

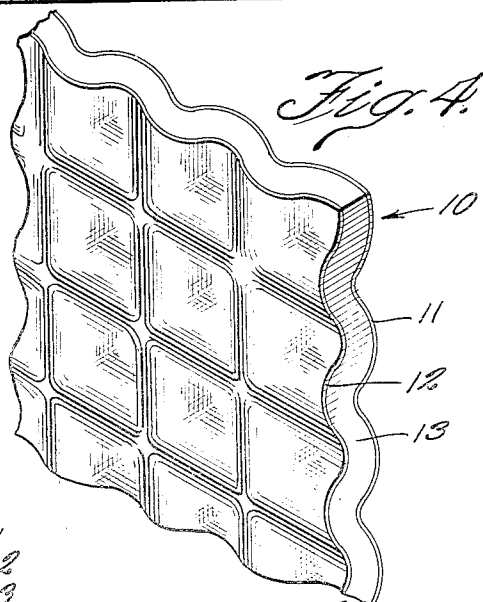
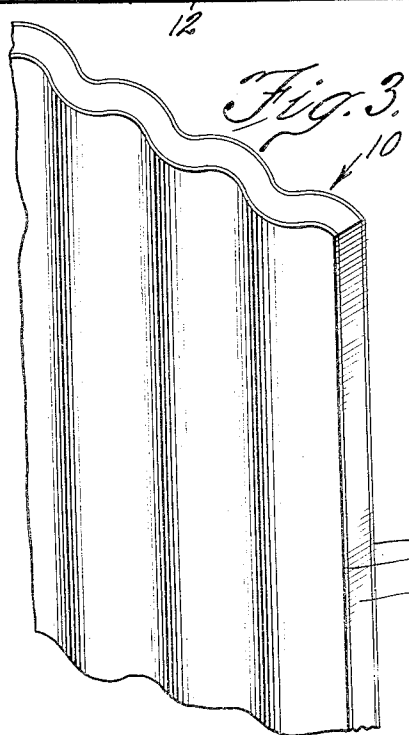
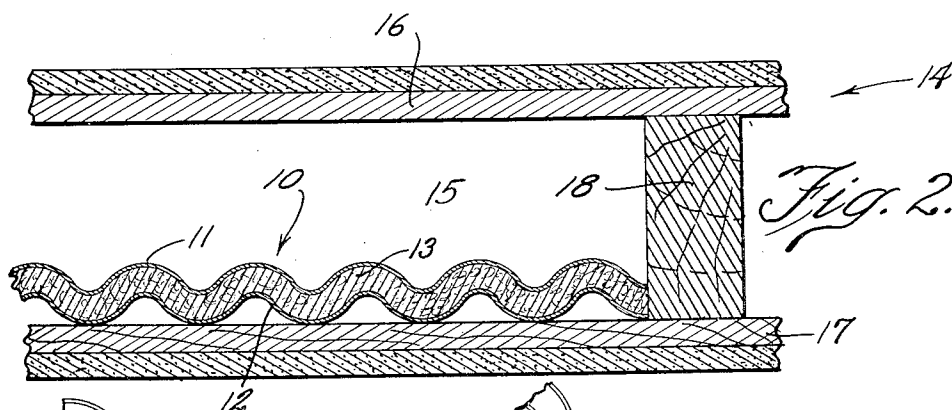
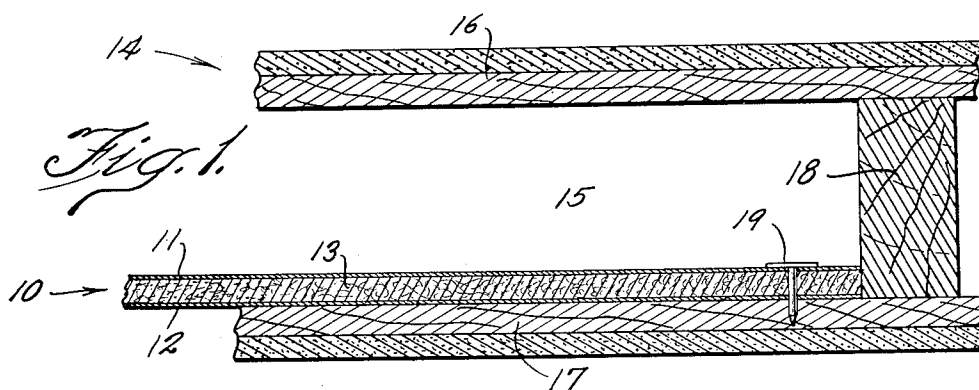
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SOUND INSULATION AND MATERIAL THEREFOR

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SOUND INSULATION AND MATERIAL THEREFOR

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Sound waves consist of trains of alternate compressions and rarefactions of the air, moving as waves at high speed from the source of the sound. Wherever there is an open air space the sound can and will go. Where an obstruction, as a partition, is interposed in the path of the waves, the trains of compressions and rarefactions impart some of their energy to the obstruction, making it a sounding body, in effect transmitting the sound from one side to the other. The remaining sound energy is reflected back. In this way an ordinary wall or partition fails to keep outside noises from coming into a room or a house. The walls themselves transmit the sounds from outside to inside.

Heretofore walls, houses, and rooms have been soundproofed after a fashion by stopping all free air passages and by filling the walls with a packing of some sort, as of rock wool or the like, or by making them very heavy so that their very mass will prevent transmitting sound energy. These methods were not satisfactory as they were unreasonably expensive and they could not be used in any but a very permanent and solid structure.

This invention has to do with an improved material for sound insulation, applicable in sheet form, as is ordinary building paper, and serving economically to exclude sounds even from a light temporary or portable structure, and has for its objects an efficient sound insulation, a sound insulating method and material reasonably low in cost and readily used, a durable sound insulating material, and a sound insulating material in sheet form that is at once flexible and strong and not overly heavy. Many other beneficial objects of this invention will appear.

One embodiment of the invention is illustrated by the accompanying drawing, in which:

Figure 1 is a cross section of a wall with the insulating material in place;

Figure 2 is a cross section of a wall with another form of the same material in place;

Figure 3 is a perspective view of the sheet of material shown in Figure 2; and

Figure 4 is a perspective view of a third form of the invention.

The same reference characters will be used to designate similar parts in the drawing and in the description of the invention which follows.

The composition of the sound proofing material used in this invention is clearly shown in Figure 1. The sheet of material 10 is composed of three layers united by a proper adhesive. The outside layers 11 and 12 consist of heavy metal foil, as lead foil. This foil may be of any desired

thickness, depending on the conditions of particular cases. Where a relatively heavy permanent structure is to be soundproofed, the foil may be comparatively heavy, within the limits of practicability as determined by cost and ease of handling. Where the installation must be lighter, the foil will be thinner, though thicknesses of less than .005 inch are not recommended as the requisite strength would be lacking and the efficiency too low. Thicknesses of .006, .008 and .010 have been found satisfactory.

Lead foil is used because of its flexibility, its lack of elasticity, and because of its greater weight per unit area and thickness. The flexibility promotes ease of handling; the lack of elasticity produces a deadening effect, damping any vibrations that may be set up locally in the metal. This is illustrated by the fact that a lead coin or container will not ring. The greater weight of the lead prevents any but a strong sound wave from imparting any vibration to the foil. It is, of course, clear that any material meeting these requirements could be used in place of the lead without departing from this invention.

Between the two layers 11 and 12 of metal foil is a comparatively thick layer 13 of felt or some similar material. This felt is fastened to the layers of foil by a waterproof adhesive, such as an asphalt or lacquer cement, the three layers being pressed closely together. If desired, the entire layer of felt may be impregnated with the cement, but this reduces the efficiency of the insulation. In place of an ordinary felt, some fireproof material such as felt made from asbestos fibers may be used.

The purpose of the layer of felt is to absorb without transmitting those vibrations which may be imparted to the metal sheet nearest the source of sound. The energy is thus dispersed within the felt and little or none is carried through to the far layer of metal. The inertia and inelasticity of the second layer of metal tends to prevent the transmission of vibrations from the felt to it and deadens or damps what few vibrations are transmitted.

The thickness of the felt may vary from one-eighth to one-half inch or more. The thicker it is the more damping and absorbing effect it will have, but on the other hand the thicker material will cost more. Hence, the thickness of the felt can be adjusted to fit the particular case without departing from this invention.

As a general rule, and particularly where the avoidance of sound reflection or echoes is important, the insulating material may be corru-

gated as shown in Figure 2, or may be provided with a surface uneven in all directions thereon, as indicated in Figure 4. This avoids a uniform reflecting surface in such a way that sound waves are not reflected uniformly as in a beam, but are scattered in all directions. The use in general of an uneven surface to minimize echoes is not alleged to be new, though its application to a sheet of material such as that of this invention is thought to be new.

While the soundproofing material may be used alone in some cases, it is usually inserted into a wall 14 in the space 15 between the outer wall 16 and the inner wall 17. Between the two layers of wall there are separators in the nature of some form of studding, as the common 2x4 pieces 18 used as studding, illustrated. The insulating material may be allowed to stand free within the wall cavity or it may be fastened to either the inner or the outer wall layer by nails 19, or other fasteners.

The use of corrugations, as shown in Figures 2 and 3 is probably the most satisfactory form of the invention. A sheet so corrugated is more flexible and yet stronger than a flat sheet, and it has furthermore a heightened soundproofing effect, due to the concentration in a unit area of a greater amount of heavy and damping material, corresponding to an increase in the thickness of the lead sheets, with consequent increase in the inertia to be overcome by the sound waves. The corrugated sheet furthermore is less likely to act as a diaphragm locally if improperly installed, because of the bracing and stiffening effect of the corrugations.

It is clear that any other conformation of the surface of the material could be used without departing from this invention. If desired, this soundproofing material may be built up to have more layers, a layer of felt being interposed between each adjacent layer of metal. This structure will operate in the same way as the three-ply material but with greater efficiency.

The soundproofing material may be used to surface a wall, or even alone without any supporting structure other than a frame, but its principal use is in combination with a wall constructed to have open spaces in the interior thereof, as the wall of a wooden frame dwelling.

What is claimed as new and is desired to be secured by Letters Patent of the United States is:

1. A sound insulating material in sheet form comprising a layer of flexible porous material and two protecting layers of heavy nonresilient metal foil upon opposite sides of said porous material.

2. A sound insulating material in a preformed sheet comprising a layer of felt and two layers of heavy nonresilient metal foil, one layer of foil in adherence continuously over each side of said felt to fully protect the felt throughout.

3. A sound insulating material in a preformed

sheet comprising a layer of felt and a layer of lead foil attached to extend continuously over and protect each surface of the felt.

4. A soundproofing material in a preformed sheet comprising lead foil and sheets of felt in alternate layers, a layer of felt separating layers of lead foil, and a layer of foil being cemented to each face of a layer of felt to fully protect the same.

5. A soundproofing material in a preformed sheet comprising a layer of felt and two layers of lead foil attached continuously over opposite faces of said felt and separated thereby, the surfaces of said sheet being irregular.

6. A soundproofing material in a preformed sheet comprising a layer of felt and two layers of lead foil attached continuously over opposite faces of said felt and separated thereby, said sheet being corrugated.

7. A sound insulating material in a preformed sheet, comprising two layers of metallic foil of a nonresilient nature, and a substantially thicker layer of felt separating and fully protected by the layers of foil, the said layers of foil being secured in adherence with the opposite surfaces of the felt continuously thereover.

8. A sound insulating material in a preformed sheet, comprising two layers of lead foil and a substantially thicker layer of felt between and separating the lead foil layers, the said lead foil layers being secured in adherence with the opposite surfaces of the felt layer continuously thereover and fully protecting the same.

9. A sound insulating material in a preformed sheet, comprising two layers of lead foil and a substantially thicker layer of felted asbestos fibers between and separating the lead foil layers, the said lead foil layers being secured in adherence with the opposite surface of the felt layer continuously thereover and fully protecting the same.

10. A sound insulating material in a preformed sheet comprising outer inert non-elastic metallic foil layers of a density to efficiently deaden sound, and an intermediate layer of a sound deadening material of soft fibrous nature carried between, and fully protected by, the foil layers, for forming a strong durable unit of a self-supporting nature capable of retaining curved or bent form as well as nails and like fastening elements.

11. A sound insulating material in a preformed sheet comprising outer layers of lead foil of a thickness between .005 and .010 inches and of a density to efficiently deaden sound, and an intermediate layer of a soft fibrous sound-deadening material carried between and fully protected by the foil layers, and forming therewith a unit of a strong durable nature capable of retaining curved or bent form as well as nails and like fastening elements.

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