March 3, 1936. E. R. POWELL 2,032,852

INSULATED WALL

Filed Feb. 4, 1933

Fig.1.

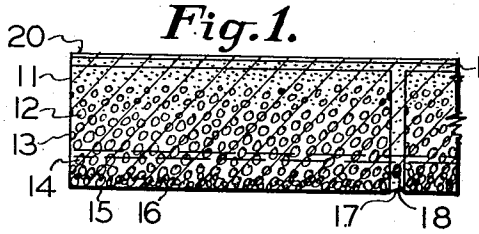


Fig.2.

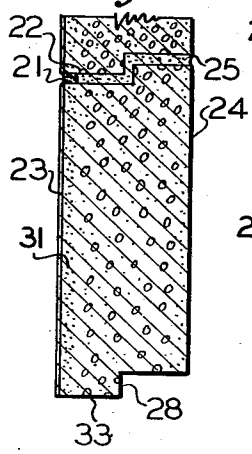


Fig.3.

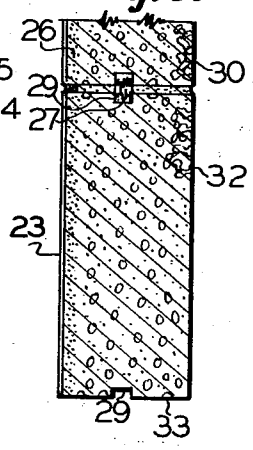


Fig.4.

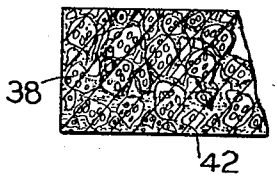
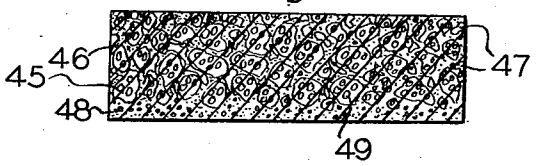


Fig.5.



INVENTOR.

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UNITED STATES PATENT OFFICE

2,032,852

INSULATED WALL

Edward R. Powell, Alexandria, Ind.

Application February 4, 1933, Serial No. 655,160

4 Claims. (Cl. 72—36)

This invention relates to an insulated wall, building units of expanded material for building such a wall, and particularly to ceramic blocks of varied characteristics and is a continuation in part of my prior applications: Cellular ceramic building material, and method of and apparatus for forming same, Serial No. 600,115, filed March 21, 1932, now Patent No. 1,963,030 dated June 12, 1934; and Cellular ceramic ware, method and apparatus for forming, Serial No. 601,796, filed March 29, 1932, now Patent No. 1,963,031 dated June 12, 1934.

One chief object of this invention is to vary, in different parts of the unit, the degree and nature of the expansion which is embodied therein and the resulting variation in internal structure resulting therefrom. Another chief object of the invention is to adapt the aforesaid variations in internal structure to particular functions which are required in a floor, wall or ceiling.

The chief feature of the invention is that by such variations in internal structure it is possible to perform all of the desired functions of a building unit and of the wall, floor or part of the building in which it is employed, much more fully than by any constant internal structure.

The principal characteristics which are desirable in a unit for a masonry ceiling slab and which may be imparted by proper internal structure in the unit, are: (1) high compressive strength in the upper layers (except where cantilever construction is used), (2) good bonding properties on the upper surface for composition floor or roof to be applied thereto, (3) thermal insulating value and rigidity in the body portion, (4) high bonding strength on the side or edge surfaces, (5) sound absorbing and decorative value in the lower surface, (6) minimum weight. If units are to be exposed on the upper side for the floor above, they should have a wearing surface and washable characteristics instead of bonding surface as indicated above. A ceiling and floor or roof constructed in this way may be considered a "wall" or horizontal wall. The vertical walls, then are walls also or may be termed "side walls".

Other desirable characteristics which result from the nature and composition of a block involving this invention are resistance to vermin, weather, fire, rot and other deteriorating agencies. These latter characteristics are in common with other ceramic products and Portland cement units of satisfactory quality.

A solid brick or block has normally a thermal conductivity of about 8 to 15 B. t. u., commercial conductivity. If, by expanded structure, this conductivity is reduced to less than about 3 B. t. u. in the same units, the difference is substantial due to the additional heat resistance of the wall or ceiling.

The principal structural characteristics which units embodying the invention should have to form a complete and desirable side wall are: (1) an impervious, decorative and washable outer surface, (2) a shock-resisting outer layer, (3) insulating value and rigidity in the body portion, (4) bonding strength on the joining surfaces or edge surfaces, (5) interlocking or offset edges to prevent leakage and avoid the necessity of double wall construction, (6) decorative and washable inner surface, (7) acoustical properties when desired, (8) minimum weight to permit handling in large units and reduce foundation loads, (9) adaptable features such as easy cutting, drilling and anchoring.

So far as known, no building unit which is uniform throughout has all of the above desirable characteristics. It is unduly difficult to adapt any one internal structure to all of the above conditions. For instance, in present practice, an impervious surface suitable for exteriors does not have acoustical properties, and material of maximum compressive strength does not have either insulating or acoustical value.

The chief purpose, then, of this invention is to embody, in various parts of the same unit, the various characteristics which will adapt it to perform the various functions enabled by these characteristics as enumerated above as and where needed.

How these various characteristics are imparted to a building unit made of common ceramic raw materials will be understood more fully by reference to the accompanying drawing and the following description and claims.

In the drawing,

Fig. 1 is a sectional view of an expanded building unit used as a part of a ceiling slab which also forms the floor or roof deck above.

Fig. 2 is a transverse section of a cellular building unit for use in a complete side wall and is taken from inside to outside.

Fig. 3 is a similar sectional view of another form of expanded building unit for use in a complete side wall.

Fig. 4 is a sectional elevation of part of a varied character block, the lower part being sub-

stantially continuous and the upper part containing voids.

Fig. 5 is a similar view of a block which has a considerably expanded body portion and a slightly expanded lower layer.

In Fig. 1, 11 represents a layer of material of high compressive strength. Such a layer is formed of vitrified ceramic material, either not expanded at all or expanded with only small bubbles, and not less than about 70 lb. per cu. ft. density for most kinds of expansion. 12 is a body portion of material which is preferably of lower density and has larger cells. 13 is an exposed cell formed when the expanded structure is dressed to size. 14 is a still lighter density portion material containing some voids of considerable size. 16 is a cell of intercommunicating type which leads to opening 15 in the lower surface to form an acoustical under surface. The block is set in mortar 17 which encloses a reinforcing rod 18. The mortar is carried over the top of the block at 19 for strength and smoothness. A composition floor or roof 20 is applied to the mortar 19.

In Figs. 2 and 3, the outer surface 23 is in the form of a ceramic glaze. The mortar joint 25 is pointed with a waterproof putty of bituminous or other elastic type 21. The body portion 31 of the unit is of expanded type to give lightness and insulating value. The outer layer 26 of material near surface 23 is comparatively heavy for shock resistance from outside. There is an offset 28 in the block to prevent straight through joints which might develop into straight through cracks. The exposed cells 22 give the mortar 25 a high bonding strength. The inner surface 24 if of a glazed and decorative type for interior purposes.

In Fig. 3, the wall unit has an offset in the form of a groove 29 which receives a sort of packing strip 27 of elastic material and prevents leakage through the wall even if there is a little settling. These precautions avoid the need of double wall construction to avoid leakage. If the wall is to have part of its surface of acoustical type, a layer of material having intercommunicating air cells 30 may be provided and openings in the inner surface leading thereto.

The surfaces indicated at points by numbers 11, 13, 22, 28 and 33 are intended to be bonded to mortar for joining to adjacent units. These surfaces may therefore be called "joining surfaces", to distinguish them from such surfaces as 23 and 24 which are exposed surfaces. The exposed and joining surfaces are not always opposite as shown. They may be adjacent as in corner units or coping.

Varied characteristic units may be formed (1) by successive depositions of materials in layers from successive depositing means, (2) by control of the expansion or air cell distribution in a single operation, (3) by successive aerating processes acting on a given body of plastic clay, or (4) by combinations or modifications of the above methods.

The block of Fig. 5 is formed of an expanded aggregate and a less expanded bonding material, the bonding material concentrating near the bottom. The top surface may be finished as a decorative layer. The aggregate and the bonding material in the decorative layer may "burn" to different colors for decorative effect. The wet molded product thus formed is dried, dressed if necessary and burned with or without glazes.

The ceramic units of varied character may be formed in various ways but in all instances the variations and other structural features are embodied in the units while they are partially at least in the form of wet plastic clay. The wet molded units are dried as single units with the variations included in each, and fired in conventional manner. The finished units from these operations are then assembled in the manner shown in Figs. 1, 2 and 3 either by grouting the joints or by "laying up" in the usual manner.

The block of Fig. 5 has lumps of aggregate 45 which are highly expanded as indicated by cell 49. These lumps are coated with bonding material as at 46 but there are some voids between the lumps such as 47. The bonding material is concentrated at the lower (as formed) side 48 to form a dense layer. The whole block is dried and fired as a single unit.

The block of Fig. 4 has voids in the upper part 38 and down to a definite level due to draining off of liquid clay. In the lower part 42 all the large voids are filled by liquid clay which is subsequently hardened and forms the bond for the unit.

Reinforcement is shown in the floor slab only. The reinforcement may, of course, be used in any part of the structure. If desired, the walls may be reinforced also and the reinforcment of the floors tied in to the wall reinforcement.

Corner blocks which may require surface coating on one side and one end may, while still wet, be spray coated to cover exposed cellular structure, or special forms may be used to mold a dense surface on two or more adjacent sides of a unit.

The scope of this invention is not limited strictly to units in which the cellular structure is produced by gas means, because cells may be formed mechanically or by burning out combustible or volatile aggregates. For economic reasons, where huge numbers of cells are to be formed, it is believed that a principally gas expanded unit proves most economical—hence the emphasis on the gas-formed cellular structure. By a principally gas-expanded unit is meant one which is expanded by air, gas or other fluid expansion rather than by a solid agency.

While only flat units are shown, it is possible to mold units of curved or other irregular shapes which have, nevertheless, varied characteristics of the sort described herein, by the same general methods. Also it is possible to use other methods of varying the degree and kind of expansion without departing from the spirit of the invention. In general, this invention includes all building units of multi-cellular type in which the structure and degree of cell structure is varied within the unit for one or more of the objects herein explained.

The apparatus and process features of this application originally contained herein are reserved for divisional application Serial No. 701,332.

In the present instance, this application is restricted to a non-leaking type of wall structure.

The invention claimed is:

1. A wall structure comprising a plurality of building units arranged as a single unit thickness wall, mortar between the units and waterproofing elastic material adapted to prevent leakage along the mortar joints the units being of ceramic material having an expanded body portion and a dense relatively impervious outer layer, part of the elastic waterproofing material being in con-

tact with the outer layer to form a substantially continuous water tight outer surface.

2. A non-sweating wall structure comprising a plurality of expanded ceramic units arranged as a single unit thickness layer, mortar between the units and of interrupted character, the interruption occurring intermediate the sides of the unit thickness wall, waterproofing cushion sealing means between the units and in the interruption; each unit having a wall surface forming glazed face, the mortar having additional waterproofing sealing means in the joints between the units and immediately adjacent the glazed faces thereof.

3. A wall structure as defined by claim 1, characterized by the addition of a ceramic glaze to a surface of a dense layer.

4. A wall structure as defined by claim 1, characterized by the addition of a ceramic glaze to a surface of a dense layer, the units being of varied character, the portion of the units remote from the glazed face having a cellular structure and having relatively high thermal resistance.

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