Oct. 30, 1934 L. R. HOFF ET AL 1,978,632

ACOUSTICAL CONSTRUCTION

Filed Jan. 25, 1932

Fig. 1.

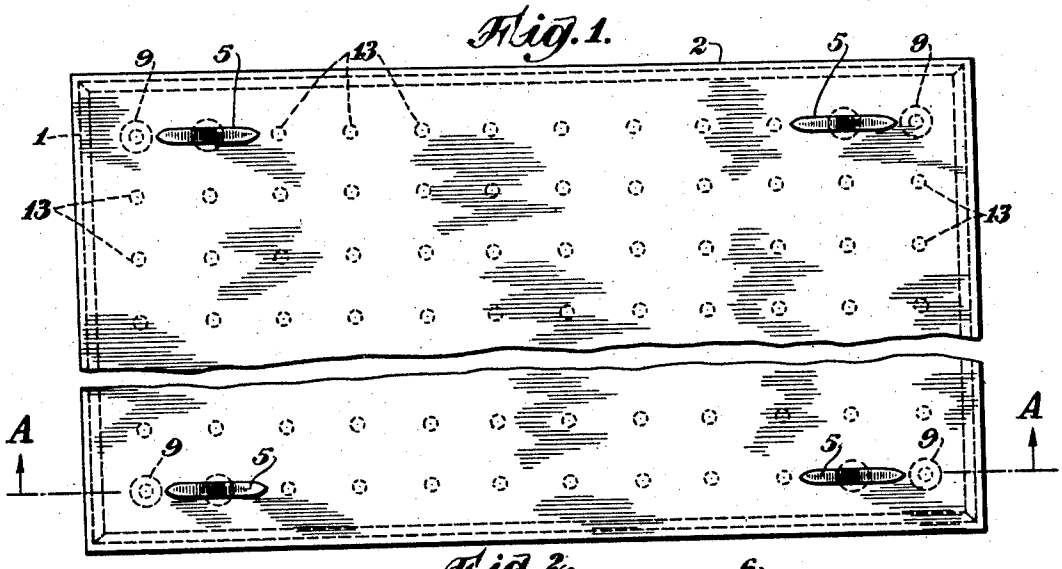


Fig. 2.

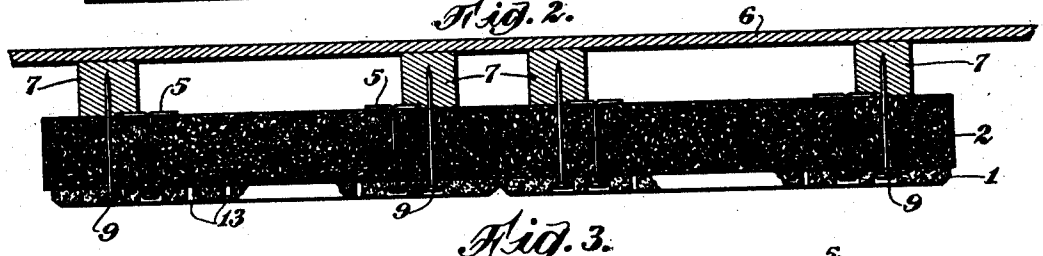


Fig. 3.

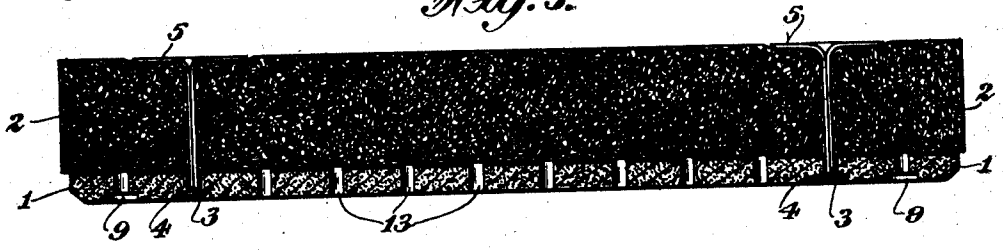


Fig. 4.

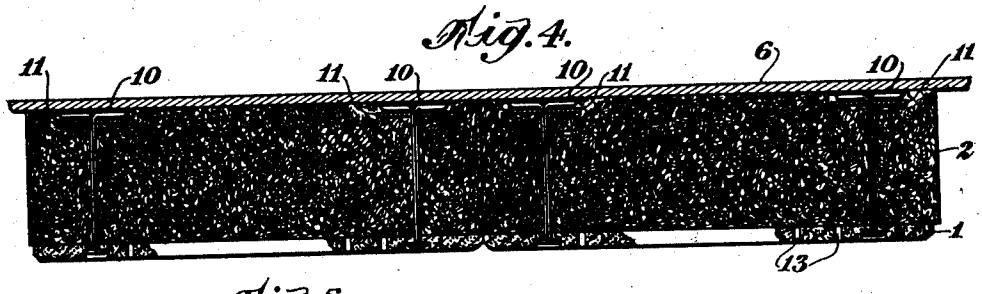
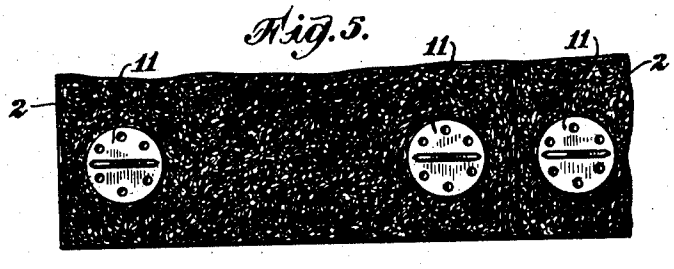


Fig. 5.



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ACOUSTICAL CONSTRUCTION

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Application January 25, 1932, Serial No. 588,576

9 Claims. (Cl. 20—4)

The present invention relates to improvements in acoustical construction, and particularly to such a construction comprising preassembled units.

One of the outstanding disadvantages in the conventional constructions employed for acoustical treatment resides in their lack of certain of the qualities necessary for exterior surfaces of a wall or ceiling. For most purposes it is highly desirable that such surfaces be permanent and fireproof in character, readily cleaned and painted, and decorative and pleasing in appearance. Conventional types of acoustical or sound-absorptive materials such as felts of fibrous material, or molded masses of mineral wool associated with a binding material, lack one or more of the properties desirable in an exterior finish, and consequently for the most part acoustical constructions have been only partially satisfactory. For instance, sound-absorptive sheets or blocks composed of molded masses of mineral wool associated with a binder, are very efficient from the standpoint of acoustical effectiveness, but due to their inherent frangibility such products are subjected to a relatively large breakage, and furthermore are characterized by surfaces which do not lend themselves readily to decorative treatment or cleaning. One of the objects of this invention is the provision of a structure wherein frangible sound-absorptive material of the type mentioned is reinforced with a facing material which renders it capable of being readily applied in unit form and which facing also prevents breakage and obviates other disadvantages inherent in the sound-absorptive material employed.

Another object of the invention is the provision of an acoustical construction of high acoustical efficiency wherein the surface of the element directly exposed to the impinging sound is of a permanent and fireproof character, readily cleaned and painted, and having a pleasing and decorative appearance.

A further object of the invention is the provision of an acoustical unit which may be readily and economically installed.

Various other objects and advantages of the invention will be evident from the following description of an illustrative and preferred embodiment shown in the accompanying drawing, wherein:

Fig. 1 is a plan view of the preassembled unit taken from the back;

Fig. 2 is a sectional view of a plurality of the units combined with a ceiling substructure;

Fig. 3 is a sectional view of the unit taken along line A—A of Fig. 1; and

Figs. 4 and 5 disclose a modification of the invention.

The unit shown in detail in Figs. 1 and 3 comprises a perforated facing member 1 and a backing member 2 contiguous to the facing member comprising a block or pad of sound-absorptive material. The facing and backing members are maintained in an assembled relation by suitable fastening means such as staples 3 which are driven through apertures 4 in the facing into the pad. The apertures are preferably countersunk as shown so that the head of the fastening element is flush with the surface. The staple employed is of sufficient length to permit each prong to be bent, thereby forming laterally extending portions 5 contacting the back of pad 2 and serving to maintain the entire unit in an assembled relation.

The units may be combined with any type of wall or ceiling surface to be acoustically treated as shown in Fig. 2. In this figure a ceiling or wall substructure which may be plaster, lathing or any other suitable material is indicated generally by numeral 6. Nailing strips 7 are affixed to the substructure at spaced intervals corresponding to the dimensions of the individual units. Each unit is disposed so that the apertures 8 in the facing member are in alignment with the underlying strips 7 and is secured in position by fastening means such as nails 9 driven through the apertures into strips 7. The staples 3 are so disposed that the bottom portion thereof is in contact with the bottom portion of strips, whereby they function to maintain the facing member at a fixed distance in spaced relationship with the substructure and in alignment with adjacent units. As shown, adjacent units are preferably disposed so that the facing members and sound-absorbing backings are in aligned, abutting relationship. In installing the units the marginal portions of the sound-absorptive backing which projects slightly beyond the edges of the facing portion, as shown in Fig. 2, are compressed against corresponding marginal portions of adjacent units whereby a tight fit between adjoining units is insured. It will be noted that the construction provides for a tight fit between adjacent units and for an abutting contact of the edge portions of the sound-absorbing material of adjacent units. This construction is especially advantageous in that it obviates the circulation of air in large quantities through the joints due to "breathing" caused by temperature fluctuations and the re-

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sulting deposition of dirt on the surface of the facing member adjacent the joint.

For the sound absorptive backing 2 there are preferably employed molded sheets or blocks of mineral wool associated with a suitable binder. Such products are highly efficient sound absorbers, and the disadvantages arising from their inherent frangibility and tendency to dust and disintegrate are obviated by the reinforcement imparted by the facing member. Various other kinds of sound-absorptive material, however, may be employed to advantage in the practice of the invention other than frangible blocks.

The facing member is preferably composed of dense, rigid or self-sustaining material in contradistinction, for instance, to porous, flexible materials such as fabrics. It is preferably of sufficient thickness to be strong and self-sustaining and also to provide sufficient depth to the perforations that they will not be ordinarily clogged up by paint applied to the surface. A thickness in excess of about one-eighth of an inch is the optimum minimum for these purposes. This sheet may suitably consist of an asbestos-cement composition commonly employed as wallboard and tiling material. Such sheets ordinarily include about 15–20% of asbestos fibers, and about 80–85% of Portland cement. In manufacturing these sheets, a pulp of the fibrous-cement mixture is formed into a felted web on a suitable felting device and the web wound on a mandrel until it forms a laminated cylinder of the desired thickness. This cylinder is then cut longitudinally and developed into sheet form. After drying the sheet may be impregnated with a suitable waterproofing material. Sheets thus made are provided with suitable perforations 13 and then cut into facing units of the requisite size. In place of employing laminated asbestos-cement sheets as described above, sheets of the same constituents but varying in their proportions and fabricated by molding under pressure such as "Transite" may be used. Various other types of sheet material may be employed for the facing member in addition to the asbestos-cement products above mentioned, the most important requirement being that the sheet is structurally strong and is of a self-sustaining or rigid character, in contradistinction to materials such as fabrics and the like. A facing member composed of an asbestos-cement composition is particularly advantageous, however, in that the resulting product is non-corrosive and non-rusting and consequently may be employed in kitchens and other places where humid conditions prevail.

The number and size of the perforations 13 are subject to considerable variations. In general the number of perforations is restricted to a minimum compatible with the attainment of the desired degree of acoustical efficiency. For a facing having a thickness of $\frac{3}{16}$ inch, a perforated area of 10% consisting of uniformly spaced perforations of a diameter of 11/64" has been found to be entirely satisfactory.

Figs. 4 and 5 represent a modification of the invention which obviates the use of nailing strips, and hence is especially fireproof. In this embodiment the assemblage is secured by an adhesive, as, for instance, a conventional form of acoustical cement, Portland cement, plaster of Paris, or the like, which is applied between the fastening means and substructure. In this construction a perforated washer 11 is preferably associated with the fastening means as shown to provide a more effective bond for the adhesive.

Sound-absorption tests on a ceiling acoustically treated in accordance with the invention gave the following results,

Cycles	128	256	512	1024	2048	4096
Coefficient	.19	.39	.81	.77	.72	.55

From the above test it will be apparent that the construction provided by this invention is highly efficient acoustically. Its unitary character renders it exceptionally easy and economical to install. It further provides an exterior surface which has all the advantages of the conventional types of surface finishes.

What we claim is:

1. A pre-assembled acoustical unit comprising a perforated facing member of rigid dense sheet material, a sound-absorbing pad contiguous to the facing member, and means extending through the facing member and pad to maintain said elements in assembled relation.

2. A pre-assembled acoustical unit comprising a perforated facing member of rigid dense sheet material, a sound-absorbing pad contiguous to the facing member, and mechanical fastening means extending through the facing member and pad to maintain said elements in assembled relation.

3. A pre-assembled acoustical unit comprising a frangible sound-absorptive block, a protective reinforcing facing of perforated, dense, rigid sheet material adjacent said block, and securing means extending through said block and facing to maintain said elements in a unitary construction whereby the frangible sound-absorptive material is protected against breakage and rendered capable of ready application.

4. A pre-assembled acoustical unit comprising a sound-absorptive molded block of mineral wool and a binder, a reinforcing facing secured to said block consisting of perforated, rigid dense sheet material, and securing means passing through said block and facing to maintain said elements in assembled relation.

5. A pre-assembled acoustical unit comprising a sound-absorptive molded block of mineral wool and a binder, a reinforcing facing secured to said block consisting of perforated sheet formed from a mixture of asbestos and cement, and securing means passing through said block and facing to maintain said elements in assembled relation.

6. A pre-assembled acoustical unit comprising a frangible sound-absorptive molded block of mineral wool associated with a binder, a reinforcing, protective facing secured to said block consisting of a relatively thick rigid, perforated sheet formed from a mixture including asbestos and cement, and having a minimum average thickness of not less than one eighth of an inch, and securing means passing through said block and facing to maintain said elements in an assembled relation.

7. In an acoustical construction, the combination of a perforated facing member of self-sustaining material, a sound-absorbing pad contiguous to the facing member, and means for assembling the pad and facing member including spacing means projecting through the pad for maintaining the facing member at a fixed distance from the back surface of the pad.

8. In an acoustical construction, the combination of a perforated facing member of self-sustaining material having openings therein for the reception of fastening elements, a pad of sound-absorptive material contiguous to the facing

member, and means for assembling the pad and facing member comprising fastening elements extending through the openings in the facing member into the pad and having laterally extending portions contacting with the back surface of the pad to maintain the latter and the facing member in assembled relation.

9. In an acoustical construction, the combination of a perforated facing member of self-sustaining material having openings therin for the reception of fastening elements, a pad of sound-absorptive material contiguous to the facing member, and means for assembling the pad and facing member comprising fastening elements extending through the openings in the facing member into the pad, and an adhesive material disposed between and securing the fastening element and substructure.

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