

July 19, 1938.

K. SLIDELL

2,124,086

SOUND ABSORBING CONSTRUCTION

Filed Dec. 21, 1935

3 Sheets-Sheet 1

Fig. 1

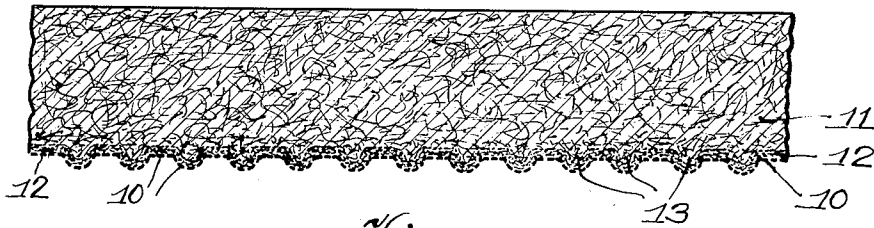


Fig. 2

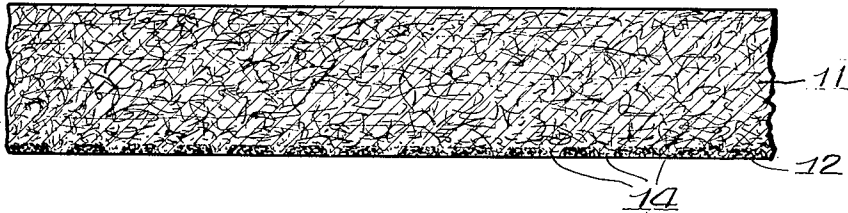


Fig. 3

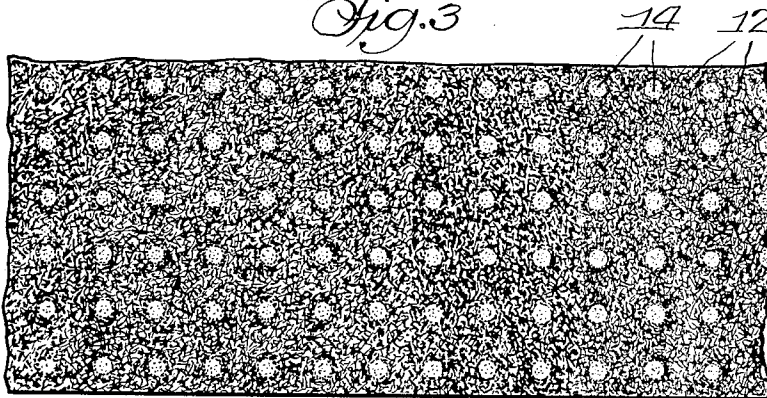
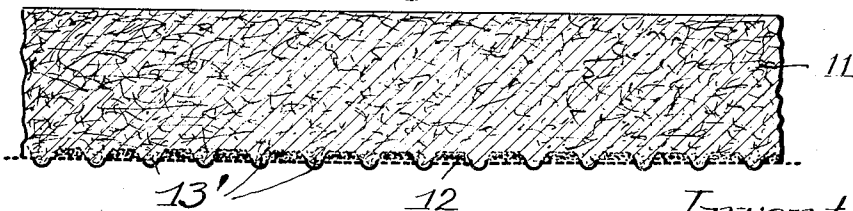


Fig. 4



Witness:

Chas. R. Moush. Dyrenforth, Lee, Critton & Hiles, Attys

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Fig. 5

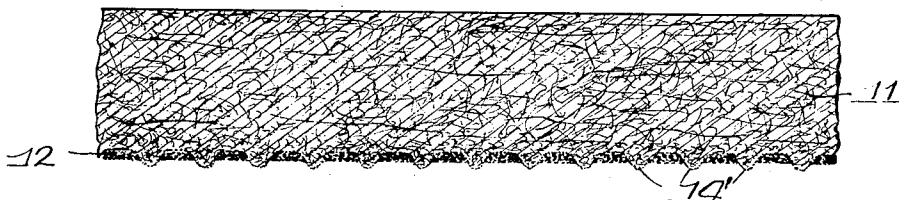


Fig. 6

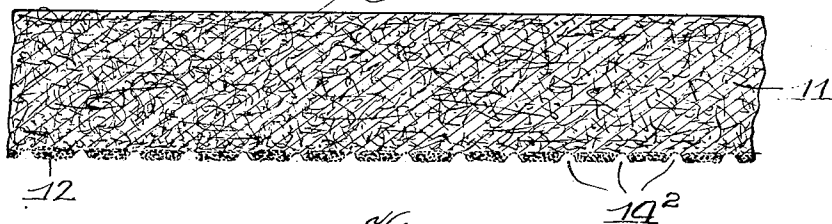


Fig. 7



Fig. 8

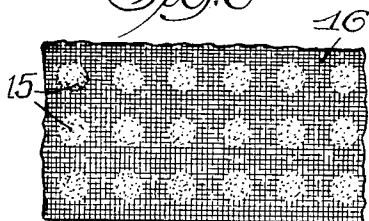


Fig. 9

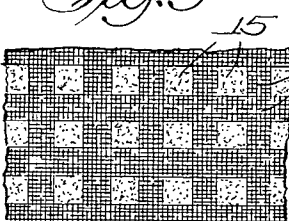
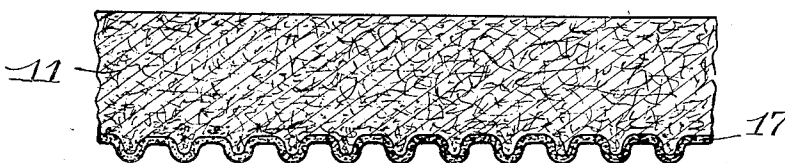


Fig. 10



Fig. 11



Witness

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Filed Dec. 21, 1935

3 Sheets-Sheet 3

Fig. 12

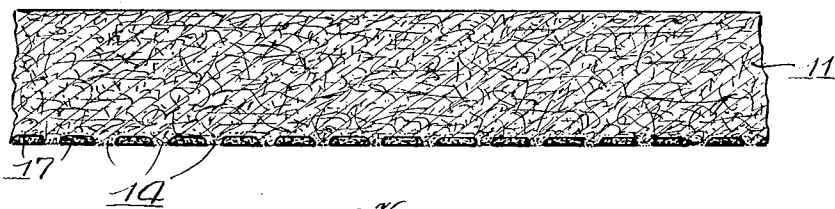


Fig. 13

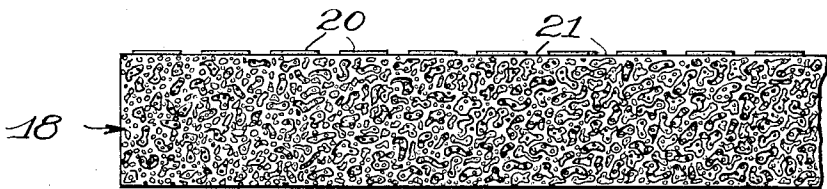
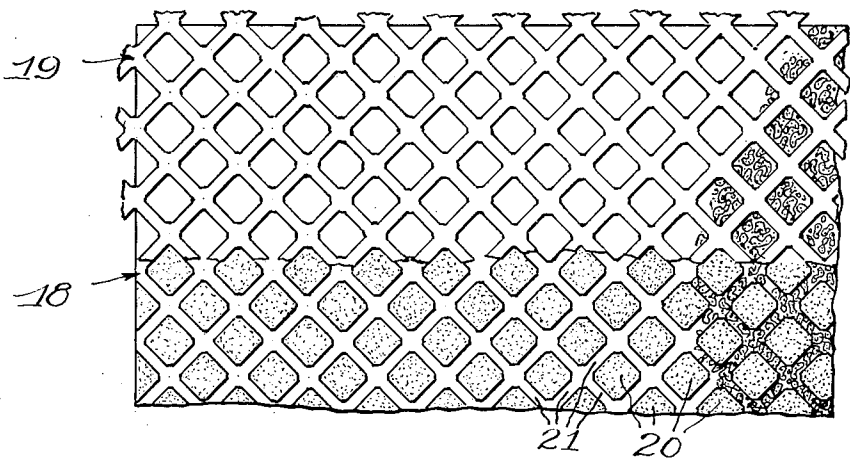


Fig. 14

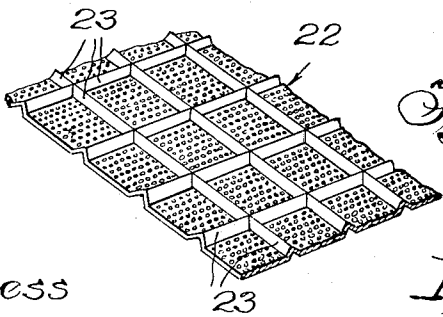


Fig. 15

Witness

Chas. R. Korsch, Dyrenforth, Lee, Chritton & Hile, Attys.

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UNITED STATES PATENT OFFICE

2,124,086

SOUND ABSORBING CONSTRUCTION

Kemper Slidell, Madison, Wis., assignor to C. F. Burgess Laboratories, Inc., Chicago, Ill., a corporation of Delaware

Application December 21, 1935, Serial No. 55,657

10 Claims. (Cl. 72-18)

This invention relates to an improved sound-absorbing construction and to a method for producing this construction.

At the present time it is the practice to mount
5 soft sound-absorbing material such as hair felt, soft asbestos, mineral wool and the like back of a membrane such as perforated metal and other stiff sheets, such as are described and claimed in Norris Patent No. 1,726,500, issued August 27,
10 1929, or back of cloth or similar material. This is done in part to give the construction a decoratable finish. Although sound-absorbing pads or tiles of denser material are used without a decoratable membrane in acoustical installations, nevertheless these are usually too dense to have
15 a high sound-absorbing capacity.

In said Patent No. 1,726,500, Norris points out that it is necessary to have only a small proportion of a metal membrane perforated to secure
20 the full absorption value of the sound-absorbing material back of it. I have applied this principle in my improved construction.

When a fibrous product with a high sound-absorbing value is formed in the wet way on a
25 screen, the surface adjacent the suction side of the screen is usually dense, due to an accumulation of the material next to the screen. This forms a substantially non-sound-absorbing skin or non-permeable facing. It has been thought
30 necessary to remove this skin to make available the high sound-absorbing interior portion. It has been the practice also to bore deep holes into the pad or tile to secure the same result but such
35 holes detract greatly from the appearance of the installation and catch dirt. Aside from its low sound-absorbing value, this dense skin is desirable since it forms an easily decoratable surface and adds stiffness to the tile or pad.

Following the principle of the Norris construction, it is only necessary to remove small areas of this dense skin to secure full advantage of the sound-absorbing properties of the interior. If
40 the tile is formed on a flat screen it becomes necessary to bore holes through this skin or otherwise remove it locally but this often detracts from the appearance where a substantially plane
45 surface is desired.

In the drawings Fig. 1 is a sectional view illustrating the formation of a tile on a screen or other foraminous member;

Fig. 2 is a sectional view of a tile with the projections removed or with porous sound-absorbing areas otherwise formed in the exposed
55 surface of the tile;

Fig. 3 is a bottom view of the tile shown in Fig. 2;

Figs. 4, 5 and 6 are sectional views of modifications;

Fig. 7 is a diagrammatic view of a screen 5 adapted for use in the manufacture of tile in accordance with the invention;

Fig. 8 is a bottom view of a screen made in accordance with Fig. 7 with uniformly distributed plugged areas;

Figs. 9 and 10 are similar bottom views but with modifications in the shape and arrangement of the plugged areas;

Fig. 11 is a section of another modification of tile in unfinished condition;

Fig. 12 is a section of the same in finished form;

Fig. 13 is a plan view of a ceramic tile having a stenciled coating applied to the surface;

Fig. 14 is a side elevation thereof; and

Fig. 15 is a perspective view of a modified form of perforated members for the formation of a tile thereon.

To secure the desired results mentioned above I form or mold the sound-absorbing pads or tiles 25 on a suitable screen or other perforated surface using suitable material, such, for example, as a pulp of asbestos fiber and a binder. The perforated surface 10 has small indentations or recesses, as shown, so that the resulting tile formed 30 on it has corresponding projections, having the cross-sectional appearance of Fig. 1. By using suction on the mold a densified surface skin may be formed. The main body of the sound-absorbing material 11 has a dense surface or facing 12 35 upon which are the distributed projections 13 containing porous sound-absorbing cores. If the indentations of the screen 10 are made of unperforated stock, as shown in Fig. 4, the pulp is not densified as much in projections 13'. After the 40 tile has dried, the projections, which may be entirely porous or may consist of a porous core with a densified skin, as shown, are ground off or otherwise removed to leave the plane surface of Fig. 2 in which the substantially non-sound-absorbing surface 12 has the small bosses of sound-absorbing backing projecting through it, i. e. distributed small sound absorbing areas 14 are exposed. Said areas, which are free of the additional material necessary to make the dense 50 facing, allow the sound waves incident on the facing to penetrate into the sound-absorbing backing. If desirable, the exposed areas 14' of sound-absorbing material may be allowed to project beyond the surface, as shown in Fig. 5, or 55

they may be finished to form slight depressions 14², as shown in Fig. 6.

By incorporating coloring matter in the sound-absorbing material before forming the tile, decorative effects may be obtained to obviate the necessity for decorating the tile after installation.

Another method by which a similar result may be obtained is by the use of the suction screen of Fig. 7. The screen is plugged at the areas 15 where the pulp is to remain porous, the dense areas forming where the screen is open as at 16. By this method the dense and porous areas are not as clearly defined as when made by the previous method, but Fig. 2 is fairly illustrative of the product which is formed, except that the porous areas are much larger.

Fig. 8 is a bottom view of the screen just referred to with round plugged areas spaced equal distances apart in longitudinal and transverse rows. Fig. 9 is a similar view with the plugged areas in the form of squares arranged in longitudinal and transverse rows. Fig. 10 is a similar view with round plugged areas arranged in diagonal rows. The plugged areas may, of course, be in the form of long lines or bands spaced apart and running longitudinally across the screen or transversely, or both, i. e. with the bands intersecting to leave the hard or sound impervious areas of the finished tile, separate and distinct from each other. Various arrangements of the plugged areas may be devised to form ornamental designs, as will be apparent.

Instead of forming the above tile with a dense surface as described, it is also possible to form the dense surface layer by using other materials than the back-up materials. These may be incorporated in the surface layer during its formation in the mold. In another modification the tile is formed with projections but with a more or less porous surface. Pitch, rosin, asphalt, plaster or other densifying material 17, as shown in Fig. 11, is then incorporated in this surface either before or after it has been dried, if the wet process is used. Duco or other paints may be sprayed onto said surface to penetrate it for a limited distance. The projections are then removed, as described previously, to leave porous openings 14 in the dense surface, comprising extensions of the sound-absorbing interior, as shown in Fig. 12. If the pitch, rosin, asphalt, plaster or other densifying material is omitted and the surface treated with the Duco or other paints only, the resulting product would appear substantially the same in cross section as Fig. 12, except that the dense areas would be thinner. In other words, Fig. 12 may be taken as representing both forms of the invention.

The same effect, of alternating areas of porous material and of dense material, may be obtained by impregnating and/or densifying, usually in a predetermined pattern, a portion of the surface of a sound-absorbing pad which has neither projections nor a dense surface, to thereby leave small porous areas comparable to what is shown in Fig. 2, in which the total or aggregate of the porous areas is small as compared to the total area of the tile, following the disclosure of said Norris patent. Any other suitable design may be employed, in which the porous areas appear as detached areas or in which the dense areas appear as detached areas with porous strips or other shaped areas separating the same. A stencil is used advantageously to form decorative designs simultaneously, the densifying material be-

ing applied through the openings in the stencil in the usual manner. In this construction the densifying material may be largely in the form of a coating, only a small amount penetrating the absorber. In other words, the densifying material may be raised more or less above the surface of the tile in what may be called patches.

Not only can the above treatment be applied to fibrous sound-absorbing material, but it may be applied to porous sound-absorbing mineral and ceramic bodies. A construction is illustrated in Figs. 13 and 14 where a stenciled pattern is shown applied to a ceramic tile 18. The stencil 19, selected as illustrative of what may be used, has the form of a lattice grid, i. e. it is largely open, so that less than half, preferably, of the tile surface is covered. Said stencil is laid upon the upper surface of the sound-absorbing tile, assumed to be face up, and paint or the like is then sprayed upon said tile through the openings of the stencil, or as an alternative, pitch, rosin, asphalt, plaster, etc., may be applied to such surfaces, in any suitable manner. The coating material penetrates into the pores of the tile a limited distance to form a firm bond, i. e. the two are practically integrally united. The stencil is then removed leaving separated areas of the tile coated with smooth or rough surfaced coating material 20 as may be desired, which coated or densified areas, surfaces or patches, aggregate about 67% of the total area in this instance. There is also left a continuous network of exposed tile surfaces 21, permeable to air-borne sounds. Any suitable pattern may be used.

The tile so formed, when mounted with others on a ceiling, is of course in inverted position, with respect to that shown, i. e. the treated surface faces downwardly as in the case of the other sound-absorbing treatments shown herein. However, any of the various forms of tiles herein may be mounted vertically or at an angle and in cases where a stencil is made use of, it may in some cases be applied to the bottom surface of an existing installation.

Fig. 15 shows a perspective view of a perforated plate 22 of metal or other suitable material having intersecting ribs 23 thereon to produce a fibrous tile in the manner previously described, but with porous lines or bands thereon in the form of recesses or grooves, which will cause the dense areas to stand out as elevated patches. If the form is used upside down, the dense areas will be recessed or sunken below the level of the remaining areas which are in the form of ridges.

The percentage of permeable to impermeable areas will vary widely in the several forms of the invention, depending on the pattern desired. For example, in Fig. 3 the permeable areas comprise less than 10% of the total. In Fig. 8 the permeable areas constitute about 20% of the total. In Fig. 9 said areas comprise about 25% of the total and in Fig. 10 said areas comprise about 39% of the total. As previously pointed out, however, the permeable areas may comprise quite a small proportion of the total area, without substantial loss of efficiency from an acoustical standpoint.

This application is a continuation in part of my copending application Serial No. 503,977, filed December 22, 1930.

I claim:

1. A sound-absorbing construction comprising a body of sound-absorbing material, addi-

tional material incorporated in a face only of said sound-absorbing material to form a more dense layer integral therewith and having a substantially smaller sound-absorbing value, the surface of said dense layer having distributed therein small areas of the more porous sound-absorbing body material, continuous with the main body thereof.

2. A sound-absorbing construction comprising a body of sound-absorbing material, at least one surface layer thereof having additional material incorporated therein to form a skin more dense than said body and integral therewith, and having a substantially smaller sound-absorbing value, said surface skin being discontinuous to expose distributed small areas of the more porous sound-absorbing body material, continuous with the main body thereof, the exposed surfaces of said sound-absorbing and densified areas being in substantially the same plane.

3. A sound-absorbing construction comprising a body of fibrous sound-absorbing material, a surface layer only thereof having additional material incorporated therein to form a more dense skin integral with said sound-absorbing fibrous material, and having a substantially smaller sound-absorbing value, said surface skin having distributed therein small exposed areas of the fibrous sound-absorbing body material, continuous with the main body thereof.

4. A sound-absorbing construction comprising a body of fibrous sound-absorbing material, a surface layer only thereof having additional material incorporated therein to form a more dense skin integral with said sound-absorbing fibrous material, and having a substantially smaller sound-absorbing value, said surface skin being discontinuous to expose distributed small areas of the fibrous sound-absorbing body material, continuous with the main body thereof, the exposed surfaces of said sound-absorbing and densified areas being in substantially the same plane.

5. A sound-absorbing construction comprising a substantially uniform body of sound-absorbing material, at least one surface layer thereof being more dense, whereby it has a substantially smaller sound-absorbing value, said dense layer being discontinuous to expose distributed small areas of the sound-absorbing body material, continuous with the main body thereof, the exposed surfaces of said sound-absorbing and densified areas being in substantially the same plane.

6. A sound-absorbing construction comprising a body consisting substantially of fibrous, sound-absorbing material, at least one surface layer thereof being more compact and having a substantially smaller sound-absorbing value, said surface layer being discontinuous to expose distributed small areas of the fibrous sound-absorbing body material, continuous with the main body thereof, the exposed surfaces of said sound-absorbing and compact areas being in substantially the same plane.

7. A sound-absorbing construction comprising a body composed throughout of sound-absorbing material, at least one surface layer thereof being impregnated with a material which renders the facing formed thereby substantially less sound-absorbing, said facing having distributed therein small areas of the sound-absorbing body material, continuous with the main body thereof.

8. A sound-absorbing construction comprising a body of sound-absorbing material, at least one side of which has additional material incorporated therein to form a more dense layer integral with said sound-absorbing material and having a substantially smaller sound-absorbing value, said dense layer being discontinuous and surrounding small portions of said sound-absorbing body material continuous with the main body thereof, the exposed surfaces of said sound-absorbing material being continuous with the outer surface of said dense layer.

9. A sound-absorbing construction comprising a body of fibrous sound-absorbing material, a surface layer only thereof having more of said fibrous material compacted therein to form a dense skin having a substantially smaller sound-absorbing value, said dense skin having distributed therein small exposed areas of the fibrous sound-absorbing material, constituting a continuation of the main body thereof.

10. A self-supporting sound-absorbing panel of porous material characterized by good sound-absorbing properties and having substantially the same density throughout the interior of the mass, the exposed surface of said panel having a preponderance of distributed, stiff, dense areas capable of being painted without materially diminishing the sound-absorbing properties of the mass of sound-absorbing material, the latter being exposed to the sound waves between said areas.

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