Oct. 29, 1940. C. F. BURGESS 2,219,440

SOUND ABSORBING CONSTRUCTION

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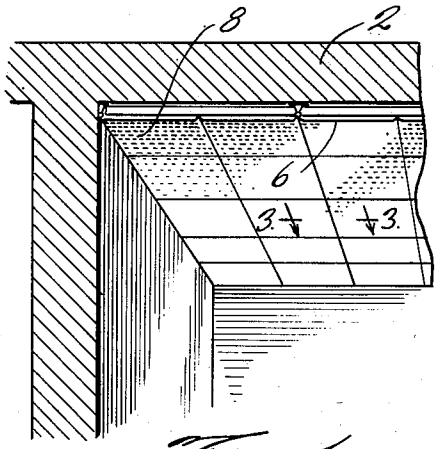


Fig. 1.

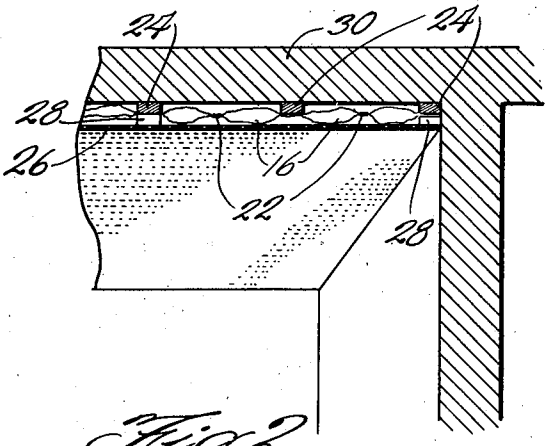
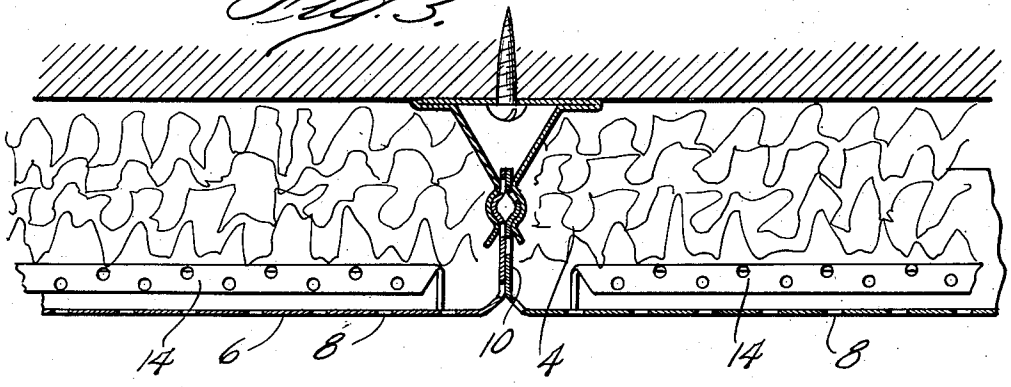


Fig. 2.

Fig. 3.



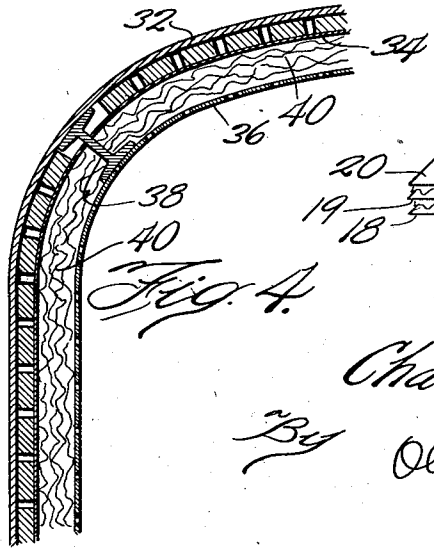


Fig. 4.

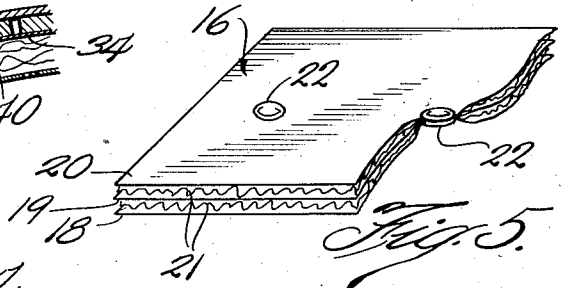


Fig. 5.

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SOUND ABSORBING CONSTRUCTION

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Application July 29, 1937, Serial No. 156,323

2 Claims. (Cl. 20—4)

This invention relates to improvements in acoustical correction constructions and embodies the use of metallic foil as a sound-absorbing material.

The object of the invention is to provide an efficient sound-absorbing construction which is exceedingly light in weight, fireproof, and durable; and which is unaffected by moisture, will not accumulate odors, is an excellent heat and sound insulator, and is easily installed.

In the drawing:

Fig. 1 is a fragmentary view of a room acoustically treated in accordance with one form of my invention;

Fig. 2 is a fragmentary view of a room acoustically treated according to another form of my invention;

Fig. 3 is a detailed sectional view taken at 3—3 of Fig. 1;

Fig. 4 is a vertical sectional view of a railway car installation; and

Fig. 5 is a perspective view, partly in section, showing a sound-absorbing blanket.

The ability of certain materials to absorb a relatively large portion of sound waves incident upon their surfaces is well known in the art. Other materials reflect a greater proportion of the waves. In order to reduce the sound level within a room reflection of the waves should be prevented as far as possible. This may be accomplished by lining the walls and/or ceiling of the room with a sound-absorbing material. Heretofore various porous materials have been used for this purpose, such as balsam wool, hairfelt, mineral wool, or ceramic products. This lining is sometimes faced with a sound-permeable membrane such as a loosely woven textile fabric, wire cloth, or perforated sheet metal or other self-sustaining material. A construction in which the sound-absorbing material is provided with a facing of perforated sheet metal is shown in Norris Patent No. 1,726,500, dated August 27, 1929. In this construction the metal does not absorb any appreciable part of the sound but is used to provide support for the sound-absorbing material and to present a surface which is readily decorable.

I have discovered that metal may itself be used as the sound-absorbing material. My improved sound-absorber consists of a body of crumpled metallic foil arranged, usually, as a lining for the interior of the walls or the ceiling of the enclosure whose acoustical characteristics are to be corrected. This lining may be composed of foil crumpled and packed into a space provided therefor in any desired manner, or it may be a single sheet of foil sufficiently crumpled to provide the desired thickness, or it may be made up from a plurality of superposed sheets of crumpled foil (4 to 6 sheets thus superposed give excellent results) or alternating sheets of crumpled and uncrumpled foil. The latter construction may conveniently be pre-assembled into a blanket as hereinafter described. The blanket may be used with or without a facing. The foil should not be more than 0.0008 inch thick; a foil 0.0004 inch to 0.0006 inch in thickness is preferable. Aluminum foil is readily available and may advantageously be used since this metal is light in weight and corrosion-resistant. Other foils, such as tin, lead or copper may be used. A blanket ¾" to 1" in thickness is suitable although greater thicknesses may be used where the greatest degree of sound absorption is desired. The foil should not be crumpled and packed too tightly. For example, when aluminum foil is used, the density of the packed foil body should be about 3 or 4 ounces per cubic foot. Metallic foil, when arranged as described herein, is a very effective sound-absorber, particularly of the shorter sound waves.

The ceiling 2 of the room shown in Fig. 1 is covered, in effect, by a substantially continuous lining of sound-absorbing material made up from a number of panels of crumpled foil 4 supported in edge to edge relation by tiles 6. As shown in detail in Fig. 3, the faces of the tiles are perforated, as at 8, and carry flanges 10 whereby the tiles and panels are supported from furring strips 12 attached to the ceiling of the room, as more fully described in Weiss Patent No. 1,738,469, dated December 3, 1929, and Norris Patent No. 1,833,174, dated November 24, 1931. The crumpled foil is arranged in a layer in the tile and the unit may then be mounted on the furring strips. The crumpled foil readily adapts itself to the confines of the enclosure formed by the tile, furring strip and ceiling.

The sound-absorbing body or panel may be spaced from the perforated facing, if desired, by providing spacers 14 which rests upon the tile and support the foil. This arrangement permits a more unform reflection of light from the exposed surface and thus improves the appearance. The panels of foil may be formed by packing the material in the tile, bringing the upper level to a point lower than the completely filled unit by

the thickness of the spacer, removing the panel to insert the spacers, and replacing the panel in the tile. The metallic foil is sufficiently rigid to support itself without sagging appreciably if the span between spacers is not too great.

A pre-formed acoustical blanket 16 is shown in Fig. 5. Three or more sheets of uncrumpled metallic foil 18, 19 and 20 are spaced from each other by sheets of crumpled foil 21 and the assembly is quilted together at intervals by grommets 22. If this blanket is installed with sheet 20 facing the wall or ceiling surface and sheet 18 exposed to the sound waves, sheets 18 and 19 should be permeable to the sound waves while sheet 20 may be impervious or sound reflecting. The uncrumpled sheets serve to hold the blanket in shape, permitting rolling of the assembled structure for shipping. Other materials, such as paper or cloth, may be substituted for the uncrumpled foil sheets. If foil is used, sheet 20 may be slightly heavier to provide added strength to the blanket. When installed this blanket may be furred from the wall by strips 24 (Fig. 2) and the blanket covered by a perforated membrane 26 spaced from the blanket by strips 28. In this construction resonating chambers are formed between ceiling 30, blanket 16, and strips 24, the necks of the chambers being defined by grommets 22. The effect of these chambers is to increase the absorption of sounds in the lower frequency range.

A transverse section of a portion of a railway car, the housing for the engines of a Diesel powered locomotive, for example, is shown in Fig. 4. The outer wall 32 of the car is subject to heat or cold depending upon the outside temperature and is rigidly attached to the framework of the car so that it responds to the vibrations caused by the engines, unevenness of the rails, or the beating of the air against the exterior surfaces of the car. A complete sound-deadening construction is illustrated, a vibration-damping device 34 being shown cemented to wall 32 in a manner fully described in Leadbetter Patent No. 2,069,413, dated February 2, 1937, and having my acoustical correction treatment arranged interiorly of this vibration-damping device. The perforated inner wall 36 is mounted in spaced relation to wall 32 by means of I-beam 38 which is welded to both members. Facing 36 may be applied in sections for convenience if desired. Crumpled metallic foil is packed in the space 40. This combined construction is effective in absorbing sounds within the enclosure, preventing the transmission of sounds through the wall of the car, damping the vibrations in the walls, and is at the same time, a very efficient heat insulator.

The above described sound-absorbing constructions are particularly useful for absorbing sounds whose frequencies are greater than about 1,000 cycles per second. Noises from typewriters, adding machines, and the clatter of dishes or that caused by the moving mechanisms of a Diesel engine, for example, are in this range. The number and/or size of the perforations in the facing sheet to provide maximum efficiency of the sound-absorbing construction vary with the wave lengths of the sounds to be absorbed. These considerations are fully set out in the Norris patent above referred to.

When used herein, the term "sound absorbing construction" is to be distinguished from "sound insulating construction" in that the former is intended to reduce noise level within an enclosure by limiting reverberation due to sound reflection from the walls thereof and thus must be exposed directly to the sound waves, and the latter is used to prevent the transmission of sound through a wall comprising the construction. A sheet or body is "sound permeable" if a major portion of sound waves on one side thereof are transmitted to the other side either by means of induced vibrations in the sheet or by the movement of the sound waves through pores or openings in the sheet or body.

The specific installations herein shown and described are intended as illustrative only and in no way limiting the application of my basic discovery herein described.

I claim:

1. An acoustical correction construction comprising, in combination, a wall or ceiling surface of an enclosure, a plurality of elongated furring strips arranged on said surface, a sound absorbing blanket covering at least a portion of said surface in spaced relation thereto and supported by said strips, said blanket comprising a plurality of spaced superposed sheets of metallic foil having crumpled metallic foil therebetween and grommetted together at distributed points between said strips.

2. The construction of claim 1 and including a sound permeable facing member covering and contiguous to the exposed surface of said blanket.

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