March 28, 1950 H. F. OLSON 2,502,020

DIFFRACTION TYPE SOUND ABSORBER
WITH FIBER GLASS WALLS
Filed Jan. 26, 1945

Fig. 1.

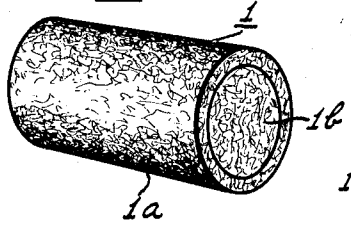


Fig. 2.

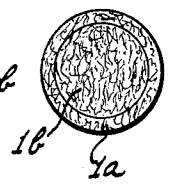


Fig. 3.

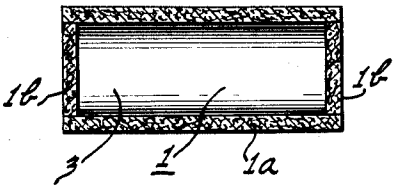


Fig. 4.

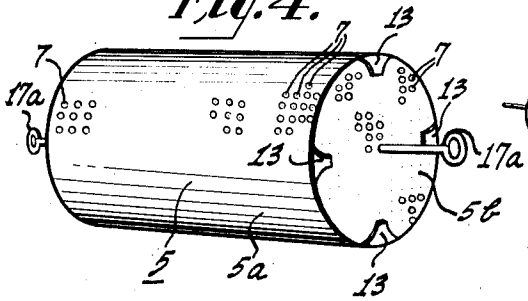


Fig. 6.

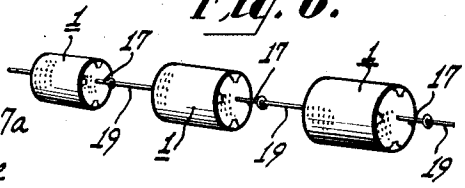


Fig. 5.

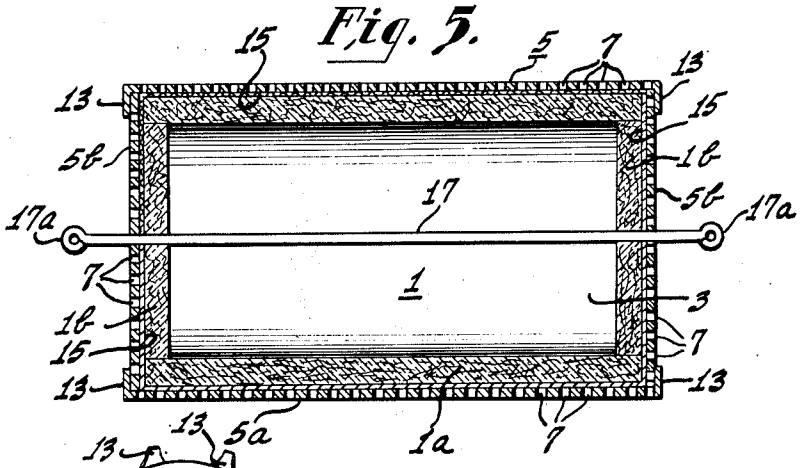
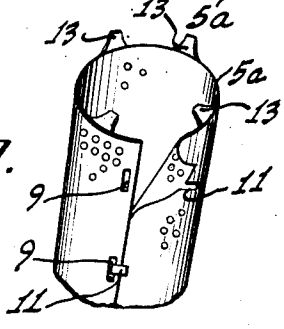


Fig. 7.



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UNITED STATES PATENT OFFICE

2,502,020

DIFFRACTION TYPE SOUND ABSORBER WITH FIBER GLASS WALLS

Harry F. Olson, Princeton, N. J., assignor to Radio Corporation of America, a corporation of Delaware

Application January 26, 1945, Serial No. 574,772

7 Claims. (Cl. 181—33)

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This invention relates to acoustic absorbers, and more particularly to an acoustic absorber of the diffraction type, the present invention having especial reference to a functional sound absorber of the type disclosed and claimed in my copending application Serial No. 512,320, filed November 30, 1943.

In my aforesaid copending application, there is disclosed a diffraction type acoustic absorber comprised of a casing which encloses a relatively large volume of air and the wall structure of which is constituted by a material which is pervious to sound waves but which offers a high dissipative impedance thereto. By making the wall structure of such a material and making the cavity or space within the casing so large that the volume of air therein offers a very small impedance to the sound waves, a very highly efficient functional sound absorber is provided.

Among the material proposed in my aforesaid copending application for the wall structure of the casing are porous papers, such as blotting or filter paper, felted materials made from wood pulp fibers and sulphite, several superimposed layers of cloth, a material known on the market as "Kimpac" and constituted by approximately sixty layers of very thin paper having a plurality of natural holes or perforations therein which do not line up with each other, and the like. While these and many other similar materials are highly satisfactory from the acoustical standpoint, they have the disadvantage that they are not fireproof, they are not vermin proof, they cannot always be provided with a satisfactory finish, as by painting or the like, and frequently they are not as rugged mechanically as they should be under certain conditions of use.

The primary object of my present invention is to provide an improved diffraction type or functional sound absorber which will be free from the aforementioned disadvantages.

More particularly, it is an object of my present invention to provide an improved, functional sound absorber of the type set forth above which is inherently fireproof and therefore will not require special treatment to render it so, which is vermin proof, and which is mechanically rugged.

It is also an object of my present invention to provide an improved functional sound absorber as above set forth which has a very good appearance, which is relatively inexpensive in cost, and which is highly efficient in use.

In accordance with my present invention, I make the absorber, or "acoustic sink" as I have termed it, of interwoven, glass fibers more or less

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compacted to provide a plurality of fine, intercommunicating passages which afford communication between the space within the sound absorber casing and the exterior thereof. The fibers may be bonded together with a suitable adhesive, such as any of the many well known thermoplastic cements, and this serves to form the wall structure of the casing into a self-sustaining unit. A casing thus formed is absolutely fireproof and vermin proof and is mechanically rugged. By compacting the fibers more or less, the acoustic resistance of the material can be made to have any desired value. As plain absorbing material (that is, as a lining for a wall structure, for example), the glass fiber material has an absorption coefficient of about 80%. However, when formed into a diffraction sound absorber according to my present invention, the absorption coefficient is very much greater, and, in fact, well over 100%. Moreover, the glass fibers can be made of any desired color merely by the inclusion of suitable pigments in the glass, wherefore it becomes unnecessary to paint the finished absorber casing and thereby, possibly, block up some of the passages with the consequence of reducing its efficiency.

The novel features that I consider characteristic of my present invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, as well as additional objects and advantages thereof, will best be understood from the following description, when read in connection with the accompanying drawing in which

Figure 1 is a perspective view of one form of acoustic absorber constructed in accordance with the present invention,

Figure 2 is an end elevation thereof,

Figure 3 is a longitudinal, central, sectional view thereof,

Figure 4 is a view similar to Figure 1 but showing the absorber enclosed in a perforated, protective casing,

Figure 5 is an enlarged, central, sectional view of the absorber unit of Figure 4,

Figure 6 is a perspective view of several sound absorbers according to my present invention joined together for mounting on a suitable supporting structure, and

Figure 7 is a fragmentary, perspective view showing certain details of construction of the protective casing of Figures 4 and 5.

Referring more particularly to the drawing, in which similar reference characters designate

corresponding parts throughout, there is shown an acoustic absorber 1 formed of a hollow, normally open-ended cylindrical member 1a and a pair of disc-like closure members 1b one at each end of the member 1a. The members 1a and 1b constitute the wall structure of the sound absorber and enclose a space or cavity 3 of substantial volume filled with air or other suitable fluid. The casing parts 1a and 1b are formed of a plurality of intertwined, glass fibers of various lengths arranged indiscriminately in random directions to provide a plurality of irregular, random, intercommunicating passages which afford communication between the space or cavity 3 and the exterior of the absorber 1. The glass fibers are compacted or compressed to any desired degree so that the intercommunicating passages will be of very small cross-sectional dimensions and therefore will provide a relatively high dissipative impedance to the acoustical waves received by the absorber from the exterior and transmitted by the wall structure to the cavity 3. The cavity 3, on the other hand, is of sufficiently large volume to have a relatively large capacitance and therefore it will afford very little impedance to the passage of the acoustical waves through the fine passages between the glass fibers. In this way, practically all of the impedance encountered by the incoming sound waves is provided by the fine, intercommunicating passages between the glass fibers.

One material which I have found satisfactory is that known commercially as "Fiberglas," this material being manufactured by the Owens-Corning Fiberglas Corporation of Toledo, Ohio. The glass fibers may be colored by incorporating any suitable pigment therein. To render the members 1a and 1b fairly rigid and self sustaining, the fibers may be more or less bonded together with the aid of a thermoplastic cement, such as Bakelite cement or the like. In any case, it will be apparent that the resulting structure will be fireproof, vermin proof and rugged in construction, and that it will have a very nice appearance. In one form of acoustic absorber which I have constructed according to my present invention, the cylindrical member 1a was about 12" long, the end closures 1b were each about 7" in diameter, and the members 1a and 1b had a thickness of about 1". Such an absorber or acoustic sink has a surface area of about 2.8 square feet. The glass fibers of this absorber unit were arranged with such compactness that the absorption of this unit at 512 cycles per second was about 4.8 sabins. Hence, the absorber coefficient of this unit was equal to

$$\frac{4.8}{2.8}\times 100 = 170\%$$

In Figures 4 and 5, the acoustic absorber 1 is shown housed within a protective casing or shell 5 which may be of metal, plastic, or of any other suitable material. The shell 5, like the absorber 1, may be formed of a longitudinally extending part 5a and a pair of end members 5b, each provided with a plurality of relatively large openings 7 of such dimensions as to freely pass acoustical waves from the exterior to the absorber 1. The casing portion 5a may be made of a sheet of flat material formed along one longitudinal edge with a series of spaced slots 9 and along its other longitudinal edge with a corresponding plurality of lugs or projections 11 adapted to fit within the slots 9. The member 5a may, therefore, be wrapped around the member 1a, its longitudinal edges brought into overlapping relation, and the lugs 11 extended through the slots 9 and bent over, as shown in Figure 7, to hold the member 5a in place. The casing member 5a is also provided with several lugs 13 along its side edges and these may be bent over against the end pieces 5b, as shown in Figures 4 and 5, after the end pieces 5b have been placed against the end members 1b of the absorber. If desired, a layer of muslin 15 or the like may be interposed between the sheathing parts 5a and 5b on the one hand, and the absorber parts 1a and 1b on the other.

To facilitate mounting the absorber units or acoustic sinks in a room, their end members 1b and 5b may be provided with axially aligned openings for the reception of mounting rods 17 formed with loops or eyes 17a at their ends by means of which they may be connected to the corresponding loops or eyes of adjacent absorber units either directly or with the aid of connecting wires or rods 19, as shown in Figure 6. The resulting arrangement or series of absorber units may then be mounted in any suitable manner in the room or other enclosure requiring acoustic treatment.

From the foregoing description, it will undoubtedly be apparent to those skilled in the art that I have provided an improved form of acoustical sound absorber which has all the advantages set forth above. It will also be apparent, no doubt, that various changes may be made in the particular form of the invention described above and that various other forms thereof are also possible. I therefore desire that my invention shall not be limited except insofar as is made necessary by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. A diffraction type acoustic absorber comprising a self-contained, closed casing enclosing an air-filled space therein, said casing being constituted by an acoustically porous material having a plurality of fine passages therethrough of such fine dimensions that they offer a relatively large dissipative impedance to the passage of said waves therethrough between the exterior of said casing and said space, and said space having a volume of such magnitude that the air therein offers a relatively small impedance to the passage of said waves through said casing, said material comprising a plurality of intertwined fibers of glass arranged indiscriminately in random directions and in such relatively compact relation as to provide said fine passages.

2. A diffraction type acoustic absorber according to claim 1 characterized in that said glass fibers are bonded into a self-sustaining structure with the aid of an adhesive.

3. A diffraction type acoustic absorber according to claim 1 characterized in that said glass fibers are bonded into a self-sustaining structure with the aid of a thermoplastic cement.

4. A diffraction type acoustic absorber according to claim 1 characterized in that said casing is constituted by a normally open-ended, hollow, cylindrical member and a pair of closure members closing said normally open ends whereby to provide said space.

5. A diffraction type acoustic absorber according to claim 1 characterized in that said casing is constituted by a normally open-ended, hollow, cylindrical member and a pair of closure members closing said normally open ends whereby to provide said space, said closure members being

provided with openings for the reception of mounting means for said absorber.

6. A diffraction type acoustic absorber according to claim 1 characterized in that said casing is constituted by a normally open-ended, hollow, cylindrical member and a pair of closure members closing said normally open ends whereby to provide said space, and characterized further in that the fibers of said cylindrical member and of said closure members are bonded together into a self-sustaining structure with the aid of an adhesive.

7. A diffraction type acoustic absorber according to claim 1 characterized in that said glass fibers are bonded into a self-sustaining structure with the aid of an adhesive, and characterized further in that said casing also includes a layer of cloth around said structure and an outer, perforated covering around said cloth layer.

HARRY F. OLSON.

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The following references are of record in the file of this patent:

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Number	Country	Date
8,529 of 1927	Australia	Aug. 18, 1927
102,941	Australia	Jan. 20, 1938

Certificate of Correction

Patent No. 2,502,020 March 28, 1950

HARRY F. OLSON

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 6, line 18, list of references cited, for "102,941" read *102,914*;

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of September, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

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