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G. C. DOUGLAS
CONSTRUCTION MATERIAL
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Fig. 1

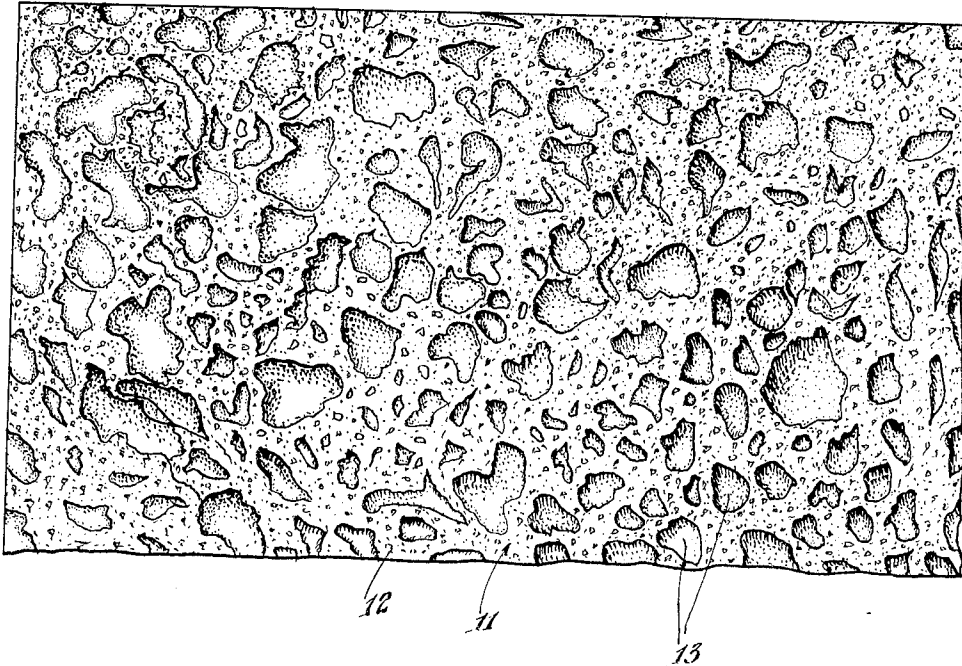
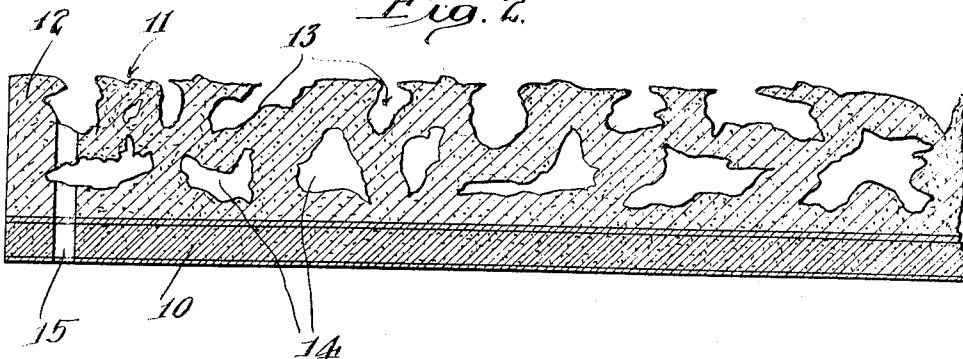


Fig. 2



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CONSTRUCTION MATERIAL

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This invention relates to a new and novel construction material. Particularly, the invention relates to a construction material in the form of tile blocks or panels having acoustic properties so that said blocks, tile or panels may be used in construction work for sound deadening or sound absorbing purposes as well as a structural wall covering. Briefly, the construction material embraced by this invention comprises a structural base having a layer of acoustic or sound absorbing material bonded to a surface thereof so as to form a unitary body capable of being fastened to walls or ceilings.

An object of this invention is to disclose and provide a unitary structural material which is strong, light in weight and having sound absorbing characteristics.

Another object is to disclose and provide a construction material having a structurally strong backing and a covering of relatively light and porous sound absorbing material having cavities on its outer surface.

Other objects and advantages, uses and functions of this invention will be apparent to those skilled in the art from the following detailed description of the structural material embraced by this invention and one preferred method of making the same.

It has been well known for some time that reverberation of sound in halls, auditoriums and other edifices could be materially reduced or substantially eliminated by introducing sound absorbing materials into said rooms, halls or auditoriums. Very often the walls of such rooms have been covered with porous materials or fibrous materials having an open texture so as to break up the continuity of the wall and thereby assist in reducing the amount of reverberation and in absorbing excess sounds. The first difficulty encountered has been mechanical, that is, the difficulty of placing or fastening such sound absorbing or acoustical bodies on walls or ceilings. The only materials which can be readily applied are fiber boards having a loose open texture as these boards can be obtained in fairly large sheets and may be readily attached to the walls or ceilings by means of nails, screws and the like.

None of the materials heretofore known to possess acoustical properties suitable for the purposes hereinabove described have been entirely satisfactory, for the reason that the materials have been incapable of absorbing the various vibrations or tones uniformly. For example, an efficient sound absorbing or acoustical material should absorb sounds lying in the pitch between C¹ and C⁷ of the musical scale by tests have shown that all of the acoustical materials now on the market (including fibrous materials, cementitious materials, and the like) absorb the higher or instrumental notes with much greater efficiency than those pitches which are used in human speech. This characteristic leads to the result that auditoriums, for example, may be constructed and properly insulated against sound reverberations and the results therein as far as instrumental music is concerned and particularly the higher notes thereof, will be very good, but when such auditorium is used for the presentation of stage plays or other purposes in which the human voice plays an important part, it is found that reverberation still occurs and it is impossible to clearly hear and understand the speakers in various portions of the auditorium.

I have discovered that a porous material having cavities on its outer surface ranging in size from about one inch to 0.02 inches and having an average opening of from about 0.2 to 0.3 inches will substantially uniformly absorb sounds of varying pitches.

A material of this nature may be readily produced from cementitious material by adding gas-forming ingredients to a cementitious material and then casting or molding a block or tile therefrom, the gas forming ingredients causing porosities in the cementitious material. After this material has set, these porosities may be exposed by scraping the surface of the tile panel or block so as to remove the excess of cementitious material which may have a tendency to envelope or cover the pores.

A cementitious material of the above described nature, however, can not be used alone to any advantage as it is relatively weak

structurally and in view of the fact that panels or blocks of such material need not be over one, or at most, two inches in thickness, such thin blocks can not be fastened to walls or ceilings without undue breakage or loss. Furthermore, the plastic or semi-fluid composition utilized making up the tile is of such fluidity that it can not be applied to a wall in the form of a plastic or fluid mixture and allowed to set on the erected wall, as the composition runs off and can not be troweled as this liberates the gases formed by the gas-forming constituents and reduces the mass to such density that the porosity of the finished surfacing is ineffective. It will be readily understood that if a body of fluid cementitious material containing gas-forming constituents is agitated or worked or troweled in any manner, such working or troweling would cause the gas to be freed from the cementitious envelope and the entire tile will contain not only a much smaller proportion of pores, but such pores as are still left in the material would not be at the surface where they are of any use, but in the bottom or deepest portions of the cementitious mass.

By means of this invention, it is possible to produce a structural cementitious acoustically sound absorbing material which is not only easily applied and fastened to walls and ceilings, but uniformly absorbs various sounds or pitches.

In describing one preferred form of this invention, reference shall be had to the attached drawings in which:

Figure 1 is a plan view of one portion of a tile or panel showing the porous surface which is exposed to the reception of sounds.

Figure 2 is a vertical section taken through such tile shown in Figure 1.

In manufacturing a tile embraced by this invention by one preferred method, a structural body or base such as, for example, a plaster board, wood panel, fibrous board, or chip board or other like material which is normally employed in the form of sheets and which is adapted to reinforce the tile, such as the plaster board 10 in the drawings, is laid within a suitable mold or upon some horizontal or substantially horizontal surface and a cementitious composition containing gas-forming ingredients then mixed with water to produce a plastic or semi-fluid mixture of the desired consistency and such plastic or semi-fluid mixture placed or poured upon the upper surface of the structural base 10. The cementitious material is applied to the structural base 10 to a desired depth or thickness, for example, one inch and is gently troweled or leveled, for example, by means of a straight edge resting on the sides of the mold in which the operation is carried out.

The cementitious material is applied to set

in contact with the structural base 10 so as to insure a thorough bond between the base and the cementitious material. If desired, the structural base 10 may be treated so as to key into the cementitious material and for this purpose, various forms of lath board now on the market may be employed with advantage.

After the cementitious material has set in contact with the structural base 10, the upper surface 11 of the cementitious body 12 may be lightly scraped or otherwise treated so as to expose the cavities or porosities 13. It will be understood that some of the porosities 13 will be formed and exposed prior to said scraping or exposing operation, but an additional number of porosities which may be covered by thin film of the cementitious material 12 are thus exposed by the scraping operation. In addition to the exposed cavities or porosities 13 there are innumerable gas filled pores 14 throughout the body of cementitious material so that the weight of the finished product is very light.

Wherever reference has been made to a cementitious material, it is desired to embrace all compositions containing gypsum, Portland cement, magnesium oxy-chloride or other similar materials containing gas-forming ingredients such as, for example, aluminum sulfate or magnesium carbonate, calcium sulfate and an acid salt or other acid material capable of reacting therewith or finely divided calcium carbide capable of reacting with water or other gas-forming constituents of similar nature.

In addition to the cementitious material and the gas-forming ingredients the composition may contain fibrous matter or a filler. A suitable filler found to be very suitable for this work should preferably be of a porous character, for example, diatomaceous earth. It will be understood that various retardation or accelerating materials may also be added to the composition depending somewhat upon the character of the cementitious material, the character of the gas-forming ingredients or the plasticity or fluidity of the mixture so that the resulting porosities may fall within the limits of size given hereinabove.

One composition which has been used with great advantage may be formed by mixing about 85 to 95% by volume of ordinary casting plaster, 2 to 8% by volume of magnesium carbonate and 2 to 8% by volume of aluminum sulfate. When this mixture is rendered plastic or semifluid by the addition of water and then quickly poured or placed upon a structural base, the aluminum sulfate dissolves in the water and acts upon the magnesium carbonate forming a multiplicity of areas throughout the mass in which carbon dioxide is being liberated. This produces a porous mass, the carbon dioxide being trapped within the body by the cementitious

material. Three to eight percent by weight of a fibrous material such as hemp, hair or asbestos may be added to the mixture so as to render it more resistant to shock. A pigment or other coloring material may also be added to the composition so as to form a body of pleasing color and in harmony with the building or interior in which the finished tile or panel is to be used.

It has been found that with the above composition the use of a retarder is not required, the gas-forming ingredients preventing a too rapid set of the gypsum. If, however, a retarder is desired, it may be added to casting plaster, or a hard wall gypsum plaster may be used.

In order to facilitate the fastening of the pre-formed tile or panels hereinabove described to walls or ceilings, the structural base 10 may be provided with means adapted to cooperate with fastening means by means of which the finished tile or panel may be attached to the walls. For example, the structural base 10 may be provided with perforations or openings 15 such perforations or openings being placed near the edges of the tile so as to allow nails, screws, or other fastening means to be easily passed there-through. During the molding and forming operation hereinabove described, pegs or other cores may be placed in the openings 15 extending to the surface 11 of the finished body so that after casting or molding the panel the pegs or cores may be withdrawn leaving an opening through the finished tile and thereby facilitating the location in openings 15. Screws may then be placed in the openings extending through the body 12 of the tile and coinciding with the openings 15 in the structural base thereof and the completed tile fastened to the wall or ceiling by means of said screws. The openings left in the cementitious body above the opening 15 may later be filled up by pointing or filling with a suitably colored cementitious composition.

Instead of the openings 15 tie wires or other fastening means may be attached to the structural base 10 extending for some distance beyond the lower or back surface of the finished tile so as to enable the tile to be fastened to ceilings or other portions of a structure. Numerous changes and modifications may be made in the fastening means without departing from the invention. For example, the tile embraced by this invention may be applied to a brick, hollow tile or rough plastered wall by spotting the wall and/or the backs of the tile with a gypsum composition, lime mortar or other cementitious material capable of thoroughly adhering to both the wall and the structural backing of the tile, and then merely placing the tile in contact with such spotted wall, as by pressing the tile into place.

It will be understood that instead of molding the tiles in their finished form and size, large sheets of the structural backing 10 may be used and very large tile made which may later on be sawed or otherwise cut to the required size.

The outer or sound absorbing surface of the tile may be variously colored or treated so as to render it water resistant, harder or to impart a polished, smoother non-dusting surface thereto. For example, the surface of the tile, after exposing the porosities on the surface, may be treated with a solution obtained by dissolving boric acid in aqueous ammonia, or with a solution containing stearic acid and sodium carbonate.

It will be seen, therefore, that by means of this invention a structural body is produced having considerable strength, although the acoustical material itself is relatively weak and brittle. The tiles may be readily placed and fastened to walls and ceilings and the peculiar character of the surface developed by the compositions hereinabove described enables the material to absorb various pitches or notes in a relatively uniform manner. Heretofore it has been impossible to utilize a composition of the character described herein in detail for sound proofing or sound absorbing surfaces, whereas by means of the tile herein described, such surfaces are made available and very desirable results may be obtained.

I claim:

1. As an article of commerce, a preformed acoustic tile comprising, a base of plaster board, a layer of porous cementitious material having cavities exposed on its surface bonded to one side of said base during the setting of the porous cementitious material and provided with means adapted to cooperate with fastening means to attach said tile to walls and ceilings.

2. As an article of commerce, a preformed sound absorbing construction material comprising, a base of structural material, a layer of porous gypsum composition having cavities ranging from about 0.02 to 0.8 inches in average dimensions exposed on its surface and bonded to one side of said base during the setting of the porous gypsum composition and provided with means adapted to cooperate with fastening means to attach said tile to walls and ceilings.

3. As an article of commerce, a preformed sound absorbing construction material in the form of panels and tiles comprising, a base of plaster board and a layer of porous cementitious material having cavities exposed on its surface, bonded to one side of said plaster board during the setting of said porous cementitious material.

4. As an article of commerce, a preformed sound absorbing construction material comprising a base of structural material and a

layer of porous cementitious material having cavities exposed on its surface, said cementitious material being bonded to one side of said base during the setting of the porous cementitious composition.

Signed at Los Angeles, California, this 13th day of June, 1928.

GORDON C. DOUGLAS.

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