March 23, 1954 E. T. RHODES 2,672,670

METHOD OF MAKING BUILDING MATERIAL

Filed Feb. 18, 1949

Fig. 1.

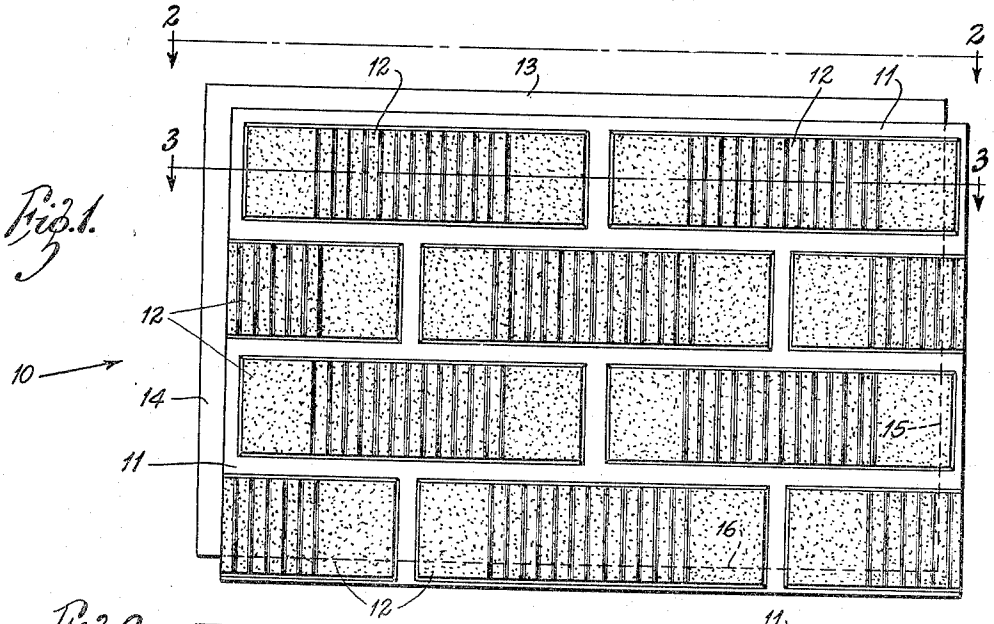


Fig. 2.

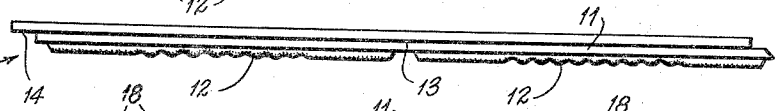


Fig. 3.

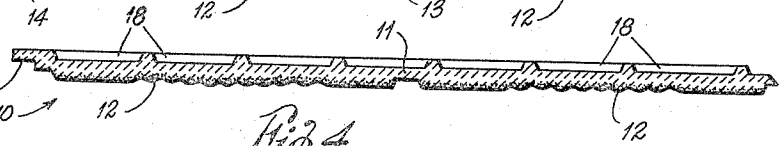


Fig. 4.

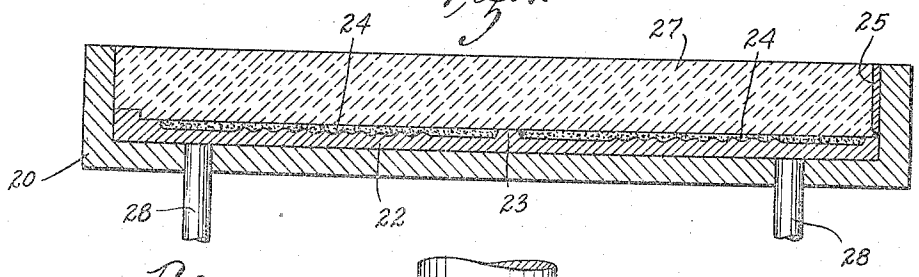
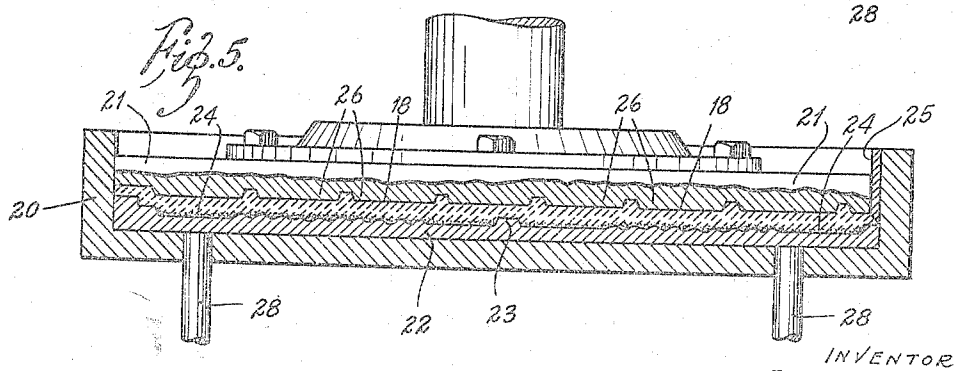


Fig. 5.



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Patented Mar. 23, 1954

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UNITED STATES PATENT OFFICE

2,672,670

METHOD OF MAKING BUILDING MATERIAL

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Application February 18, 1949, Serial No. 77,170

5 Claims. (Cl. 25—155)

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The present invention relates to a method of making building material.

As will appear from the description to follow, the present invention is concerned particularly with making a very strong building slab of great density and very low absorption characteristics. It will be understood also from the description that the method, although preferably employed to make a building slab that is relatively thin and may be used for external sheeting or veneering, it also can produce other shapes of building material of succative, cohesive material, such as blocks and the like. Hence, while the description will proceed by a complete disclosure of the method of making a slab that is relatively thin, and the slab made by the method, it must be borne in mind that the use of the invention in the production of other shapes or blocks of construction material is contemplated.

Heretofore, building material of this kind has been made of somewhat similar component materials, but such earlier slabs have lacked the tensile strength, density, low absorption characteristics, low warping characteristics and general durability that are attained by the present invention.

Furthermore, with specific reference to the slab type of construction, it is a desirable feature of this invention that facing slabs may be made for application to new or old buildings, which facing slabs produce in over-all effect that of a brick or stone building, whereas actually they are of a veneer construction that is very much cheaper to build and which has insulation properties that are superior to solid masonry construction, as well as a great deal less expensive to build.

It is another object of the invention to produce such a material with facing integrally formed therewith; and to provide a method whereby such unit of facing and backing material may be formed as a single process.

In the drawings:

Fig. 1 is an elevation of a slab made in accordance with the present invention;

Fig. 2 is an edge view of the slab, taken from above Fig. 1, as indicated at 2—2;

Fig. 3 is a section through the slab taken on the line 3—3 of Fig. 1;

Fig. 4 is a somewhat diagrammatic sectional view of a stage in the molding of the material for the slab; and

Fig. 5 is a somewhat diagrammatic view of a later stage in the molding of the material for the slab.

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In the description to follow, explanation will be made of the formation of a flat slab. It will be understood how other similar building elements may be made, by consideration of this particular illustration.

The slab of Fig. 1 is generally indicated at 10. It is here shown as having what may be termed a backing or base 11 of predetermined size that is illustrated as being of the size of a number of bricks and half bricks. Superposed onto the base 11 are a plurality of portions of facing material 12 that are, in the illustration, simulated bricks. In Fig. 1, there are six full brick sections and four half brick sections. The base 11 is cut back on two edges, as at 13 and 14, and overhangs on the other two edges, as at 15 and 16, so that the slabs may be mounted on a wall and overlapped. In other words, another slab like the one illustrated may be disposed above the one shown with the tongue 13 of the illustrated slab engaging within the groove or rabbet 16 of the one above. In like manner, another slab may be located to the right of that illustrated in Fig. 1, with its tongue 14 engaged within the rabbet 15 of the slab shown in Fig. 1. The parts may be attached to the wall by suitable fastening means such as screws. The material has adequate strength to withstand the compressive forces of the screws and, as a result, an extremely strong wall may be obtained.

It is desirable, especially to enhance insulation qualities of a wall, to provide a plurality of recesses 18 in the back of the slab. These may be rectangular or of other suitable shape.

To make the slab, facing material, where used, is employed to simulate the color and texture of bricks, stones or whatever is desired. A preferred formulation of facing material to obtain a brick appearance is as follows:

30 lb. of granulars;
45 lb. high early cement, such as Portland or like hydraulic cement;
10 lb. asbestos fiber; and
15–17 lb. of pigment, where special colors are desired, the amount being determined by the desired color tone.

The foregoing gives the preferred formulation. The granulars afford greater strength, toughness, and durability, and add to the permanency of color, particularly the reds and browns. The asbestos fiber is used as a reenforcement to add strength and flexibility to the product, and to add to its heat insulation quality, by counteracting the thermal conductivity of the cement. The pig-

ment is employed where colors other than the natural color are desired, and to obtain contrasts where the natural (or differently colored) backing material is exposed.

While the above formulation of the facing material is most desirable, the proportions may be varied and still obtain a usable product. The granulars may range from 10–40%, but a 15–30% gives markedly better results. The cement may range from 30–75%, but should be within 30–60%. The fibers may range from 10–20%. It is preferable to employ from 15–17% of pigment where pigment is used.

The granulars may be natural colored granulars such as burnt shale or crushed monument granulars, all of a quality that will not fade when exposed to weather. The materials should pass through a 20-mesh screen. The asbestos fiber may be #7M short sold by Asbestos Corporation, Ltd. It is preferable to employ short fibers in the facing, which usually is disconnected sections that do not require great strength. Shorts afford easier working and a finer texture to the facing.

The facing materials are all put together in a dry state and thoroughly mixed while still dry for a period of about fifteen minutes, preferably by whirling and beating. This dry mixing forces the finer particles of cement into the loosely woven asebestos fibers. Following the dry mixing, a very fine spray of water is added while the mixing continues for about an additional ten minutes, until preferably about five percent by weight of water has been added. The range of water preferably further is about four to seven percent. After the water has been added, the material is then run through a #8 sieve, which action leaves the facing material in a fluffy loose state and ready to be used.

The base or backing materials preferably include the following:

60 lb. high early cement, such as Portland or like hydraulic cement;
10 lb. short asbestos fibers;
15 lb. long asbestos fibers;
15 lb. ground limestone; and
2½ lb. special waterproofing compound.

The asbestos fibers may be #7M short and #522D long, obtained from Asbestos Corporation Ltd. The fibers and cement function in the base material as in the facing material. The long fibers give great strength and flexibility in the backing material, which carries the major part of the load. The ground limestone is desirable because it acts as a good filler and also lends flexibility to the treated slabs. The waterproofing compound may be the commercial water proofing compound of Medusa Cement Company. It is a desirable component, because it provides a waterproof end product after the processing herein described is completed. Such waterproofing compounds usually last from two to three years. The present product continues to cure for about the same length of time, and by the end of such interval it attains a great density so that it is itself waterproof.

The above formulation for the backing material is optimum. However, a usable product may be obtained when the cement varies from 40–60% of the total; the fiber total varies from 20–40%; and the limestone, when used, varies from 10–20%.

These materials are put together in a dry state and mixed while dry for a period of about fifteen minutes, preferably by whirling and beating. During the dry mixing, the cement is forced into intimate mixture with the loosely woven fibers of asbestos.

After the dry mixing period is finished, an additional period of about ten minutes is employed for the addition of water. This water is added during a continuation of the mixing operation by the use of a very fine spray. The amount of water is limited to about three to seven percent by weight, and preferably about three percent. In order to avoid the possibility of balling, the material after the water is added is run through a #3 power sieve, which leaves the material in a loose fluffy state.

In the molding operation illustrated here where facing material is employed to simulate bricks, a press having a bed member **20** and a head **21** is employed. The bed **20** has a cavity in which a pallet **22** is fitted. This pallet is preferably of relatively light aluminum. It has on its upper face a mold cavity to shape the outer surfaces of the slab. This includes a plurality of ribs **23** that correspond with the mortar joints or spaces to simulate mortar joints between the several brick sections. The ribs separate a plurality of brick or half brick cavities **24**. The pallet is otherwise shaped as indicated to provide a final product of the desired, previously described shape. A frame **25** may be employed on two sides, to give the bevel at these two edges of the slab.

The press head **21** is adapted to fit within the bed cavity and over the pallet **22**, as shown in Fig. 5. The head **21** is shaped to provide the back of the slab, and includes a plurality of projections **26** to form the recesses **18** in the back of the slab **10**. In the first molding step, the facing material prepared as aforesaid is filled into the mold at least up to the tops of the ribs **23**, which may be kept clean by a removable template or the like, or made clean after this step. The facing material must be given a suitable depth that will make it durable when subjected to the weather, without overly exposing the base material.

After the facing materials are thus applied, the base material is filled into the mold cavity to a suitable level, such base material being shown in Fig. 4 at **27** in its fluffy state. The depth is sufficient to assure that, when the full pressure is applied to the base material by the press and the press is subjected to molding force in proper degree, the end product will have approximately the final thickness of the slab.

In the preferred operation, the base material, in its fluffy and semi-dry state resulting from the previous description, is filled to the top of the mold cavity in the base **20**, and scraped off. This cavity has a depth to assure the proper amount of material. For a slab having an end thickness of about $\frac{11}{32}$'' including facing, in its major area, and about $\frac{7}{32}$'' for the major part of the backing material, an initial thickness of fluffy material of about 1'' is desirable. With thinner sections this ratio of initial to final thickness may be reduced, but, with thicker sections, it will be enlarged. In general, the ratio should be at least better than 2:1 and preferably at least about 3:1.

When the proper supply of fluffy material is added, the head **21** of the press is brought down, preferably relatively slowly, and the slightly damp products are compressed, as indicated in Fig. 5. The press may be one that operates in a cycle of about five or six seconds from its fully opened position to its closed position to its fully opened position again.

It is necessary to have a large force applied by the press. The unit pressure is preferably in the order of 1250 p. s. i., and at least about 750 p. s. i. The desirable characteristics in the end product are not obtained with a pressure of substantially less than 750 p. s. i.

When the press head 21 is subsequently withdrawn, the pallet 22 is ejected, ejecting pins 23 being diagrammatically shown. This pallet is then supporting the highly compressed, semi-dry, but still incohesive matter. The pallet with the material on it is placed on a drying rack. The material in the mold is then sprayed with a fine spray of water until thoroughly wet. About $\frac{3}{16}$'' of water is applied, which fills the cavities 18. The spraying of this water avoids damage to the incohesive cementitious compressed materials on the pallet. Then the pallet is allowed to stand for about twelve hours.

When the slabs are removed from the plates, they are immersed in water for about an hour. This may be done by a batch operation where a large number of such slabs, stacked on edge on properly formed racks, are immersed as a group. By this immersion, they take up an additional quantity of water that is necessary for the final curing operation. The preliminary setting operation that takes place during the twelve hour period in which the material remains on the pallet is sufficient to cause the slabs to set up to a permanent state so that they will not expand upon the final submersion, and so that they will be quite adequately strong to be subjected to the final curing step that has been set forth. The final curing step takes place by withdrawing the slabs from the immersion tank and stacking them in place for about fifteen to twenty days so that the water may effect the cure and so that excess water may evaporate. At the end of such fifteen or twenty days period, the slabs are then ready for use, being hard, tough and very dense.

A rule of thumb for testing the completeness of the final wetting operation is to observe when bubbling from the slabs stops. Generally for a slab of the illustrated type, an immersion of forty minutes to an hour is sufficient, but this varies somewhat with the atmospheric conditions and with the thickness of the sections.

The final curing stage usually is finished within fifteen days, where temperature and humidity are controlled. It should not be speeded up in a manner that will cause encrustation of the outer parts. For ordinary air curing, at about 65–70° F., a longer period is required.

To illustrate the relative density of the present slab with similar slabs made under other processes, comparative tests indicated that a slab made by the former process would have a forty percent absorption factor under certain circumstances, as compared to a twelve percent or less absorption factor of the present material.

It will be seen that the principal handling operations can all be done within a period of an hour or less, including the mixing, pressing and spraying for the preliminary curing operation.

The slabs, when removed from the pallets, will have the desired configuration, and, in the illustrated form, will have the facing material forming at least the outer surfaces of the brick-like sections 12. Obviously, different colors of facing materials may be used, and different shapes of facing materials. The familiar alternative to the brick configuration is the configuration of stone.

The foregoing superior product is provided by the process described, and the process obtains its result with a minimum number of steps. It is especially desirable to obtain the end product with integral facing by a single compression operation.

What is claimed is:

1. In a method of making a building material: the steps of mixing cement and compressible fibres into a loose, fluffy mass, the major part of the mass being cement; thoroughly distributing about 3%–7% by weight of water into the mass while maintaining it in its loose, fluffy state; shaping the same by compressing it on a platen under pressure of at least about 750 p. s. i. to at most about one-third of its original thickness, and thereby producing a dense shaped mass that is too dry to be self-supporting; further wetting the mass while still on the platen and allowing it to stand for a period sufficient to cause it to become cohesive, thereafter finally wetting it thoroughly for a period of time to cure into a dense, monolithic mass.

2. The process of claim 1 wherein the further wetting of the material on the platen is preformed by a fine spray to afford even distribution and to avoid deformation of the mass on the platen.

3. The method of claim 1 in which the fibers are asbestos fibers.

4. The method of claim 1 wherein the cement comprises about 40%–60% by weight of the total, the fiber total varies from about 20%–40%, and wherein there is a filler of ground limestone or the like that constitutes about 10%–20% of the total.

5. The method of claim 1 including the formation of a layer at one surface thereof by thoroughly mixing granulars of about 10%–40%, cement from about 30%–75%, fibers about 10%–20%, and the balance pigments, the percentages being by weight, said materials being thoroughly mixed while dry in a loose, fluffy state and then being moistened by the addition of about 4%–7% of water, and thereafter being disposed as a loose, fluffy layer with the previously mentioned material of claim 1, and with said material is compressed and molded, wetted, caused to take up water, and cured in the manner set forth in claim 1.

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