

Aug. 11, 1942.

O. HAYDON ET AL

2,292,444

TILE

Filed Aug. 3, 1940

Fig. 1.

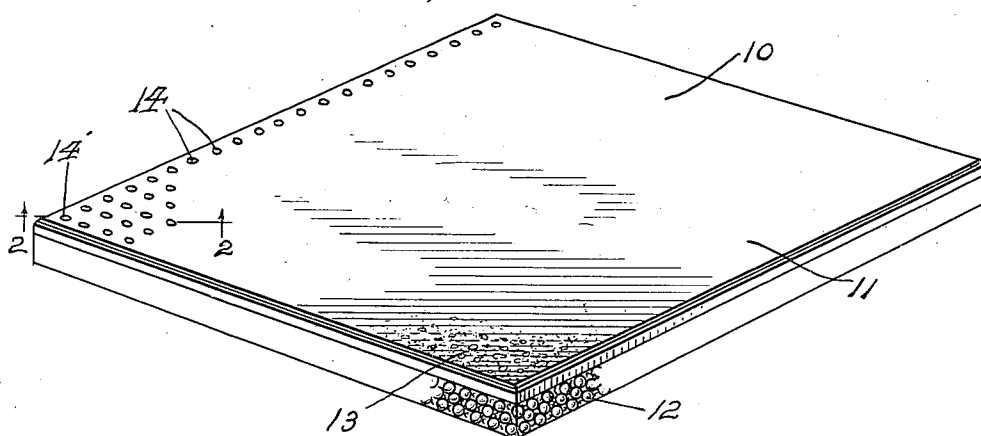


Fig. 2.

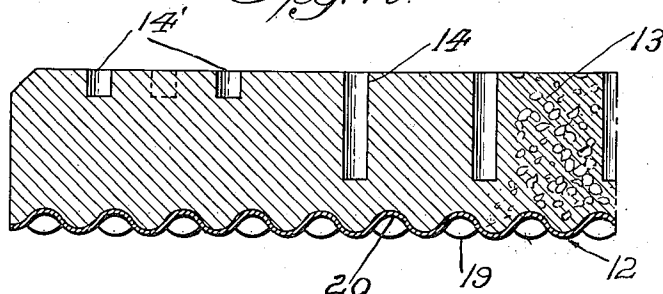


Fig. 3.

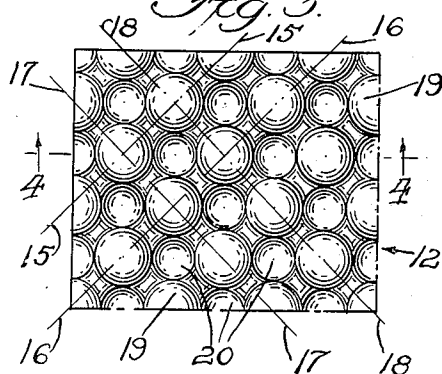
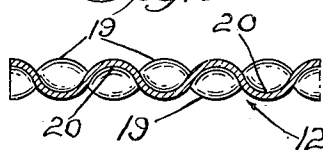


Fig. 4.



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UNITED STATES PATENT OFFICE

2,292,444

TILE

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Application August 3, 1940, Serial No. 350,891

3 Claims. (Cl. 72-18)

This invention relates to a new and improved tile and its construction and it in particular deals with the method of manufacture of the composite composition tile which is the subject matter of our invention.

The preferred form of the composite tile of the invention is an acoustical correction tile, that is, a sound absorbing tile such as is particularly illustrated in the drawing and which comprises a porous sound absorbing cementitious body portion which is preferably cast on a sheet form reinforcing backing. It is to be understood that the composition tile of our invention need not necessarily be an acoustical correction tile but that it may be merely a decorative tile and that the cementitious body may be either porous and cellular in order that it may be of relatively light weight or the body portion may be non-cellular and dense. Still further, the body portion of the tile may be provided with independent artificial openings extending inwardly from a surface to enhance the acoustical value or the face of the tile may be given a suitable decorative configuration or the like should such be desired to accomplish the particular purposes for which the tile is designed for use.

It is to be understood that the invention is not limited to the specific form of tile as illustrated in the accompanying drawing but that such merely illustrates a representative and preferred form of our invention. As will be well understood by those skilled in the art to which our invention appertains, the preferred embodiment as illustrated in the drawing is susceptible to various modifications, and it is the intention that such shall be covered insofar as such fall within the limitations of the accompanying claims.

The objects of our inventions are:

The provision of a tile comprising broadly a set cementitious body portion having a sheet form backing and in particular such a composite tile which does not warp during the process of its manufacture.

A still further object of our invention is the provision of a composite light weight porous and cellular acoustical correction tile the body of which is composed of a porous and cellular cementitious material which is reinforced with a sheet form backing, and particularly wherein in such combination the sheet form backing is of such configuration and construction that it does not have a tendency to warp the cementitious body portion during the process of manufacture.

Still other and further objects of our invention are the provision of a suitable process for

producing the preferred form of our tile product, including, the provision of suitable compositions and methods of manufacture for the production of the desired light weight and planar tile form product comprising our invention.

In the accompanying drawing,

Figure 1 is a perspective view of the improved composite tile;

Figure 2 is an enlarged section of our composite tile taken on section line 2-2 of Figure 1;

Figure 3 is an elevation illustrating the sheet form backing and reinforcement; and

Figure 4 is a cross-section of the sheet form backing and reinforcement taken on section line 4-4 of Figure 3.

In the drawing our composite tile is illustrated in Figure 1 wherein the tile is designated by the numeral 10, the cementitious body portion thereof by numeral 11 and the reinforcing backing by numeral 12. It will be noted that in Figure 1 the reinforcing backing 12 is illustrated as having been turned up over the side edges of the tile so that it extends substantially the height of the side edges of the tile and that at one corner of the tile the detail of the reinforcing sheet, such detail being more clearly illustrated in Figures 3 and 4, has been indicated and it is, of course, to be understood that actually this detail of the reinforcing sheet is continuous for the entire area of such reinforcing sheet.

Further, in connection with Figure 1, at the front corner of the tile as at 13 it is indicated that the tile body may be of a porous and cellular structure and along the left hand back edges of the tile there are illustrated independent artificial openings 14 extending from a surface of the tile body into the interior portion thereof, such independent openings 14 providing for the entry of sound waves from the exposed surface of the tile into the interior of its body.

In Figure 2 the various forms of the body of the tile as have been above noted with respect to the illustration in Figure 1 are also shown, the porous and cellular portion of the construction being there identified by the numeral 13 and the independent artificial openings by the numeral 14. In connection with the artificial opening 14 it is to be noted that certain of these may be of shallow depth or that they may be of substantially the depth corresponding to the height of the tile, but it is to be noted that the particular depth of the openings 14 is not critical with respect to the inventions of this application, excepting that it is preferable that if the tile is provided with such independent artificial open-

ings that several of such on the corners of the tile indicated in Figure 2 at 14' shall be of shallow depth so that there will be a substantial amount of material at the corners and below the bottoms of such shallow artificial openings 14' 5 whereby the tile may be amply secured by nails driven into such shallow openings 14' until the heads of the nails seat at the bottoms of the openings 14'.

The reinforcing backing sheet which is illustrated in detail in Figures 3 and 4 is a particular form of sheet material which is fabricated in such manner that the sheet has some "give" or stretchability in all directions in the plane of the sheet and has substantially uniform flexibility in all directions. The preferred form of sheet 12 is one which is formed with what might be termed continuous corrugations in two sets, one arranged at right angles to the other. Looking at one side of the sheet 12 there will be seen spaced rows of slightly spaced circular elevations, one row of such being the circular elevations falling on line 15—15, Figure 3, with the adjacent and slightly spaced line of such elevation or projections falling on line 16—16 of Figure 3. A series of elevations similar to those just described but arranged at right angles to those elevations or projections falling on lines 15—15 and 16—16 are apparent as falling on lines 17—17 and 18—18, these projections or elevations falling on one side of the sheet being indicated by numerals 19. Arranged between the respective lines of elevations from a face of the sheet, as for example those falling on lines 15—15 and 16—16, there are a series of depressions wherein each depression occurs centrally between four surrounding elevations or projections 19, such depressions being indicated by the numeral 20.

A sheet constructed as above described, when looking at the other face from that particularly illustrated in Figure 3 will have the same appearance as does the face which is illustrated, that is, the spaced rows of depressions 20 as viewed from one side appear on the other side of the sheet as spaced rows of elevations or projections 19 and likewise the projections 19 of the face of the sheet as particularly illustrated will on the other face appear as spaced rows of depressions 20 arranged between the elevations or projections 19 of that face with the respective elevations and depressions appearing in parallel rows in two directions at right angles one to the other.

It is, of course, to be understood that the construction of the backing sheet 12 is not to be specifically limited to the preferred form which is illustrated in the drawing and which has been described in detail, but that the sheet may be of any form which is the equivalent of that which has been illustrated and described, that is, the sheet 12 may be provided with any form of corrugations, ribbing, embossing or the like which provides a sheet which, similar to the sheet specifically illustrated and described, has substantially uniform flexibility in all directions and likewise has a degree of "give" or stretchability in all directions in the plane of the sheet.

In the manufacture of a tile in accordance with our inventions there is preferably provided a suitable mold, not illustrated, in which may be positioned a backing or reinforcing sheet 12 which as previously mentioned may be either only coextensive with the area of the back of the tile or may be provided with turned up edges as is particularly illustrated in the drawing, the only

difference in this respect being in that a backing sheet 12 which has its edges turned up serves when the tile is cast thereon to reinforce the finished tile to a slightly greater extent than does the construction where the backing sheet 12 is merely co-extensive with the area of the rear face of the tile.

A suitable cementitious mixture is then prepared and suitably poured into the mold on the backing and reinforcing sheet 12 and is leveled off and allowed to set or harden and then, if desired, as will be well understood, the face of the tile may be suitably leveled as by a sanding or planing and if desired the edges of the tile may be bevelled or similarly finished.

The cementitious material which forms the body of the tile may be, for example, calcined gypsum, suitably mixed with water and other ingredients to form a slurry which may be cast on the sheet 12, it being understood that while gypsum is the preferred material for the body of the tile, that such may be formed of cement, a magnesium oxychloride mixture or in fact of substantially any setting cementitious substance. The cementitious substances for the body of the tile may be prepared in the usual manner as a slurry and cast to form a relatively dense and heavy tile, particularly if the tile is to be used merely for decorative purposes, or especially if the tile is to be used for acoustical correction it will preferably be formed of a porous and cellular structure which may be obtained in various ways, as for example, by the injection of a gas into the slurry as it is being mixed, by the inclusion therein of various bubble forming substances as for example saponin with starch for stabilization, by the separate preparation of a tenacious foam which is mixed through the cementitious slurry, or the porous and cellular structure may be, as it will be well understood, achieved by any other suitable process which will produce the desired cellularity and porosity of the finished tile.

The preferred mixture for formation of the slurry for casting the body of the tile is one in which the materials comprising the mix are in the proportions of—calcined gypsum, 24½ lbs.; water, 16 lbs.; lightening agent 1.41 oz.; these expressed in percentages by weight being—calcined gypsum, 60.28%; water 39.50%; and lightening agent 0.22%.

The material of the composition which has been referred to as a lightening agent will be so referred to in discussing the process of producing the desired tile product and subsequently this lightening agent will be defined in order that those skilled in the art may be able to by following the description hereof produce the product comprising the inventions which are herein set out in detail.

In the process of preparing the above mixture of material for casting the desired tile the procedure is preferably as follows: The required amount of water and lightening agent, together with a small amount of coloring pigment, if the final product is to be colored, are placed in the container of a suitable mixing apparatus and are subjected to sufficient agitation to insure nominal solution of the ingredients. Of course, in connection with the coloring which is used those skilled in the art will understand that preferably such should be a suitable fast color and that it should be compatible with the primary ingredients, as for example, if the primary ingredients is calcined gypsum, the coloring material should be lime-proof, but since these features concern only

matters of suitable selection no detail will be given.

For mixing the various materials which are combined for the production of the desired tile, particularly if a light weight tile is to be produced there is employed a mixer which mixes the ingredients with a high speed beating action. The beater used is preferably a so-called dough mixer having a container mounted for rotation at a slow speed and with vertically mounted beaters or whippers which extend down into the container and are rotated at relatively high speed.

After the water, lightening agent and colored pigment, if such is used, have been mixed in the mixer to nominal solution, there is then added the required amount of stucco or calcined gypsum and the whole is subjected to a violent whipping action for a short period of time, about 30 seconds, but, specifically for such time as is required for whipping into the mixture the requisite air bubbles or air cells for the desired reduction in weight of the final product. This whipped mixture will be referred to as a fluffed mix.

It is to be understood that the preferred method of mixing as has been described, has been described only as representative and that any type of mixing may be used which will afford violent agitation, as differing from a mere mixing, for the incorporation of the air cells or air bubbles into the mix.

The mix which has been fluffed up is then poured into the molds which have been previously mentioned and in which the backing or reinforcing sheets as previously described have been placed and when the molds are substantially filled the surface is screeded off and the cementitious composition is allowed to set up. After the composition has set up it is removed from the molds and placed on kiln cars which are run into a suitable kiln for drying the product and then after the molded tile are dried they are suitably surfaced and bevelled or the like as has been previously described.

The backing or reinforcing sheet which has been previously described in considerable detail as regards its construction is preferably a sheet of material ordinarily referred to as paper which is composed of cellulose fiber and which is preferably slack sized, which, because of the specific form thereof with the continuous rows of elevations or projections as has been described, is flexible in all directions, and because of such compensates for expansion and contraction without tendency to warp the cementitious cast which has been cast thereon in the process of producing the tile of the invention in accordance with the such process as has been heretofore described.

The cast and dried composite tile which has been previously described may have incorporated therein during its process of manufacture 1 lb. of dextrine, for 10 sq. ft. of 1" thickness, which will serve to harden and strengthen the material throughout or the such tile, preferably after its face has been finished by sanding or the like has been described, may be sprayed with a size which will strengthen the surfaces, such size comprising a mixture of water, 5 gal.; casein 1.37 lb.; sodium silico-fluoride, 25 grams; preservative, as for example, pentachlorophenol, 20 grams; ammonia, 250 ccs. The inclusion of the dextrine in the mixture as described strengthens the entire tile throughout its body, whereas the spraying of the surface of the tile with the casein solution as described serves to strengthen and harden the sur-

face of the tile without extending such effect throughout the body of the tile.

A tile manufactured in accordance with the foregoing process has the decided advantage over tile previously manufactured in that in the combination described the particular backing or reinforcing sheet does not cause a warping of the tile when it is dried, and the backing sheet as described having an equal or uniform resistance to bending in its various directions and also providing for or compensating for expansion and contraction in all directions in the plane of the sheet does not as the cementitious material which is cast thereon is dried, tend to draw the structure with consequent warping so that the composite tile manufactured as described is a flat and unwarped product which cannot be obtained so far as it is aware with any other combination of backing sheet and cementitious body material other than that which has been disclosed and described in the foregoing.

The lightening agent referred to is a substance which when beaten up with the cementitious material, water, and so on of the mix, will bring about the formation and stabilization within the mix of a large number of relatively uniform air bubbles which when the mixture is hardened or sets results in a porous and cellular finished product. The preferred type of lightening agent for use particularly in connection with calcined gypsum, cement, and the like, is that class of chemical compounds generally defined as the sulphonic acid of alkylated aromatic polynuclear hydrocarbons or the salts thereof. This particular class of lightening agents which have the desired properties of, or are termed as, surface tension reducing agents and surface active agents produced the desired results to a degree which it has not been possible to obtain with any other class of chemical agents. For some reason this particular class of chemical agents will in the presence of lime and lime salts cause the formation of a great number of stable air bubbles within a mix as has been described when the mix is subject to violent agitation, these air cells or bubbles being extremely stable so that the slurry in which the bubbles are incorporated may be cast and dried without substantial loss of the air bubbles which have been incorporated therein, and therefore resulting in a product which, of course, depending upon the amount of lightening agent used and the amount of beating, is porous and cellular and is of a weight much less than a similar product made without the incorporation of the air cells in the mix thereof. A very satisfactory weight is that of 1 1/8 pounds for a tile 1" x 12" x 12".

It is, of course, to be understood that the lightening agent, or, referring to this matter more generally, the means for producing a light weight final product which is porous and cellular, is not limited to the incorporation of a lightening agent as referred to, but alternatively the porosity and cellular structure may be obtained by other more or less equivalent means. For example, a stable foam may be produced by proper frothing of a casein and rosin mixture and such froth may be incorporated in a slurry of the cementitious material or there may be incorporated in the cementitious material a metal, as for example, powdered aluminum, which will react with ingredients of the mix to produce a gas which will be more or less retained within the mix particularly if there is also incorporated a small

amount of a film forming colloid, as for example, starch, casein, or the like.

The various modifications for the production of a light weight cementitious body for the tile will be readily understood by those skilled in the art and it is to be understood that these various modifications in the production of a light weight body material are to be comprehended as within the confines of our invention as defined in the appended claims.

There having been described and fully disclosed a composite tile which is a new and improved product and there having been described the processes of the manufacture thereof, there is claimed:

1. The method of producing from a gypsum plaster mix an unwarped tile having a paper reinforcing sheet on one face and comprising the steps, preparing a wet gypsum mix, providing a preformed paper sheet which over the entire area thereof has closely adjacent individual but spaced dimpled portions formed by projections comprising integral portions thereof projected from the general plane of the sheet, applying a layer of wet gypsum plaster mix to the surface of the paper sheet and allowing the gypsum plaster layer to set with a surface thereof in contact with a surface of the preformed paper sheet, whereby as the gypsum plaster sheet crystallizes, crystals thereof anchor into the adjacent surface of the preformed paper sheet, a surface of the gypsum plaster sheet exposed during the setting period whereby differential expansion and contraction of the gypsum plaster layer and the paper sheet may occur without placing the gyp-

sum plaster layer under stresses sufficient to cause the tile to warp.

2. A tile comprising, in combination, a set gypsum mix forming a lightweight porous and cellular body portion and a reinforcing backing paper sheet having the edges thereof turned up substantially at right angles to the plane of the body of the sheet, said reinforcing backing paper sheet having over substantially the whole area thereof individual adjacent, but spaced dimpled portions thereof projected from the general plane of the sheet, whereby the sheet has substantially uniform flexibility in all directions, the set gypsum mix cast directly on and having the crystalline structure thereof interlocked in the fiber structure of the reinforcing backing paper sheet and within and confined by the upturned edges thereof, whereby the edges of the tile and the lightweight porous and cellular body portion are reinforced and the tile is free from warping stresses.

3. A reinforced cementitious tile comprising, a sheet of a set cementitious mix, in combination with a felted fiber backing sheet which over substantially the entire area thereof has closely adjacent but spaced dimpled portions thereof projected from the general plane of the sheet, the rear face of the cementitious facing sheet adhered to a face of the felted fiber backing sheet and the front face of the cementitious facing sheet being the exposed face of the reinforced cementitious tile.

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