March 28, 1950 G. L. BEERS 2,502,017

SUSPENSION MEANS FOR ACOUSTICAL ABSORBERS

Filed Dec. 27, 1943

Fig. 1

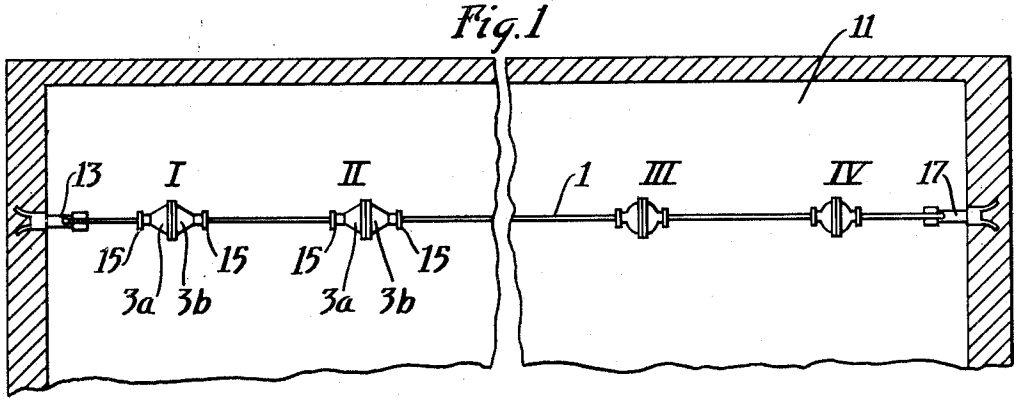


Fig. 2

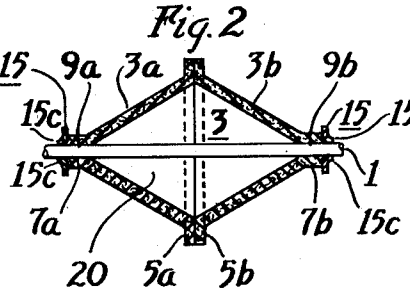


Fig. 3

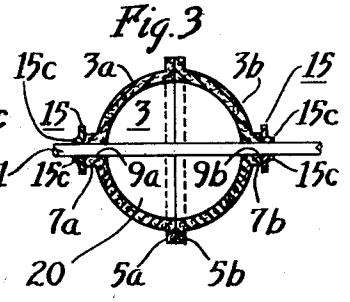


Fig. 4

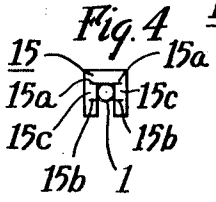
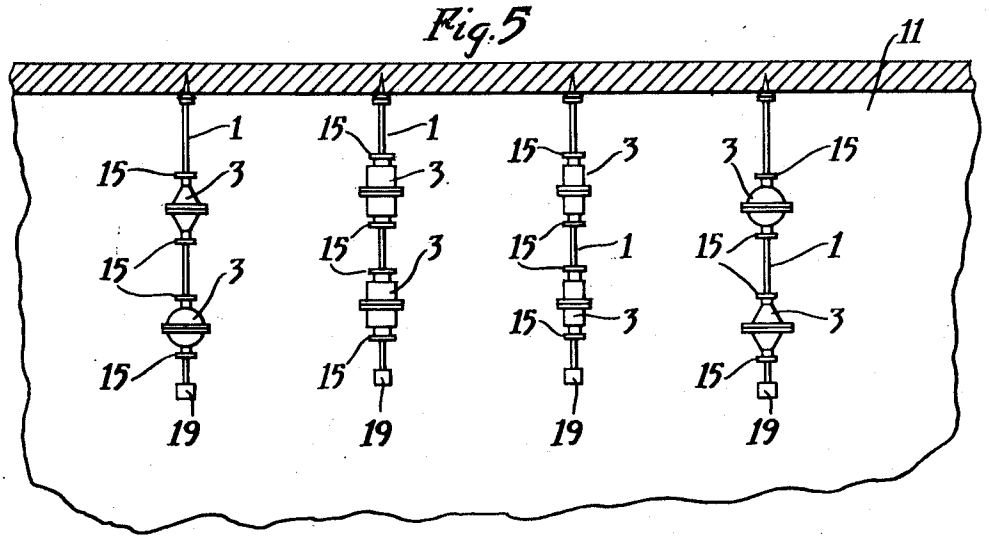


Fig. 5



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2,502,017

UNITED STATES PATENT OFFICE

2,502,017

SUSPENSION MEANS FOR ACOUSTICAL ABSORBERS

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Application December 27, 1943, Serial No. 515,763

14 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 particular reference to the type of acoustic absorber disclosed and claimed in the copending application of Harry F. Olson, filed November 30, 1943, Serial No. 512,320, assigned to the same assignee as the present invention.

In the aforesaid Olson 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 diffraction type absorber is provided.

As disclosed by Olson in his aforesaid application, the absorbing unit or "acoustic sink," as he has called it, may be made up from a suitably blanked sheet which can be folded to provide a box-like structure. However, units so constructed require a series of folding, assembling and mounting operations at the point of use which are time consuming and relatively costly. To avoid these objections, it has been proposed heretofore to form the absorber units or sinks of a pair of complemental parts which may be nested together compactly for storage, but which can be assembled when the unit is to be set up for use by placing the two halves together and securing them to each other by an adhesive, adhesive tape, stapling, or the like. The assembled units are then ready for installation on suitable supporting members throughout a room, auditorium, or other enclosure requiring acoustic treatment.

While the latter arrangement overcomes, to a large extent, the objections noted above, it still involves certain operations, such as the individual assembly and subsequent mounting of the units, which require considerable handling of the parts, and the primary object of my present invention is to greatly simplify the assembly and installation of acoustic absorbers or sinks of the type set forth above whereby to materially reduce the cost of the complete installation.

More particularly, it is an object of my present invention to provide an improved acoustic absorber unit and an improved acoustic absorber system which may be formed therefrom in a facile manner and with a minimum of operations.

Another object of my present invention is to

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provide an improved method of assembling and installing acoustic absorbers of the type set forth whereby both the assembly and the installation or mounting of the units will be accomplished in a single operation.

Still another object of my present invention is to provide an improved acoustic absorber of the diffraction type which is neat in appearance and which may be rendered suitably decorative.

A further object of my present invention is to provide an improved mounting arrangement for acoustic absorbers of the type set forth as a result of which the individual units can be readily cleaned when necessary.

Still a further object of my present invention is to provide an improved acoustic absorber construction of the diffraction type and mounting therefor which will retain the parts of the absorber in suitable relation at all times regardless of temperature variations to which the unit and its supporting member may be subjected.

It is also an object of my present invention to provide an improved acoustic absorber construction and mounting therefor as above set forth which can be readily installed even by one unskilled in the art, which is very inexpensive in cost, and which is highly efficient in use.

As proposed heretofore, the absorber units or sinks are fabricated in two hollow parts of suitable shape, such as cones, pyramids, hemispheres, or the like, the two parts being substantially identical in shape so that they can be nested together for compact packing when assembled for storage or shipment. In accordance with my present invention, I provide each part with a peripheral flange so that when these parts are butted together with the flanges in engagement with each other, the parts form a casing which encloses a cavity. The flanges are formed at the large, open-ended, base portions of the casing halves, and I provide a small opening in the center at the opposite or vertex end of each casing half so that it can be threaded onto a supporting line, such as a wire, string, tape, or the like which can be stretched across a room.

To assemble the units or sinks, the correct number of complemental casing halves are threaded onto the wire or other suitable line constituting the supporting member, the latter being anchored at one end at a suitable mounting point. After the appropriate number of sink halves or parts are threaded onto the wire so that they can be pushed together to form the desired number of complete casings or enclosures, the other end of the wire or the like is fastened at a suitable point

following application of sufficient tension thereto to keep it from sagging. Starting at one end of the supporting line, a clamp is placed thereon at a desired location for the first sink. One-half of this sink is pushed against the clamp and the second half, with is peripheral flange facing the flange of the first mentioned half, is moved along the supporting line until the two flanges butt together, after which a second clamp is fastened to the line to hold the two halves together.

The sink or casing halves are constructed of a material which is pervious to sound waves, but which offers a high impedance thereto, as taught by Olson in his above identified application. One material which has been found especially suitable is a felted product made from wood pulp fibers which are accreted by suction from a pulp solution in known manner. This material, like blotting paper and the like, is constituted by a plurality of intertwined fibers of various lengths arranged more or less compactly and indiscriminately in random directions to provide a plurality of irregular, random passages of very small cross-sectional dimensions. These fine passages afford communication between the exterior of the sink casing and the space or cavity enclosed thereby, and they provide the requisite dissipative impedance to the acoustical energy received thereby. A material of this sort is usually sufficiently flexible and yieldable to have enough give to take care of any expansion or contraction of the wire or other similar supporting line due to temperature and humidity changes. Thus, adequate pressure will always be maintained between the two casing halves to avoid leaking of the air between the cavity enclosed by the casing and the external atmosphere. This method of assembling and mounting the acoustic sinks not only avoids separate assembly and mounting operations, but entirely does away with the need for gluing the two casing halves of the sink together. Moreover, the sinks are mounted symmetrically with respect to the supporting line, and this results in a neat appearance. If, after a period of time, the sinks have collected dust on the upper surfaces thereof, they can be rotated easily on the wire to provide ready access to the dust so that the dust can be brushed off. If desired, the sinks can be made in various colors and used for decorative purposes.

The novel features that I consider characteristic of my 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 of several embodiments thereof, when read in connection with the accompanying drawing in which

Figure 1 is a fragmentary, partly sectional view of an enclosure representing a room or the like in which one arrangement of acoustic sinks according to my present invention is shown,

Figure 2 is an enlarged, central, longitudinal section of one form of acoustic absorber or sink according to my present invention,

Figure 3 is a similar view of a slightly different form of absorber according to my present invention,

Figure 4 is an end elevation of the supporting line and one form of clamping member mounted thereon, and

Figure 5 is a view similar to Fig. 1, but showing a somewhat different mounting arrangement of

acoustic sinks in accordance with my present invention.

Referring more particularly to the drawing, wherein similar reference characters indicate corresponding parts throughout, and especially to Figs. 2 and 3, there is shown an elongated, flexible, supporting line 1, such as a wire, string, tape, or the like, on which is mounted an acoustic absorber 3 comprised of two casing halves 3*a* and 3*b* of substantially similar form and symmetrically arranged on the line 1. These casing halves are hollow, geometric figures of suitable shape, and may be cylindrical, conical, pyramidal, hemispherical, or of any other suitable configuration. A suitable material for the casing halves may be made by accretion of pulp fibers on a suitably shaped forming screen in the manner disclosed, for example, in Pare Patent No. 2,488,555, granted November 22, 1949, to provide a layer of intertwined fibers having fine passages therebetween. In the form of the invention shown in Fig. 2, the absorber unit 3 is made up of two conical casing halves 3*a* and 3*b*, whereas in the form shown in Fig. 3, the two parts 3*a* and 3*b* are formed substantially as hemispheres. In any case, the casing halves 3*a* and 3*b* are open at their larger ends or base portions and are there formed with radially outwardly extending peripheral flanges 5*a* and 5*b*, respectively. At their opposite or vertex ends, the casing halves 3*a* and 3*b* are formed with small collars 7*a* and 7*b*, respectively, (exaggerated somewhat as to size in the drawing for the purpose of illustration), the collars 7*a* and 7*b* being formed with small openings 9*a* and 9*b* of a size just sufficient to freely receive the supporting line or wire 1. Thus, the wire 1 may be threaded substantially axially through the casing parts 3*a* and 3*b* by merely passing the wire through the openings 9*a* and 9*b* and sliding the parts along the wire to any desired location.

In installing an assembly of acoustic absorbers or sinks according to my present invention, one end of the wire or line 1 may first be secured to one wall of a room 11 requiring acoustic treatment, as by means of a suitable anchoring bolt 13. The requisite number of casing halves 3*a* and 3*b* in complemental relation, that is, with the flanges 5*a* and 5*b* of each cooperating pair facing each other, are then threaded onto the wire 1. Finally, the right-hand end of the wire 1 may be secured to a second bolt or the like 17 which is secured to the opposite wall of the room 11, with suitable tension applied to the wire, as by a turnbuckle or the like (not shown) which may be hidden from view by an appropriate casing or cover of ornamental appearance.

At a suitable location, such as the point I in Fig. 1, a suitable anchoring or locking device 15 is placed on the wire. The anchoring device 15 may be constituted by a substantially U-shaped, resilient member provided with oppositely directed slits 15*a* and 15*b* to form resilient barbs or the like 15*c* adapted to bite into the wire 1, the space between the tabs 15*c* being somewhat smaller than the diameter of the wire 1. Reading from left to right in Fig. 1, the left-hand anchoring member 15 is first applied to the wire 1 somewhat to the left of its shown position and it is then moved slightly to the right along the wire 1. This causes the barbs 15*c* thereof to protrude to the left, as clearly shown in Figs. 2 and 3, so that if an attempt is thereafter made to move the anchoring member 15 back to the left, the barbs or tabs 15*c* will bite

into the wire and prevent such movement. The casing half 3*a* is then moved to the left until its collar 7*a* is brought into engagement with the left-hand anchoring member 15. Thereafter, the casing part 3*b* is moved over to the left until its flange 5*b* abuts against the flange 5*a* of the casing part 3*a*. The right-hand anchoring member 15 is then applied to the wire 1 somewhat to the right of its shown position and it is moved to the left until it engages the collar 7*b* of the casing half 3*b* and suitable pressure is applied at the flanges 5*a* and 5*b*. The absorber unit at location I is then complete. This procedure may be followed for each of the absorber units or sinks at locations II, III and IV which represent suitable, spaced mounting points along the wire 1.

In the form of the invention shown in Fig. 5, the absorber units 3 are mounted on vertically extending lines 1 which may be suspended from the ceiling of the room 11 in any appropriate manner. The lines 1 may be maintained under suitable tension by means of weights 19 which are secured to the lower ends thereof. Otherwise, the individual absorber units 3 and the manner of mounting the same may be similar to that described above in connection with the horizontal line arrangement of Fig. 1. In any case, it will be observed that the casing halves 3*a* and 3*b* are assembled and mounted in a single operation and without the necessity of gluing or otherwise securing the same to each other.

When assembled in the complemental relation shown in the drawing, the casing parts 3*a* and 3*b* enclose a cavity 20 which is sufficiently large to have a large acoustic capacitance and therefore to provide only a very small acoustic impedance to the incident sound waves received by the absorber units 3. The material of which the casing parts 3*a* and 3*b* are made is pervious to the sound waves but offers a large, dissipative impedance thereto in accordance with the teachings of Olson in his above identified copending application. Being rather loosely mounted on the supporting line 1 so as to be normally freely slidable thereon, it is apparent that the units 3 can be readily rotated on the line despite the fact that they are anchored against longitudinal movement thereon. Thus, when dust has accumulated on the top surfaces thereof, they can be easily rotated through a sufficient angle to permit ready access to the portions requiring cleaning. Also, it will undoubtedly be apparent that the units or sinks 3 can be made suitably decorative to enhance the appearance of the room in addition to providing the desired acoustic effects. All these and other advantages are afforded by the present invention while still permitting the individual casing halves to be assembled in nested relation for storage and the like.

Although I have shown and described several arrangements and types of acoustic absorbers according to my present invention, it will, no doubt, be apparent to those skilled in the art that many other variations are possible. For example, the casing halves 3*a* and 3*b* need not be made as geometric figures having surfaces of revolution, but may be in the form of pyramids, parallelepipeds, or the like, and if they are formed on surfaces of revolution, they may be ellipsoids, tori, or the like. Furthermore, where it is not found desirable to make the sinks 3 of yielding material, the locking members 15 may be provided with a yieldable spring element which will

have the requisite give longitudinally along the line 1. Also, instead of the type of clamping or anchoring member 15 shown in detail in Fig. 4, other suitable forms of anchoring members may be employed, such as an ordinary slidable collar with a locking set screw. If the latter form of locking member is used, then it will obviously be necessary to first thread one locking collar onto the line 1 followed by two complemental casing halves 3*a* and 3*b*, in turn followed by a second locking collar. Of course, the latter form of locking member may be C-shaped or U-shaped, in which case the assembly may be made as described above in connection with Fig. 1. Other variations will undoubtedly readily suggest themselves to those skilled in the art. 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 absorbing system comprising an elongated supporting member and a plurality of acoustic absorbing devices mounted on said member at spaced points therealong, said devices each comprising a pair of complemental, hollow parts formed of sound absorbing material and cooperatively arranged to enclose a cavity, and said member passing substantially axially through said parts.

2. A diffraction type acoustic absorbing system comprising an elongated supporting member and a plurality of acoustic absorbing devices mounted on said member at spaced points therealong, said devices each comprising a pair of complemental, hollow parts formed of sound absorbing material and cooperatively arranged to enclose a cavity, the parts of each pair being substantially similar in configuration, and said member passing substantially axially through said parts.

3. A diffraction type acoustic absorbing system comprising an elongated supporting member adapted to be suspended in space, a plurality of devices formed of sound absorbing material mounted on said member at spaced points therealong, said devices each comprising a hollow structure enclosing a cavity and being normally freely slidable on said member, and means anchoring said devices to said member at said points.

4. A diffraction type acoustic absorbing system comprising an elongated supporting member, a plurality of devices formed of sound absorbing material mounted on said member at spaced points therealong, said devices each comprising a pair of complemental, hollow parts cooperatively arranged to enclose a cavity and being normally freely slidable on said member, said member passing substantially axially therethrough, and means anchoring said devices to said member at said points.

5. An acoustic absorbing system according to claim 4 characterized in that said material is provided with a plurality of five passages therethrough whereby it is pervious to acoustical waves, said passages having such fine dimensions as to offer a large dissipative impedance to said waves, and characterized further in that said material is yieldable whereby each of said devices is yieldable on said line longitudinally thereof in response to changes of temperature and humidity.

6. An acoustical absorbing system according to claim 4 characterized in that said anchoring means maintains each cooperative pair of said parts in cavity enclosing relation on said member.

7. An acoustical absorbing system according to claim 4 characterized in that each of said parts is constituted by a casing portion open at one end, characterized further in that said devices are each so arranged on said member that the open ends of the parts thereof are in abutting relation whereby to enclose a cavity, and characterized still further in that said anchoring means maintains each cooperative pair of said parts in cavity enclosing relation on said member.

8. An acoustical absorbing system according to claim 4 characterized in that each of said parts is constituted by a casing portion open at one end, characterized further in that said devices are each so arranged on said member that the open ends of the parts thereof are in abutting relation whereby to enclose a cavity, and characterized still further in that said anchoring means maintains each cooperative pair of said parts on said member in cavity enclosing relation and in pressing engagement with each other.

9. An acoustical absorbing system according to claim 4 characterized in that each of said parts is constituted by a casing portion open at one end and terminating in a flange, characterized further in that said devices are each so arranged on said member that said open ends of the parts thereof are in substantially aligned relation and the flanges of the parts thereof are in abutting relation whereby to enclose a cavity, and characterized still further in that said anchoring means maintains each cooperative pair of said parts in cavity enclosing relation on said member.

10. An acoustical absorbing system according to claim 4 characterized in that each of said parts is constituted by a casing portion having a large opening at one end and a small opening at the opposite end, said small openings being of a size just sufficient to freely receive said supporting member, characterized further in that said devices are each so arranged on said member that said first named ends of the parts thereof are in abutting relation whereby said large openings are in aligned relation and said parts enclose a cavity, characterized further in that said member passes through said small openings and said cavity, and characterized still further in that said anchoring means maintains each cooperative pair of said parts in cavity enclosing relation.

11. An acoustical absorbing system according to claim 4 characterized in that each of said parts is constituted by a tapered casing portion open at its large end and having a small opening at its smaller end of a size just sufficient to freely receive said supporting member, characterized further in that said devices are so arranged on said member that the large ends of the parts

thereof are in abutting relation whereby said parts enclose a cavity, characterized further in that said member passes through said small openings and said cavity, and characterized still further in that said anchoring means is secured to said member in abutting relation to said smaller ends and maintains each cooperative pair of said parts in cavity enclosing relation.

12. A diffraction type acoustic absorber comprising a pair of complemental, hollow parts each having an open end and an opposed, closed end, said open end terminating in a flange and said closed end having a small opening therein for the reception of a supporting member, said parts being adapted to be assembled in a relation wherein said flanges will face and abut each other and said open ends will be in substantial alignment with each other whereby said parts will provide a casing which encloses a cavity, said openings being then at opposed ends of said casing, and said parts being constituted by a material which is provided with a plurality of passages therethrough whereby it is pervious to acoustical waves, said passages having such fine dimensions as to offer a relatively large dissipative impedance to acoustical energy received thereby.

13. A diffraction type acoustic absorber according to claim 12 characterized in that said parts are each constituted by a geometric body having a surface of revolution.

14. A diffraction type acoustic absorber according to claim 12 characterized in that said parts are each constituted by a tapered, geometric body having a base end and an apex end, characterized further in that said flange extends outwardly from said body at said base end, and characterized still further in that said small opening is provided at said apex end.

GEORGE L. BEERS.

REFERENCES CITED

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

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1,483,365	Mazer	Feb. 12, 1924
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1,816,618	Sklar	July 28, 1931
2,160,638	Bedell et al.	May 30, 1939
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FOREIGN PATENTS

Number	Country	Date
102,914	Australia	Jan. 6, 1938

Certificate of Correction

Patent No. 2,502,017 March 28, 1950

GEORGE L. BEERS

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

Column 3, line 6, for the words "with is" read *with its*; column 6, line 64, for "five" read *fine*;

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

Signed and sealed this 25th day of July, A. D. 1950

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

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