Oct. 2, 1934. D. FINLEY 1,975,637

ACOUSTICAL MATERIAL

Filed May 30, 1930

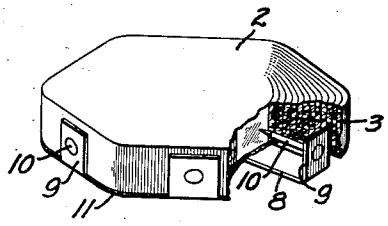


Fig. 1

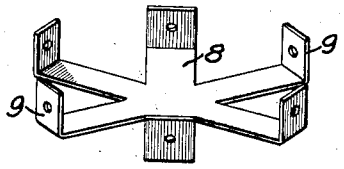


Fig. 2

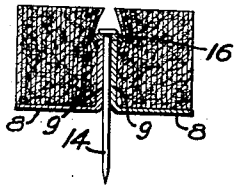


Fig. 3

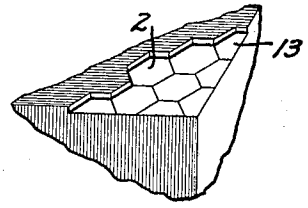


Fig. 4

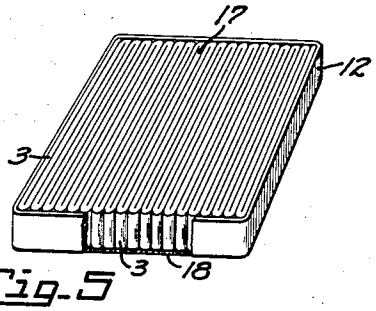


Fig. 5

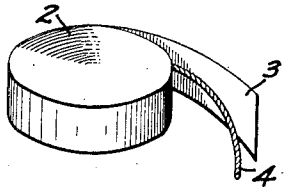


Fig. 6

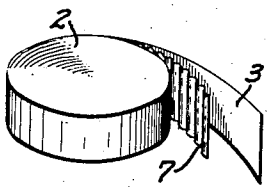


Fig. 8

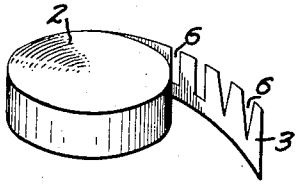


Fig. 7

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ACOUSTICAL MATERIAL

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Application May 30, 1930, Serial No. 457,603

5 Claims. (Cl. 154—44)

My invention relates to an acoustical material, and particularly to such material for absorbing sound waves.

It is among the objects of my invention to provide a material for surfacing the walls and ceiling of a room to improve its acoustical properties, by reducing cavernous or undesirable echoing effects.

Another object of the invention is the provision of a waterproof sound-deadening material which is fire-resistant, insect-proof and of light weight.

Further objects of the invention include the provision of a sound-deadening material which is easily cleaned; and with which many decorative effects are obtainable.

The invention possesses numerous other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of my invention. It is understood that I do not limit myself to this disclosure of species of my invention, as I may adopt variant embodiments thereof within the scope of the claims.

Referring to the drawing:

Figure 1 is a perspective view of an acoustical block embodying my invention; portions of the block are omitted to show the construction.

Figure 2 is a perspective view of the frame used to hold the block in shape.

Figure 3 is a fragmentary view of the block in vertical section showing means for securing it to a supporting surface.

Figure 4 is a perspective view showing a plurality of the blocks secured in place on the ceiling of a room.

Figure 5, is a perspective view of an acoustical block embodying a modification of my invention; portions of the block and retainer ring are omitted to show the construction.

Figures 6, 7 and 8 are perspective views showing a block being built up, and illustrate other modifications of my invention.

Generally speaking, sound-deadening materials in the field of acoustics have been expensive in character; and while the basic materials may have been comparatively inexpensive, this gained advantage is usually offset by the manufacturing processes to which the materials are subjected. In fact, the added costs of fabrication have, in some cases, been all out of proportion when compared with the costs of the basic materials involved. Some of the sound-deadening materials have simply taken the form of woven sheets of a more or less combustible character; others have been of such material as slag wool confined in various types of cells; and still others have merely been in the nature of a plaster.

The shortcomings of a combustible material will be understood without comment. The means for holding such materials as slag wool in place are cumbersome; and the product may easily become detached and fall on persons beneath. None of the forms of acoustical material named, including the plaster, lends itself to easy cleaning. When, after a period of time, a cleaning is necessary, the natural tendency is to give the material a coat of paint. This treatment is disastrous for the sound absorbing properties of the material, and almost entirely destroys its efficacy.

The herein disclosed invention is highly effective as a sound wave absorbent; is fire-resistant, insect-proof, easily cleaned and of light weight. Furthermore, the acoustical material is made from inexpensive basic materials, many of which are now classed as wastes, and is manufactured by processes including simple operations which may be carried out without undue fabricating cost. Still further, the acoustical material may be made in any desired texture, design or combination of colors, thus adding to the decorative effects obtainable; and these effects are not lost after a period of service, since the original texture and color are restored by a simple cleaning process.

In terms of broad inclusion, the acoustical material embodying my invention comprises a light weight fire-resistant body of porous strip material arranged so that the edges of the strip make up the faces of the body. The porous strip material is characterized by an almost infinite number of deviating and intercommunicating passages throughout the material, and opening upon the surfaces thereof. These myriad passages serve to absorb a portion of sound waves impinging on the body in which the edge faces of a porous strip material make up the exposed surface; and the intercommunication of the deviating passages within the porous strip offers a resistance to gaseous flow which dissipates the energy of the sound waves. Since the energy of the impinging waves is thus depleted, the energy emerging from the body in the form of unaltered waves of the original character is correspondingly diminished and sound wave reflection from the body is materially reduced.

Preferably the porous strips in the body are spaced, so that portions of the sound waves may enter therebetween, and hence be absorbed by the sides of the adjacent porous strips. The body

is preferably formed in blocks adapted to be interfitted to provide a continuous surface, and means are provided for securing the blocks to a support. The blocks are also preferably made waterproof and insect-proof; and may be made in any desirable color or combination thereof. The shape of the blocks is largely arbitrary, depending upon the decorative effects desired.

In greater detail the acoustical material embodying my invention comprises a body or block 2, made from a porous strip material 3, preferably wound into a roll. The block may be made any desirable size; the dimensions merely depending upon the width of the strip and the number of turns in the roll. A convenient and effective block is formed by a roll one and one-half inches in thickness and twelve inches in diameter; but these dimensions may vary as economy or conditions may dictate.

The strip used may be of any suitable porous material; and a fibrous material, such as felt similar to that used in the manufacture of prepared roofing, has been found to give very good results and is preferably used. Fibrous materials of this sort are characterized by a deviating and intercommunicating porosity, inherent in the loosely interlaced and open fibre structure of the felt. The degree of porosity, or the openness of the fiber structure, may be regulated by any of several well known methods. One of these depends upon the thoroughness with which the stock is beaten; greater thoroughness producing shorter and more easily packed fibers, and therefore smaller openings between the fibers.

In the following description of my invention a fibrous material is used for the purposes of illustration, but it is to be noted that other porous materials may be used.

In order that a fibrous material be an efficient sound-deadener, it has been found that there is a certain desirable size for the intercommunicating passages between the fibres. Sound waves consist of alternating zones of dense and rarified air; and when these waves impinge on the surface of a porous material the dense air penetrates into the pores thereof.

The many deviating and intercommunicating passages within the body of the porous material offer resistance to gaseous flow, for there is a linear displacement of each volumetric increment of air, and this frictional resistance is converted into heat. As a result, the energy of the absorbed waves is depleted, and the sound reflection from the surface of the material is greatly reduced.

It has been found that the space enclosed by the passages or intercommunicating pockets should have a certain volumetric capacity in order to attain the maximum sound-deadening properties of the material. Experiment has proven that if the body or block 2 is of fibrous strip material, arranged so that its edges are exposed to the impinging sound waves, the many deviating and intercommunicating passages, inherent in the open fibre structure, serve to retard sound wave propagation; and the resulting material embodies the required characteristics of sound wave absorption and dissipation.

In order that the effectiveness of the acoustical block be enhanced, and this to substantially the maximum of its possibilities, the adjacent turns of the fibrous strip are preferably spaced apart a slight distance. It is found that if the surges of compressed air constituting the wave crests are permitted to penetrate for a distance between the convolutions of the rolled strip, an added amount of the wave energy is absorbed by the fibrous material via the flat sides of the several strips.

Ordinarily it is sufficient if the fibrous strips are loosely rolled, to provide the spacing between the strips; and if the calendering operation be omitted in the manufacture of the strips, the resulting roughness will serve to space the strips apart the proper distance. Another method would be to roll a cord, such as the string 4, between the convolutions, as shown in Figure 6. Anther method would be to provide the slots 6 in the upper edge of the fibrous strip, as shown in Figure 7. Still another method would be to roll a deformed strip of material, such as the corrugated paper board 7, between the convolutions, as shown in Figure 8. An additional method of accomplishing the spacing would be to reduce the thickness of the upper edge of the fibrous strip by any suitable means, such as grinding off a portion thereof, or forming thin longitudinal zones in the process of the strip manufacture.

The more or less plastic nature of the rolled fibrous strip permits it to be formed into any desired shape; and Figure 1 shows such a roll formed into a hexagonal block. The shape of the block is preferably maintained by a metal spider 8, having the upwardly projecting tabs 9 adapted to engage the sides of the block. Any suitable means may be used to secure the spider in place, such as the nails 10 extending thru the tabs 9 and projecting into the block as shown in Figure 1. An adhesive 11 is also preferably applied to the lower face of the block to secure the rolled fibrous strip together, turn by turn.

When the roll of strip material is formed into a given shape, such as the hexagonal form shown in Figure 1, the convolutions of the strip are opened or spread, in line with the corners of the block, to effect the shaping thereof. This spacing between the adjacent turns serves the useful purpose of permitting the wave crests to penetrate between the fibrous strips, as has previously been described. Although the spider 8 is shown as a convenient means for holding the block 2 in shape, it is obvious that other holding means might be used, such as the retained ring 12 shown in connection with Figure 5.

It is obvious, also, that the metallic holding means may be omitted; and a coil, such as shown in Figures 6, 7, or 8, pressed into the desired shape and retained for the frictional resistance between the coils; or, if desired, the shape retained by cement applied during the winding process, either between the coils, or afterward to the flat bottom of the block.

The blocks 2 may be arranged on any suitable supporting surface; Figure 4 showing a group of the blocks arranged on the ceiling of a room. As the blocks 2 are hexagonal, the bounding edges may be filled in with plaster or pieces of wood 13 to square out the ceiling. Another method for doing the same thing would be to provide a wide moulding or frieze, extending out from the wall to cover the block edges.

The blocks are preferably secured to the supporting surface by a nail 14, carrying a cupped clamping head 16 adapted to latch over the two tabs 9 of adjacent blocks, as shown in Figure 3. When the nail 14 is driven into a support, the edge strips of material of the adjacent blocks tend to broom out above the inserted nail to enclose the nail and clamping head. It is to be

noted that any other suitable means might be used for securing the blocks to a support.

It is possible to arrange the fibrous strip material 3 into a body or block, so that the edges of the strip make up the faces of the body, by means other than that of rolling up the strip. Figure 5 shows a modification of the acoustical material embodying my invention, in which the fibrous strip 3 is folded back and forth to form a rectangular body or block 17.

If preferred, the strips may be cut up into pieces having a length equal to that of the block; thence strips being arranged adjacently and suitably secured together. A block built up in this manner would have an appearance substantially as shown in Figure 5, except that the folds would not appear at the ends of the block.

The retainer ring 12 holds the block 17 in shape; it being obvious that other suitable holding means might be used, such as a spider similar to that shown in Figure 2. An adhesive 18 is preferably applied on the lower face of the block 17 to secure the strips, fold by fold. The strips in block 17 are also preferably spaced apart by suitable means, such as previously set forth in connection with the rolled strip.

The texture of the blocks is somewhat apparent, even when viewed from a distance, and this may make it desirable to set the blocks with regard to the direction of the strips in the block. In the case of the folded strips, as shown in Figure 5, the grain, or direction of the strips, in alternate blocks may be arranged with and across the larger axis of the ceiling or wall being covered, to produce pleasing effects. This consideration makes it desirable in some cases to use interfitting block shapes, similar to those now used in floor tiles.

Color is an important factor in determining the desirability of blocks such as these, and it has been found that the fibrous material may be made progressively lighter in color by more thoroughly removing the darker fibres from the furnish forming the source of the material; at the same time, light colored materials, such as sulphite pulp, may be added to the furnish. Pigments may be added to the fibrous material in the process of manufacture; ochre will produce a yellowish material, using a basic furnish of light color; chrome oxide will give greenish tints; and ultramarine will give a blue coloration.

The fibrous material used in making up the blocks is preferably made fire-resistant by treating it with a chemical salt, such as sodium chloride or ammonium phosphate. The fire-resistant property may be secured, however, by using, either in whole or in part, an incombustible fibre such as asbestos. The material is also preferably protected against termite or other insect infestation by treating it with sodium fluosilicate, or other chemical effective against such insect life.

In some instances it might be desirable to have the acoustical material waterproof, and in this event the desired property may be secured by adding a suitable waterproofing substance, such as a solution of aluminum stearate, to the furnish in the manufacture of the fibrous material. When, after a time, it is desirable to clean a wall or ceiling, covered with the acoustical material herein disclosed, it is only necessary to run over the surface with a grinding wheel or sand papering machine, and the surface of the blocks is thus renewed while they are in place.

I claim:

1. An acoustical material comprising porous strips having notches in one edge and arranged so that the notched edges of the strips provide the surface to be exposed.

2. An acoustical block comprising a porous strip wound in convolutions, and spacing means wound with the strip to space the convolutions.

3. An acoustical block comprising a porous strip wound in convolutions, and a corrugated strip wound with the porous strip to space the convolutions.

4. An acoustical block comprising a porous strip wound in convolutions, and retaining means for holding the coil and for shaping the same to form a polygonal block.

5. An acoustical block comprising a porous strip wound in convolutions, and retaining means for holding the coil and for shaping the same to form a block having substantially straight sides.

DOZIER FINLEY.