

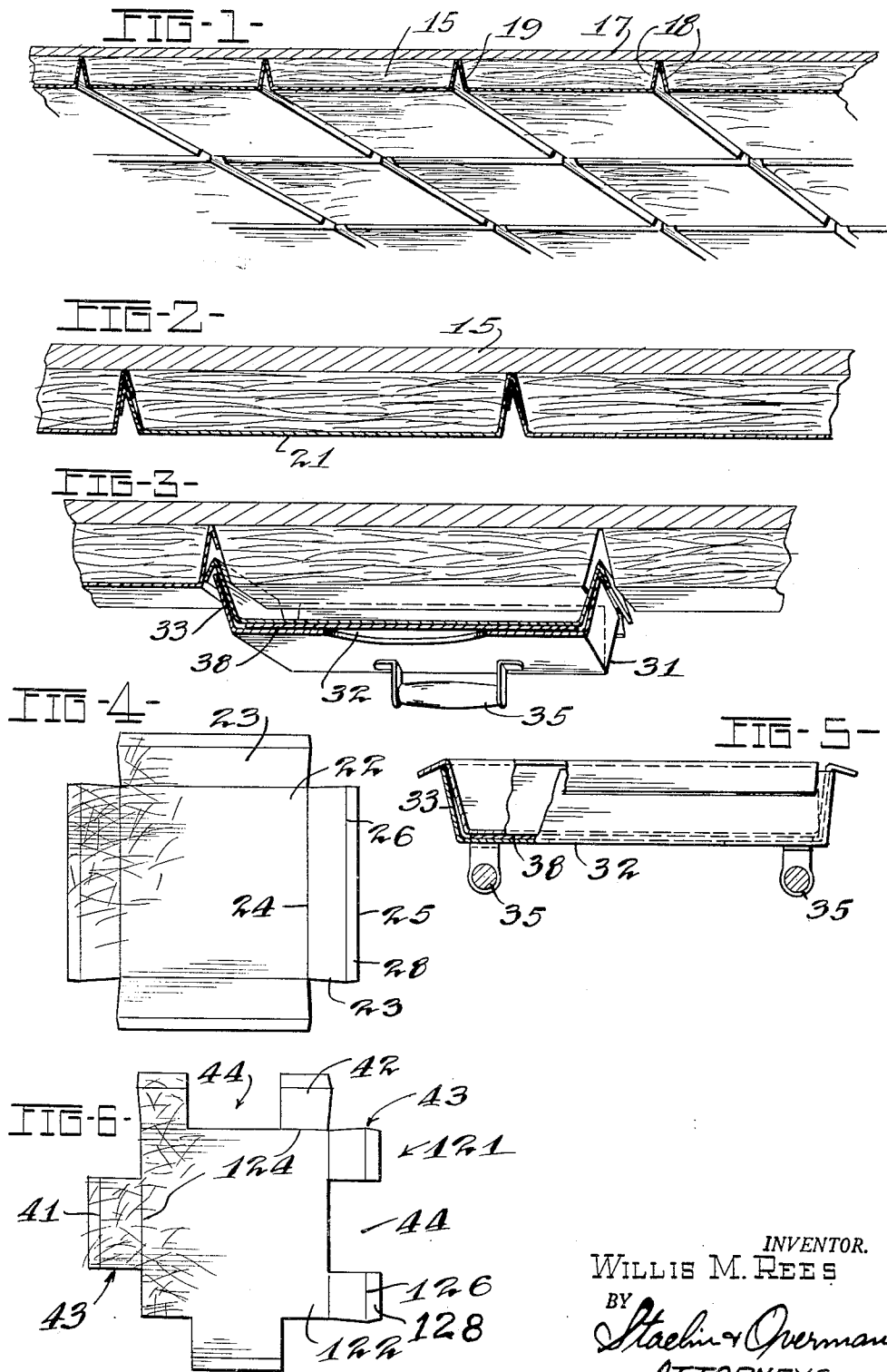
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ACOUSTIC WALL TREATMENT WITH REPLACEABLE FACING

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ACOUSTIC WALL TREATMENT WITH
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1

This invention relates to sound absorbing structures and more particularly to wall and ceiling structures or coverings designed to absorb air-borne sound for reduction of noise intensity and control of hearing conditions.

Many effective sound absorbing materials are in the form of pads or boards of fibrous material or of such other material as to have a large number of small interstices opening at the surface of the material. It is by virtue of these surface openings or pores that sound waves are absorbed by the material, and the continued effectiveness in use of the sound absorbing material is dependent upon the maintenance of this open nature of the surface of the material.

With the passage of time, however, conventional acoustic materials depreciate because dust collects in the interstices at the surface. There is no satisfactory way of completely removing dust that becomes embedded in the porous surface of the material so that lodgment of dust in the surface interstices is to a large extent a permanent impairment of the appearance of the acoustic material.

Since cleaning of the surface of acoustic material is not fully effective in removing the dust embedded in the pores it is usually necessary to paint the surface to restore a slightly appearance to the material. Repainting of the surface even a few times may completely blind the surface interstices and seriously impair or even entirely destroy the sound absorbing properties of the material.

It is an object of the present invention to provide acoustic constructions not subject to the limitations found in previous constructions.

It is a further object of the present invention to provide a sound absorption construction that is not subject to gradual deterioration by repeated cleaning or repainting. It is an ancillary object to provide an acoustic construction that does not have to be cleaned nor repainted.

More specifically, it is an object to provide a sound absorbent that has a readily renewable surface. This is accomplished by providing a removable layer or sheet of material, preferably pervious to sound waves, as a surface for the main body of sound absorbent so that dust collected on the surface of the absorbent is completely removed with the layer or sheet, the layer or sheet then being replaced with a new sheet to restore the acoustic construction to its original appearance.

It is a more specific object of the invention to provide acoustic absorbents with a renewable

2

surface of sheet material that has a high degree of sound transmission that is not affected by atmospheric moisture, that is fire safe, and that is sufficiently flexible to permit removal and replacement but that is nevertheless rigid enough to be retained in place over the face of the absorbent.

It is a further object of the invention to provide replaceable coverings for acoustic absorbents that may be readily installed over absorbents already in place and that requires no extraneous means for holding the covering in place over the face of the absorbents.

Other objects will appear from the following description taken in connection with the drawings, in which:

Figure 1 is a perspective view of a ceiling acoustically treated in accordance with the present invention, partly in section and partly broken away;

Figure 2 is an enlarged cross-sectional view of the treated ceiling shown in Figure 1;

Figure 3 is a similar view showing the facing of the present invention being put into place;

Figure 4 is a plan view of one of the facing units of the present invention;

Figure 5 is an elevational view partly broken away and partly in section of a device for applying the facing units; and

Figure 6 is an elevational view of a modified form of facing unit.

The invention is particularly applicable to those types of sound absorbing wall and ceiling constructions now in use in which acoustic tiles, that is, rectangular or square pads or boards of sound absorbing material, are supported on walls or ceilings, or on beams, rafters, etc., defining a room or enclosure (all of which are included in the term "wall"), by means of an adhesive such as a mastic cement, or where the tiles are fastened in place by other means such as nails or screws that pass through the tiles and are driven into the wall or ceiling. Commonly the edges of the tiles, which are in abutting relation with each other, are chamfered so that the effect produced is a continuous covering of absorbing material marked off into squares or rectangles by grooves of V-shape in cross-section.

Referring to Figure 1 of the drawing, sound absorbing tiles 15 are arranged in edge abutting relation to cover a ceiling 17. The edges of the individual tiles are chamfered at 18 to provide between the tiles V-shaped grooves 19. The tiles are secured to the ceiling by any suitable means as, for example, a layer of mastic cement inter-

jacent the upper face of the tile and the surface of the ceiling or by other means such as large-headed nails which are driven through the tile and into the ceiling. When tiles already installed are not provided with chamfered edges, or when the chamfer is not of the extent or angle providing V-shaped grooves of the required size or depth, the grooves may be formed or enlarged by saws, sanding or abrading disks, or other tools by running the tools along the lines of juncture between adjacent tiles, or along other lines where it is desired to provide grooves.

The acoustic tiles 15 are in the form of rigid, form-retaining blocks or pads of suitable material having sound absorbing properties, such as interbonded wood fibers, bagasse, rock wool, or other mineral wool. For the sake of light weight coupled with high sound absorbing properties, they are preferably formed of fibrous glass having associated therewith a resinous or other rigid binding material for bonding the fibers together into a rigid mat or pad of low density.

In accordance with the present invention the acoustic tiles are provided with renewable surfaces in the form of facing units 21 adapted to cover the exposed faces of the tiles and to be releasably held in place on the tile.

The facing units are made of a sheet material which is preferably of light weight and preferably of a high degree of porosity so that sound waves originating within the enclosure may pass through the sheet and into the acoustic tiles to be absorbed thereby. However, if desired, the sheet material may have a low degree of porosity or substantially none and be sufficiently flexible to vibrate under the action of sound waves and in this way transmit the sound by diaphragmatic action to the sound absorbing tiles.

The facing units 21 are in the form of rectangles 22 of sheet material each having lateral flanges 23 joined to the four sides thereof. The rectangle 22 of sheet material constitutes a facing for the tiles 15 while the flanges 23 form tabs for securing the facing in place on the tile. The line of juncture between the flanges and the side edges of the facing 22 is preferably scored or creased as at 24 to facilitate bending the flanges up to an almost right angle relation to the facing. The flanges may be also scored along lines 26 parallel with the outer lengthwise extending edges of the flanges and spaced inwardly a short distance from these edges to define outer flanges 28.

The scored line 26 should be made by relatively light pressure so that when the flange 28 is bent along a scored line it has a sufficient resiliency to return part way to its original position. If desired, the scored line 26 and/or the scored line 24 may be omitted and the unit shaped at the time of application, although it is preferable to lightly score the unit in the way described.

The scored lines 24 and 26 facilitate shaping the facing unit 21 at the time of installation into approximately the form of a box having outwardly and downwardly slanting marginal flanges along the upper sides of the box. A unit bent to this shape is shown in Figure 3. The unit bent to this shape is arranged to cover the individual tiles forming the acoustic covering for the wall or ceiling. It is applied to the covering by inserting the upwardly bent flanges 23 of the unit into the V-shaped grooves between abutting tiles, the flanges 23 being proportioned to have their upper edges as defined by the crease lines 26 received adjacent the apex of the V-shaped groove to frictionally hold the flanges in the grooves. When the facing units are thus positioned over the individual tiles, the flanges 28 along the upper edges of the flanges 23, due to their tendency to straighten out and move toward the plane of the flanges 23, engage the sides of the V-shaped grooves to aid in frictionally holding the facing units in place over the tiles. As shown in Figure 2, the flanges 23 and 28 of adjacent facing units overlap each other in the V-shaped grooves and frictionally engage each other to further aid in holding the facing units in place.

It is possible, especially where the V-shaped grooves are narrow, to omit the flanges 28, the facing units then being held in place by the frictional engagement between the walls of the grooves and the flanges 23 of the facing units.

The units may be applied over the individual tiles by hand and with the aid of any suitable instrument, for instance, a straightedge or flat piece of metal, for urging the flanges 23, 28 upwardly into the V-shaped grooves. Application is made most efficiently by the device shown in Figures 3 and 5. This is a pan 31 constructed of sheet metal, having a large opening 32 in its bottom and provided with slanting sides 33. The sides are preferably of a width corresponding to the width of the flanges 23 when the facing unit 21 is inserted in nested relation in the pan. The side edges preferably do not connect with each other at the corners of the pan but leave the corners open to match the shape of the unit 21. The pan may be provided with a pair of handles 35 secured to the bottom of the pan adjacent the opposite ends thereof to permit the pan to be held by the two hands of the operator.

In applying the facing units to the tiles, a unit is nested within the pan so that its flanges 23 lie inside of and along the sides of the pan with the flanges 28 extending outwardly over the upper edges of the sides of the pan as shown in Figure 5. The pan with the facing unit therein is then pushed up over the tile with the sides of the pan pressing the flanges 23, 28 of the facing units upwardly into the V-shaped grooves. After the pan has been moved upwardly to full extent the operator places one hand or the thumbs of both hands onto the portion of the facing unit exposed through the hole 32 in the bottom of the pan and holds the facing unit against the tile during the first portion of the withdrawing movement of the pan.

If desired, a flat sheet 38 of metal may be placed in the pan prior to placing therein a facing unit 21. This metal sheet is preferably of a shape similar to the shape of the bottom of the pan and of slightly smaller size. When the operator withdraws the pan he may place his hand or his thumbs against the portion of the metal plate exposed through the opening 32 in the bottom of the pan to hold the plate and the facing unit against the tile during the first portion of the withdrawing movement of the pan. The metal plate distributes the pressure over substantially the entire face of the facing unit and aids in holding the facing unit in place when the pan is withdrawn.

If the sound absorbing tiles are of relatively large size it may be desirable to employ a small amount of adhesive between the facing 22 and the lower face of the tile to hold the facing securely against the tile and prevent its sagging. The adhesive, such as quick-drying methacrylate base compound, may be dabbed at spaced points onto the upper face of the facing or onto the

lower face of the tile just before the two are brought together.

When the facing units have become soiled they are removed from the structure by grasping the corners of the unit and pulling the units away from the tiles. It may facilitate removal of the units in some cases if a sharp pointed tool is inserted a short distance through the facing and used to pull the unit away from the face of the tile. A new facing unit is then applied to the tile in the way previously described, and the sound absorbing structure is, by this simple operation, restored to its original appearance and efficiency.

The modified facing unit 121 shown in Figure 6 is similar to the facing unit 21 except that in place of the flanges 23 extending continuously along the edges of the facing 22, there are provided tabs 41 and 42 secured to the edges of the facing 122 of the unit. These tabs are similar to the flanges 23 in that they are joined to the edges of the rectangular portion of the facing unit, preferably by lines of scoring 124, and also have scored lines 126 adjacent to but spaced from their outer edges to define outer flanges 128 on each tab. The tabs 42 on two of the adjoining sides of the rectangular facing 122 are located adjacent the ends of the sides of the facing so as to be separated by a space 44. The tabs at the two opposite adjoining edges are of a length slightly less than the length of the spaces 44 and are aligned therewith.

Facing units of this form when inserted over the tiles have the tabs 41 of one facing unit received between the tabs 42 of the adjacent unit so that the tabs of both units extend all the way up into the V-shaped grooves between the tiles.

The sheet material is one that is relatively inexpensive so that when soiled it may be removed and replaced with new sheets of the same kind. The sheets are also of a material that may be painted or otherwise decorated without substantial effect on the porosity or the flexibility, as the case may be, of the sheets. Any decorating or painting of the sheets is best done prior to installation of the sheets in the acoustic construction.

In addition to the flexibility required to permit the sheets to be bent for insertion into place over the faces of the tiles, the sheets must also possess sufficient stiffness so that when supported along their margins they do not appreciably sag when mounted in horizontal positions. If a material is otherwise qualified for use as the sheets 31, a tendency to sag may be overcome by applying to the backs of the sheets or to the exposed faces of the tiles small spaced dabs of a suitable adhesive so that the sheet is held to the face of the tile at sufficiently closely spaced points such that there is no apparent sagging of the sheet below the face of the tile.

The requirements of porosity, flexibility, stiffness, and ease of decoration, and other properties such as resistance to moisture and fire-proofness, are all combined in a sheet material composed of interlaced fine glass fibers of from about .0002 to .0008 inch in diameter bonded together in a web by a suitable binding agent. The interlaced arrangement of the fine fibers imparts a uniform appearance to the surface of the web in addition to a very high degree of porosity. The web may be from .002 or .003 to .020 of an inch in thickness. The thickness is not critical except that it is at these thicknesses that the flexibility and stiffness required are found coupled with

low cost. Thicker webs would have no advantages in the present invention but only serve to increase the cost and the weight of the acoustic structure.

The webs of glass fibers are produced by depositing the fine fibers by means of an air blast onto a collecting surface such as a conveyor and causing the fibers to build up into a mat of the required thickness. Alternatively the fibers as continuous glass filaments may be wound on a large drum and traversed back and forth along the drum to be arranged in layers with the fibers in each layer all parallel and acutely angularly related to fibers in immediately adjacent layers.

The fibers may be bound together in the web by any suitable binding material such as starch, gelatin or other material. The binding agent may be a thermosetting resin, such as phenyl or urea formaldehyde or other resin, where it is desired to provide the sheet with increased resistance to the effects of atmospheric moisture. With any of these forms of binding agents the proportion of binding material in the web is relatively low, being present usually in amounts equivalent to about 5 to 15% of the weight of the glass fibers.

This sheet material of fibrous glass may be colored or decorated as desired as by incorporating dyes or pigments within the binding material or by applying to the sheet material a suitable dye or paint, for instance, pigmented casein paint. Such a paint may be lightly sprayed onto one or both surfaces of the sheet material after it is made and before it is installed in the acoustic structure. Such spray painting of the sheet material may, of course, be done after the installation of the sheets but this latter is usually less advantageous.

While the invention preferably employs sheets formed of webs of fibrous glass, other sheet material has also been considered. Relatively heavy paper, for instance, could be used for the facing units, or thin sheets of resin, metal foil, and the like could be employed. Most of such materials are sufficiently flexible to transmit sound waves by diaphragmatic action but if not may be provided with small closely spaced perforations to admit sound waves into the sound absorbing tiles. Where necessary the stiffness of such material may be increased by suitable embossings as, for instance, by impressing the material with ridges running diagonally or across the rectangular portions of the facing units in straight or curved lines.

By this invention there is provided a sound absorbing construction in which the pads, boards or tiles of absorbing material are of the thickness, say 1 to 4 inches, required to attain the desired degree of sound absorption faced with sheets of material of such thinness as to have no substantial sound absorption but being capable of transmitting to the pads or boards all sound waves impinging on the sheets. The specified association of the two achieves an acoustic construction of great efficiency, long life and of continued high efficiency and pleasing appearance throughout its life.

I claim:

1. An acoustic construction for the walls and ceiling of an enclosure comprising a sound absorbing layer overlying the wall and formed by a plurality of rectangular tiles of fibrous material arranged in a plane with the edges of each tile contiguous to and slightly spaced from the edges of adjoining tiles, and a renewable facing

for said sound absorbing layer including a plurality of thin sheets of porous material individual to said tiles and each having tabs at its edges integral with the sheet and resiliently held in place between adjacent edges of said tiles to hold the sheets in place over the face of the tiles.

2. An acoustic construction for the walls and ceiling of an enclosure comprising a layer of sound absorbing material overlying the surface of the wall, a plurality of regularly spaced crossing grooves in the layer of sound absorbing material and opening toward the enclosure, a replaceable facing for the layer of sound absorbing material in the form of rectangular sheets of thin fibrous material arranged in contiguous relation and overlying the layer of sound absorbing material, and tabs integral with the rectangular sheets and extending from opposite side edges thereof and resiliently engaging opposite sides of said grooves to releasably secure the facing to the layer.

3. An acoustic construction for the walls and ceiling of an enclosure comprising a layer of sound absorbing material overlying the surface of the wall, a plurality of regularly spaced crossing grooves in the layer of sound absorbing material and opening toward the enclosure, a replaceable facing for the absorbing material in the form of rectangular sheets of thin fibrous material arranged in contiguous relation and overlying the layer of sound absorbing material, tabs integral with the rectangular sheets and extending from opposite side edges thereof and received and frictionally held in said grooves to releasably secure the facing to the layer of absorbing material, and flanges at the ends of said tabs bent reversely to the tabs for engaging the sides of said grooves to aid in retaining the tabs in the grooves.

4. A replaceable facing for acoustic constructions in which a layer of sound absorbing material is provided with a plurality of regularly spaced grooves opening at the face of the layer exposed to the acoustically treated enclosure, comprising a thin rectangular sheet of interbonded fibrous glass, tabs secured to the sheet at opposite edges thereof, and weakened lines defining the lines of juncture between the tabs and the sheet, whereby the sheet may be secured to the face of the layer of sound absorbing material by insertion of the tabs into the grooves in said layer.

5. A replaceable facing for acoustic construc-

tions in which a layer of sound absorbing material is provided with a plurality of regularly spaced grooves opening at the face of the layer exposed to the acoustically treated enclosure, comprising a thin rectangular sheet of material, tabs secured to the sheet at opposite edges thereof, weakened lines defining the lines of juncture between the tabs and the sheet, and a second weakened line in each tab parallel to the first line and spaced outwardly therefrom to define a flange along the outer margin of each tab, whereby the sheet may be secured to the face of the layer of sound absorbing material by insertion of the tabs and flanges into the grooves in said layer.

6. A replaceable facing for acoustic constructions in which a layer of sound absorbing material is provided with a plurality of regularly spaced grooves opening at the face of the layer exposed to the acoustically treated enclosure, comprising a thin rectangular sheet of material, a plurality of spaced apart tabs secured to the sheet at each of the two adjoining edges of the sheet and at least one tab secured to the sheet at each of the other two adjoining edges of the sheet, said last mentioned tabs being aligned with the spaces between the tabs at the opposite edges of the sheet and being of a size no larger than said spaces, and scored lines defining the lines of juncture between the tabs and the sheet, whereby the sheet may be secured to the face of the layer of sound absorbing material by insertion of the tabs into the grooves in said layer.

7. A replaceable facing for acoustic constructions comprising a thin sheet of interbonded glass fibers, the sheet having tabs secured thereto at its edges and having resilient flange portions extending reversely to the tabs.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
458,448	Ewing	Aug. 25, 1891
1,785,507	Weiss	Dec. 16, 1930
2,045,312	Roos et al.	June 23, 1936
2,098,717	Calkins et al.	Nov. 9, 1937

OTHER REFERENCES

Scientific American, November 1944, page 218.