on abutments **86** by dogs **90**. The hydraulic lift is then operated to draw the grid upwardly through the several layers, the plate **88** preventing the lifting of the material as a mass. The grid **84** may be drawn through the material only once or may be raised and lowered one or more complete cycles, depending upon the pattern desired in the completed product. Thus, the more nearly the mixing approaches completion, the finer will be the pattern. Different patterns may also be obtained by employing grids having different spacings between the bars, or varying arrangement of the bars, or both. In any event, it will be understood that the mixing is imperfect in order to provide a distinct pattern in the product.

When the mixing has proceeded to the desired extent, the dogs **90** are retracted and grid **84** lifted from the box by the hydraulic lift, the grid picking up the plate **88** and also removing it from the box. Thereafter, the box is tilted by the means **68**, **70**, and **72** (see Fig. 3), the gate **66** opened, and the contents of the box discharged down the chute **64** to the bed of a filter press of any suitable or conventional construction (not shown). In the event that the resultant product, as shown in Fig. 1, is to include a uniform color base layer, a standard asbestos-cement mix is first laid in the filtering press and lightly consolidated to substantially uniform thickness and the material from the box **58** discharged thereover. It has been found desirable that the mix discharged from the box **58** be spread over the filter bed or over the top of the base sheet by means of a hand rake or the like. The press is then closed and the entire sheet consolidated under a pressure, say, of from 1500 to 2000 pounds per square inch. During the compressing operation the contained water flows in a substantial amount throughout the composition and finally through the filtering bottom of the press. The compressed and densified material is then removed from the press and allowed to stand until the cement has hardened.

As an alternative to the method of blending the several batches in the blending box described above, the same may be extruded through extruders mounted adjacent each of the wet mixers **32** and into which the contents of the mixers are discharged. In this method, relatively thick sections of the batches are simultaneously extruded from each of the extruders and cut off to form blocks which fall into a box from which they are dumped into the press without further mixing or blending.

Any suitable or conventional finishing steps may be applied to the hardened sheet. Thus, for example, the surface of the sheet may be polished and also lacquer, wax, or other finishing materials may be applied thereto.

The finished product resulting from the above-described method is substantially homogeneous throughout, the several differently colored compositions being integrated with one another. This integrality of structure is due, for the most part, to the presence of the asbestos fibres which, during the pressing operation and the flow of water through the material, are extended across the interfaces between the several compositions. The fibres, in addition to reinforcing the several compositions and extending across the interfaces therebetween, serve the additional function, due to their natural high water retention properties, of retaining water within the material in the press for a sufficient length of time to permit some flow and displacement of adjacent compositions with equalization of densities and a softness of transition of color from a portion of one color to another in the finished product. Also, the higher proportion of water that can be employed due to the use of the fibres permits of softer consistencies of the compositions resulting in a well-knit structure without objectionable color blending.

The paste-like consistency of the composition, that is, its property of coherence and ability to retain its water content during the mixing operations, while at the same time being plastic and easily deformable, makes possible ready control of the fineness of the color configuration in the mottled product, due to the relative stability of the individual color groups. This, furthermore, provides a ready means of controlling the degree of intermingling of the colors at the color boundaries, softer consistencies giving softer transition lines, and harder consistencies giving sharper transition lines, with accompanying sharp configuration. Also, the several differently colored compositions may be of different consistencies, whereby streaks or vein-like intrusions are formed similar to those of a natural stone, such as marble.

Having thus described our invention in rather full detail, it will be understood that these details need not be strictly adhered to, but that various changes and modifications will suggest themselves to one skilled in the art, all falling within the scope of the invention as defined by the subjoined claims.

What we claim is:

1. The method of making a stone-like unit of mottled appearance comprising forming a plurality of paste-like, similar but differently colored, substantially homogeneous compositions each including a hydraulic cementitious material and reinforcing fibres distributed therethroughout, mixing the compositions imperfectly and subjecting said mixture to strong compression and densification in a filtering mold to cause water to flow in substantial volume throughout said mixture and finally therefrom whereby said compositions are welded into a substantially homogeneous body, and then hardening the cementitious material.

2. The method of making a stone-like unit comprising forming a batch comprising a plurality of layers of differently colored, paste-like, substantially homogeneous compositions, each including Portland cement, asbestos fibres, and water, mixing the batch imperfectly to form alternating differently colored surface portions, subjecting the batch to strong compression and densification in a filtering mold to cause water to flow throughout the said batch and finally therefrom whereby the colors are blended at the zones of contact between said compositions and said compositions are welded into a substantially homogeneous body, and then hardening the cementitious material.

3. The method of making a mottled stone-like unit comprising forming a plurality of paste-like, differently colored, substantially homogeneous compositions, each including a hydraulic cementitious material and reinforcing fibres distributed therethroughout, discharging each of said compositions to form a separate layer in a blending device, imperfectly mixing said compositions in said blending device, discharging said imperfectly mixed compositions into a filtering mold, subjecting the compositions to strong compression and densification in said filtering mold, and thereafter hardening the cementitious material.

4. The method of making a mottled stone-like unit comprising forming a plurality of paste-like, differently colored, substantially homogeneous compositions, each including by weight from 70 to 85 parts of hydraulic cementitious material, from 30 to 15 parts of asbestos fibres, and from 77 to 61 parts of water, with said fibres distributed throughout said compositions, mixing the compositions imperfectly and subjecting said mixture to strong compression and densification in a filter mold to cause water to flow in substantial volume through said mixture and finally therefrom, whereby said compositions are welded into a substantially homogeneous body, and then hardening the cementitious material.

5. The method of making a mottled stone-like unit comprising forming a plurality of paste-like, differently colored, substantially homogeneous compositions, each including by weight from 70 to 85 parts of hydraulic cementitious material, from 30 to 15 parts of asbestos fibres, and from 77 to 61 parts of water, with said fibres distributed throughout said compositions, discharging each of said compositions to form a separate layer in a blending device, imperfectly mixing said compositions in said blending device, discharging said imperfectly mixed compositions into a filtering mold, subjecting the compositions to strong compression and densification in said filtering mold, and thereafter hardening the cementitious material.

6. The method of making a stone-like unit of mottled appearance comprising forming a plurality of dry batches of hydraulic cementitious material, reinforcing fibres and pigment, discharging said batches in measured quantities into separate mixers, mixing said batches with measured quantities of water until each batch is substantially homogeneous, discharging the resultant wet batches successively into a blending device to form superposed layers of the batches therein, imperfectly mixing said layers, discharging the resultant imperfectly mixed composition into a filtering mold, subjecting the composition to strong compression and densification in the filtering mold, and thereafter hardening the cementitious material.

7. The method of making a stone-like unit of mottled appearance comprising forming a plurality of dry batches of hydraulic cementitious material, reinforcing fibres and pigment, discharging said batches in measured quantities into separate mixers, mixing said batches with measured quantities of water until each batch is substantially homogeneous, discharging the resultant wet batches successively into a blending device to form superposed layers of the batches therein, drawing a reticulated member through said superposed layers to imperfectly mix the same, discharging the resultant imperfectly mixed composition into a filtering mold, subjecting the composition to strong compression and densification in the filtering mold, and thereafter hardening the cementitious material.

8. The method of making a stone-like unit of mottled appearance comprising forming a plurality of dry batches of hydraulic cementitious material, reinforcing fibres and pigment, mixing said batches with measured quantities of water until each batch is substantially homogeneous, discharging the resultant wet batches successively into a blending device to form superposed layers of the batches therein, drawing a reticulated member through said superposed layers while restraining the same from movement from said blending device, to imperfectly mix the same, discharging the resultant imperfectly mixed composition into a filtering mold, subjecting the composition to strong compression and densification in the filtering mold, and thereafter hardening the cementitious material.

9. The method of making a stone-like unit of mottled appearance comprising forming a plurality of dry batches each including by weight from 70 to 85 parts of hydraulic cementitious material and from 30 to 15 parts of reinforcing fibres, discharging said batches in measured quantities into separate mixers, mixing said measured batches with 77 to 61 parts of water for 100 parts by weight of the measured batch, discharging the resultant wet batches successively into a blending device to form superposed layers of the batches therein, imperfectly mixing said layers, discharging the resultant imperfectly mixed composition into a filtering mold, subjecting the composition to strong compression and densification in the filtering mold, and thereafter hardening the cementitious material.

10. The method of making a stone-like unit of mottled appearance comprising forming a plurality of dry batches each including by weight from 70 to 85 parts of hydraulic cementitious material and from 30 to 15 parts of reinforcing fibers, discharging said batches in measured quantities into separate mixers, mixing said measured batches with 77 to 61 parts of water for 100 parts by weight of the measured batch, discharging the resultant wet batches successively into a blending device to form superposed layers of the batches therein, drawing a reticulated member through said superposed layers to imperfectly mix the same, discharging the resultant imperfectly mixed composition into a filtering mold, subjecting the composition to strong compression and densification in the filtering mold, and thereafter hardening the cementitious material.

11. An apparatus for the manufacture of mottled stone-like units comprising means for forming a plurality of wet batches of hydraulic cementitious material and reinforcing fibres, means for receiving said batches in superposed layers, a reticulated member disposed for movement

through said superposed layers for imperfectly mixing the same, and means for moving said reticulated member.

12. An apparatus for the manufacture of mottled stone-like units comprising means for forming a plurality of wet batches of hydraulic cementitious material and reinforcing fibres, means for receiving said batches in substantially parallel, contiguous, superposed layers to form a laminated mass, a reticulated member disposed for movement through said mass for imperfectly mixing the same, means for moving said reticulated member, and means for restraining movement of said mass during the travel of said reticulated member therethrough.

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