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ACOUSTIC PANEL

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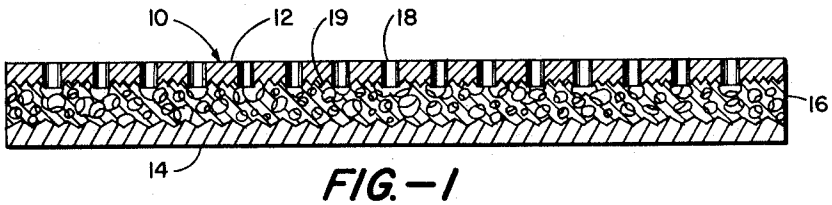


FIG.—1

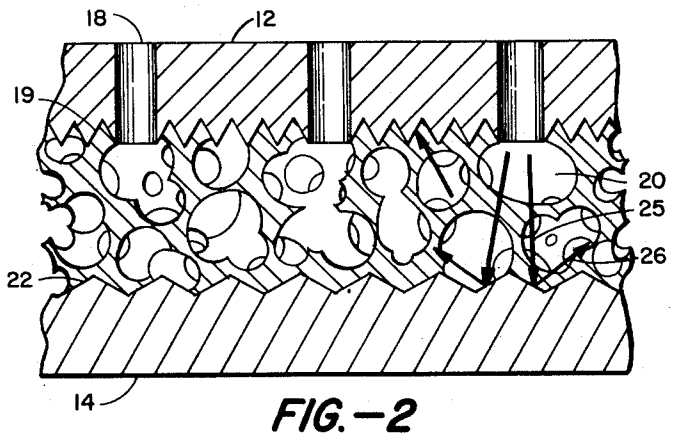


FIG.—2

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ACOUSTIC PANEL

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This invention relates to soundproofing and more particularly to an acoustic damping panel.

It has been proposed to form an acoustic panel with a plurality of Helmholtz resonating cavities formed therein. Each Holmholtz resonating cavity will absorb sound at its fundamental resonant frequency and at its overtone resonant frequencies. If such an acoustic panel is formed with a large number of Helmholtz cavities which have different sizes and shapes, the resulting acoustic panel will have wideband frequency absorption characteristics. However, the fabrication of an acoustic panel with a large number of differently shaped Helmholtz cavities is difficult and somewhat expensive using prior construction techniques.

What is needed, therefore, and comprises a principle object of this invention, is to provide an acoustic panel having a large number of differently shaped Helmholtz-type cavities formed therein which can be easily and economically fabricated without the use of complex and expensive machinery.

The invention, in its broadest aspect, comprises the fabrication of an acoustic panel formed from an inner perforate strip, an outer imperforate strip, and an intermediate strip of a low modulus open-celled foam structure. The perforations in the inner strip communicate with the cells in the foam structure to form the acoustic equivalent of a large number of Helmholtz cavities in the acoustic panel. Consequently, the resulting acoustic panel will have a wideband frequency absorption characteristic.

This and other objects of this invention will become more apparent when understood in the light of the specification and the accompanying drawings wherein:

FIGURE 1 is a side sectional view of an acoustic panel constructed according to the principles of this invention and

FIGURE 2 is an enlarged sectional view of a portion of the acoustic panel shown in FIGURE 1, and showing the path of sound therethrough.

Referring now to FIGURE 1 of the drawings, an acoustic panel indicated generally by the reference numeral **10** comprises an inner perforate strip **12** preferably formed from a low modulus cellulose material. The acoustic panel includes a spaced parallel outer imperforate strip **14** which may also be formed from a suitable cellulose material. The inner and outer strips are secured to an intermediate strip of an open-celled foam material **16** by any suitable means such as gluing. This material may be an open-celled urethane material, an open-celled polyester, an open-celled styrene, or other materials having generally similar properties. These materials all have a low modulus of elasticity so that the sound absorption characteristics of the panel is augmented by the increased surface area caused by the cells or cavities in the low modulus material.

As best seen in FIGURE 2, each of the perforations **18** in the inner perforate strip **12** communicates with the open cells **20** in the open-celled foam structure **16**. These perforations are smaller than the size of the open cells so that the combination of the perforations **18** and open cells **20** is the acoustic equivalent of Helmholtz resonating cavities. Since there is a large natural variation in the size and shape of the cavities or cells in the open-celled foam structure **16**, there will be a large variation in the size, shape, and volume of the equivalent Helmholtz cavities. Each Helmholtz cavity has a fundamental absorption frequency determined primarily by its volume and overtone absorption frequencies determined primarily by shape. Consequently, the large number of differently shaped Helmholtz-type cavities in the panel will cause the acoustic panel to have a wideband sound absorption characteristic.

The inner surface **22** of the imperforate strip **14** is serrated, as best seen in FIGURE 2. The effect of these serrations is to cause any sound originating near the inner perforate strip **12** of the acoustic panel and penetrating the acoustic panel to serrated surface **22** to be reflected by the serrated surface at an angle to the normal to this surface, see the arrows **25** and **26** in FIGURE 2. With this arrangement, sound reflected from the inner surface **22** of the imperforate strip **14** travels a long path back through the open-celled foam material **16**.

If the open-celled foam structure is also formed from a low modulus material, as described above, the increased pathway followed by the reflected sound will cause a substantially greater quantity of sound to be absorbed in the material **16**. Surface **19** of the inner perforate strip **12** may also be serrated as suggested in FIGS. 1 and 2 to further increase losses in sound intensity in the sound reflected from surface **22** and passing through the open-celled foam structure to surface **19**. As shown in FIGS. 1 and 2, the serrations on the inner surface **22** of the outer imperforate strip may be different in shape from the serrations on the inner surface **19** of the inner perforate strip.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred example of the same and that various changes in the shape, size, and arrangement of the parts may be resorted to without departing from the spirit of this invention or the scope of the claims.

We claim:

1. An acoustic panel comprising an inner perforate strip, an outer imperforate strip, and an intermediate layer of low modulus open-celled foam material secured together, the perforations in the inner strip communicating with the cells in the foam structure and defining thereby a plurality of Helmholtz cavities, the variation in the size of the cells causing a wide variation in the dimensions of the Helmholtz cavities and causing a wide variation in the fundamental sound absorption frequencies and the overtone absorption frequencies of the Helmholtz cavities in the panel, whereby the acoustic panel will have wideband sound absorption characteristics, and serrations on the inner surface of the outer imperforate strip so that sound penetrating said acoustic panel to said serrations is reflected thereby at an angle to the normal of said surface to increase the path length of the sound through the low modulus open-celled foam structure in order to augment the sound absorption characteristics of the panel.

2. The acoustic panel described in claim 1 wherein said intermediate layer is formed from an open-celled urethane foam.

3. The acoustic panel described in claim 1 wherein said intermediate layer is formed from an open-celled polyester.

4. The acoustic panel described in claim 1 wherein said intermediate layer is formed from an open-celled styrene.

5. An acoustic panel as in claim 1 including further serrations on the inner surface of the inner perforate strip.

6. An acoustic panel as in claim 5 wherein the serrations on the inner surface of the outer imperforate strip are of a shape different from said serrations on the inner surface of the inner perforate strip.

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