Nov. 22, 1966 T. MARINER 3,286,784

ACOUSTICAL MATERIAL

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Fig. 1

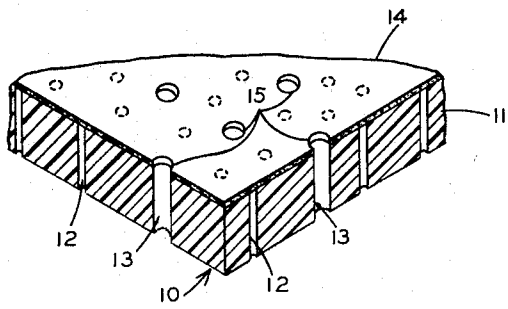
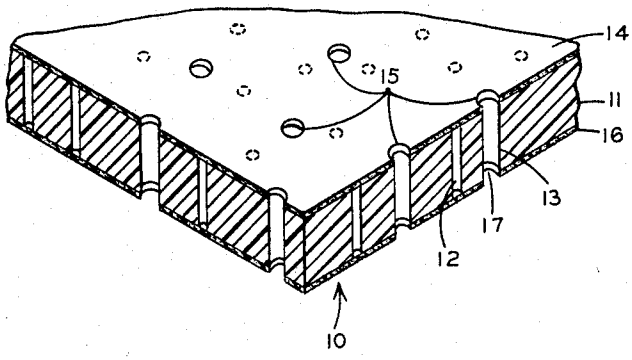


Fig. 2



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ACOUSTICAL MATERIAL

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This invention relates to acoustic material and more particularly to thin sheet material capable of absorbing sound efficiently over most of the audible spectrum and also distributing ventilating air. The material of the present invention is formed of a plurality of layers. The material may be translucent. The sheet material may be used by itself as an illuminating, ventilating, and sound absorbing medium in building structures such as ceilings, walls, etc.

Many attempts have been made in the prior art to find a sheet material which may be used both as a sound absorbing ceiling material and a ventilating ceiling material. One of the solutions of the prior art has been to use a perforated metal pan system wherein a series of perforated metal pans were suspended from the main ceiling of a room. A series of acoustical pads were then mounted above and behind the metal pans in spaced relationship thereto between the metal pans and the building ceiling. The space between the metal pans and the acoustical pad was then used as an air flow channel to supply air to the perforations in the metal pans to be distributed to the room below. However, it was found that this system did not provide uniform air distribution. The metal pan system did, however, provide adequate sound absorption. Since it was desired to find a ceiling which would perform both functions, further development work was performed. Another solution has been to suspend specially constructed runners which incorporate air ducts and apertures therein. These runners would be arranged in a substantially parallel relationship. Acoustic panels would then be placed on said runners so that they would extend between adjacent runners to be supported thereby. A adjacent runners in this system were usually placed at least two feet apart. It is apparent, therefore, that even though this system might provide adequate sound absorption, the spacing between the runners would not afford uniform air distribution.

It is therefore an object of the present invention to provide a new and improved material for use in building structures where such material will be capable of absorbing sound and distributing ventilating air in a uniform manner.

Other objects of the present invention will be readily apparent from the detailed discussion of the device noted below with reference to the drawing in which

FIGURE 1 is a view in perspective of an embodiment of the invention; and

FIGURE 2 is a view in perspective of another embodiment of the invention.

Referring now to FIGURE 1, there is shown a sheet of material comprising a plurality of layers. The sheet is generally shown at **10**. One layer **11** of the sheet **10** is preferably formed of a gas impermeable material. This primary layer **11** contains a plurality of spaced, relatively small perforations **12** generally having a predetermined size and a plurality of spaced apertures **13**, generally having a size greater than the predetermined size of said perforations **12**. Overlying and adjacent the primary layer **11** on one side thereof is secondary layer **14**. This secondary layer **14** has apertures **15** of substantially the same size as and which are in register with the apertures **13** in the primary layer **11**. The sequence of assembling, forming, and punching of the layers is

not critical and may be varied. The layers may be formed together in laminar relationship by any well known means. Thus, the layers may be pre-punched and subsequently assembled, for example. Also, the primary layer may be punched to include only the perforations and then assembled with the other layer, after which the apertures may be punched through the entire assembly. Although two examples of forming the device have been given, other methods of forming the device including the apertures and perforations therein may be used. The secondary layer **14** is of a gas permeable, porous, fibrous material. It is to be understood that each layer may comprise a plurality of sub-layers of varying thickness. Sheets, layers, and sub-layers themselves may vary in thickness. Many types of materials may be used in the composition of the sheets. Each layer and sub-layer may be formed of different materials. The secondary layer **14** may be applied to either or both sides of the primary layer **11**. The number, spacing, and pattern of the perforations as well as the size thereof are not critical and will be selected according to procedures known to those skilled in the art to give the optimum sound absorbing characteristics for a given situation. Similarly, the number, spacing, pattern, and size of the apertures may be varied to afford the desired ventilation characteristics. The size or sizes of the perforations are generally smaller than that of the apertures, since the size or sizes of perforations which afford optimum sound absorption usually will be too small for proper air distribution. This condition is especially true with regard to the use of thin materials having perforations designed for optimum sound absorption. It was found that the number and size of perforations in such thin materials provide too high a flow resistance to permit adequate flow of ventilating air at pressures low enough to be supported by the thin materials. It is to be understood that all of the perforations or apertures need not be of the same size or shape and that each perforation or aperture may have a size and/or shape different from those of other perforations or apertures.

Referring now to FIGURE 2, there is shown a sheet material similar to that of FIGURE 1. However, it will be noted that the sheet material shown in FIGURE 2 is provided with a secondary layer on each side of the primary layer **11**. The secondary layers are indicated at **14** and **16**, respectively. Secondary layer **16** is similar to that secondary layer designated as **14**. Secondary layer **16** has apertures **17** of substantially the same size as, and which are in register with, apertures **13** in primary layer **11**. It is apparent that the embodiment shown in FIGURE 2 may be formed of the same materials mentioned with regard to the embodiment of FIGURE 1. It is to be understood that the construction of the device of FIGURE 2 is subject to the same variations mentioned with regard to FIGURE 1 above.

One application of the present invention may take the form of a sound absorbing and ventilating sheet material having a very small thickness on the order of .018". This particular sheet may have a primary layer of translucent plastic material with secondary layers of porous paper or other fibrous material. The primary layer may have the greatest thickness, being on the order of .015". Each of the secondary layers may have a thickness of approximately .0015". This composite sheet material will be light in weight and may be used as a sound absorbing, illuminating, and ventilating ceiling, wall, or other building structure. The small perforations in the sheet may be approximately .043" in diameter with a density of approximately 7,000 holes per square foot. The large apertures extending completely through the

sheet may be approximately .080" in diameter and have a density of approximately 300 per square foot. It is evident that shipping and storage costs for panels cut from such sheet material will be low due to the light weight and small thickness of such panels. Furthermore, panels cut from the sheet material mentioned in the example immediately above will be translucent and easily adaptable for installation in an illuminating ceiling wherein a light source is placed between the main building ceiling and a subceiling formed of such panels.

The sheet material according to the invention affords the unexpected result of providing a ventilating sheet material with relatively large apertures extending completely therethrough and having low flow resistance for proper distribution and flow of ventilating air and relatively small perforations which extend partially through said sheet for excellent sound absorption wherein the relatively large apertures extending completely through the sheet apparently do not destroy the sound absorbing characteristics of the smaller sound absorbing perforations. In other words, there appears to be no appreciable short circuiting of the sound waves through the ventilating apertures. It will be understood that the layers or sheets of the present invention do not need to be in a laminar form but may be spaced from one another. Various modifications will occur to those skilled in the art without departing from the spirit and scope of the invention as defined in the claims.

I claim:

1. Acoustic sheet material comprising at least one primary layer of material having a plurality of spaced, relatively small perforations generally of a predetermined size therethrough and having a plurality of spaced apertures generally of size greater than said predetermined size of said small perforations and at least one secondary layer of material on at least one side of and adjacent said primary layer, said secondary layer having a plurality of apertures of substantially the same size as and in register with said primary layer apertures.

2. Acoustic sheet material according to claim 1 wherein said one primary layer is of a substantially gas impermeable material.

3. Acoustic sheet material according to claim 2 wherein said one secondary layer is of a porous, gas permeable material.

4. Acoustic sheet material according to claim 1 wherein at least one secondary layer is on another side of and adjacent said primary layer, said last-mentioned secondary layer having a plurality of apertures of substantially the same size as and in register with said primary layer apertures.

5. Acoustic sheet material according to claim 4 where in said primary layer is of a substantially gas impermeable material.

6. Acoustic sheet material according to claim 5 wherein at least one of said secondary layers is of a porous, gas permeable material.

7. Acoustic sheet material according to claim 5 wherein at least one of said secondary layers on each side of said primary layer is of a porous, gas permeable material.

8. Acoustic sheet material according to claim 4 further wherein at least two of said layers are in laminar relationship with one another.

9. Acoustic sheet material according to claim 2 wherein said primary layer is of a translucent material.

References Cited by the Examiner

UNITED STATES PATENTS

2,703,627	3/1955	D'Eustachio	181—33
2,805,842	9/1957	Andorfer	181—33
2,838,806	6/1958	Sabine	181—33

FOREIGN PATENTS

547,266	10/1957	Canada.

References Cited by the Applicant

UNITED STATES PATENTS

2,030,157	2/1936	Schlenker.
2,672,547	10/1954	Ericon.
2,703,627	3/1955	D'Eustachio.
2,805,842	9/1957	Andorfer.
3,020,184	2/1962	Cubberly et al.
3,058,411	10/1962	Hanson et al.

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