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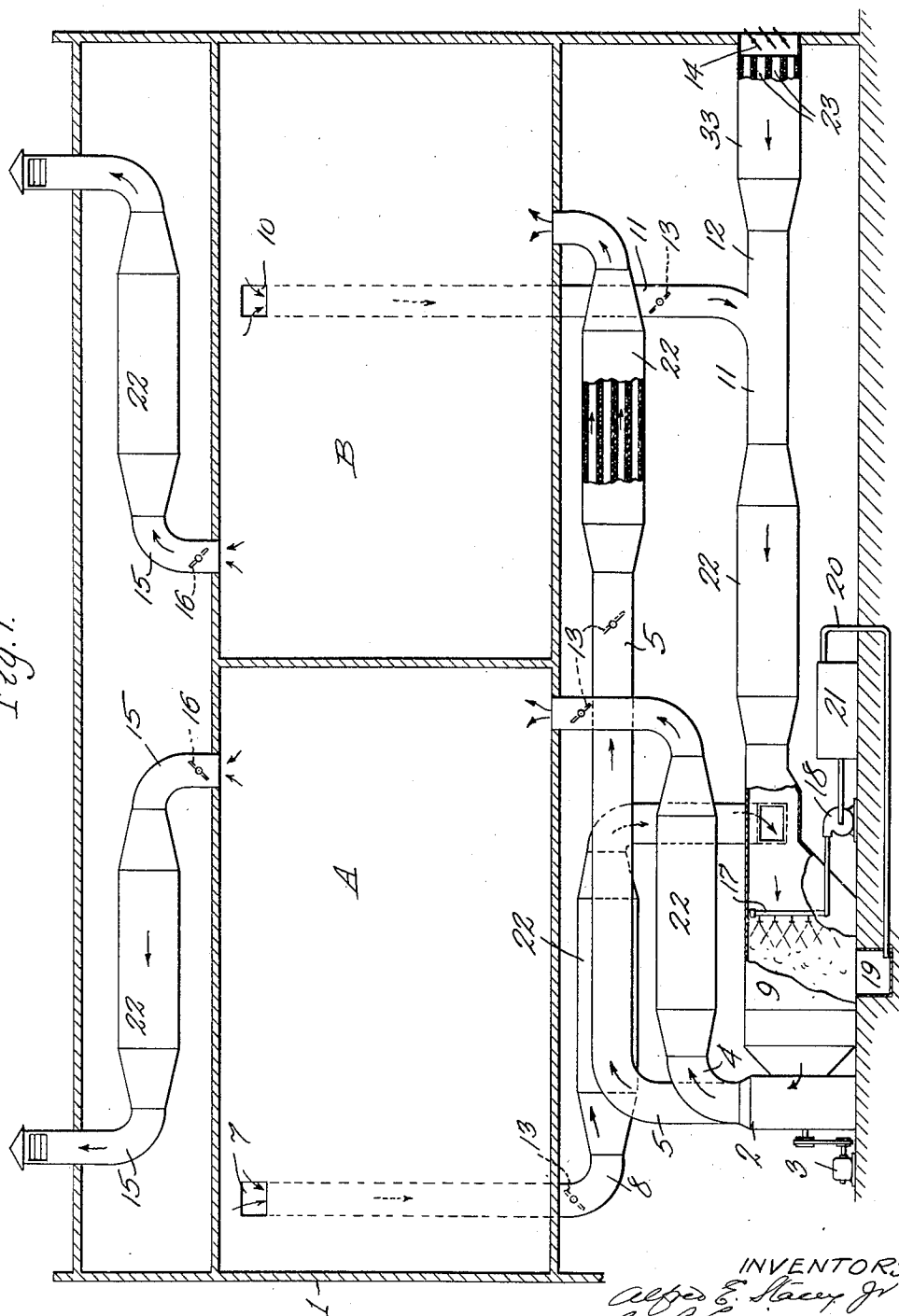
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SOUND ABSORBING MEANS

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Fig. 1.



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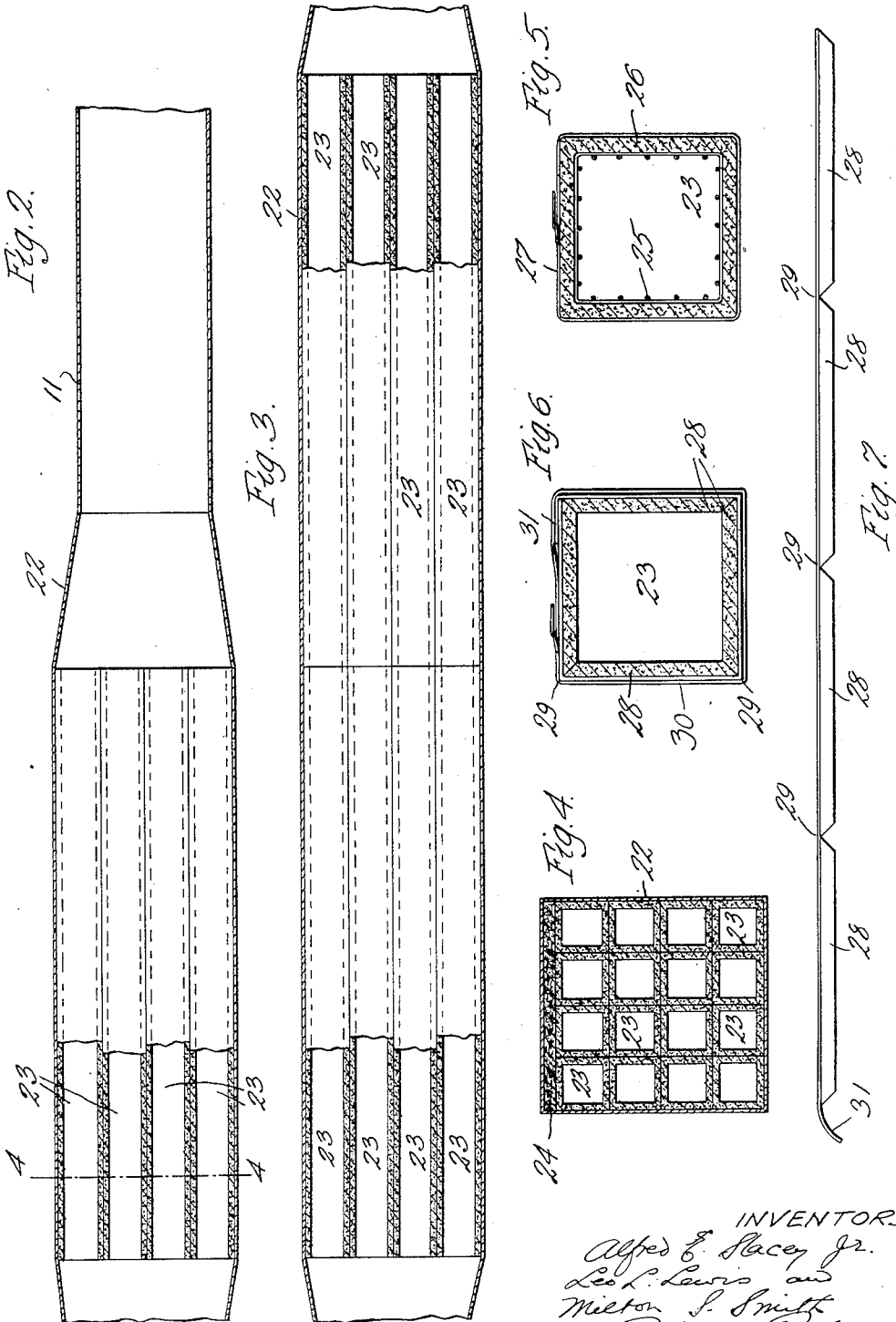
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SOUND ABSORBING MEANS

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This invention relates to sound absorbing means and particularly to means forming a part of ventilating and air conditioning installations. It has been found that the conduits forming a part of such installations for the conveyance of air to and from rooms act in the nature of conductors and convey undesirable sounds into or between said rooms. For example, in broadcasting and talking moving picture studios, it is desirable that the rooms be completely closed in order to avoid the entrance of extraneous sounds, because such extraneous sounds will be picked up and sent out by the transmitters of broadcasting studios, and in the case of films, such extraneous sounds will be recorded on the film or disks along with the music and talking.

Inasmuch as considerable heat is given off in such rooms by the lighting and by the occupants, and since it is necessary to ventilate such rooms, it becomes desirable to condition the air thereof. When ventilating or air conditioning equipment is utilized for this purpose, it is necessary to prevent the transmission of sounds from the apparatus into the rooms, the transmission of sounds from one studio room to another through the ducts of such equipment, and also prevent the transmission of outside sounds into such rooms through relief and fresh air supply conduits.

An object of the invention is to provide an improved duct system through which air may be conveyed freely and the transmission of sounds by such air in the system effectively prevented.

Another object of the invention is to provide an improved air conditioning system for a plurality of rooms, with which the transmission of sounds from one room to another, or into any room from any outside source, through the system will be prevented.

Another object of the invention is to provide an improved duct system for accomplishing these purposes, which will not require material deviations from the standard practice heretofore employed, and which will be relatively simple, effective, and inexpensive.

A further object of the invention is to provide an improved sound-absorbing tube which may be shipped in flat or compact condition and assembled on the job.

Another object of the invention is to provide improved sound-absorbing means for use in ducts or conduits.

Further objects and advantages will be apparent from the following description of an embodiment of the invention, and the novel features will be particularly pointed out hereinafter in connection with the appended claims.

In the accompanying drawings:—

Fig. 1 is a sectional elevation of a building with an air conditioning and ventilating system associated therewith, the rooms and system being illustrated largely diagrammatically and conventionally;

Fig. 2 is a longitudinal section through a portion of one of the conduits, to illustrate the construction by which sound waves traveling along the air in such conduits may be absorbed;

Fig. 3 is a similar sectional elevation of a conduit, and illustrating the manner in which the capacity of the sound-absorbing means may be increased;

Fig. 4 is a transverse, sectional elevation through one of the conduits having the sound-absorbing construction therein, such as along the line 4—4 of Fig. 2;

Fig. 5 is a sectional elevation on a larger scale of one of the tubes forming a part of the sound-absorbing means, to illustrate the details of construction of one embodiment thereof;

Fig. 6 is a similar sectional elevation of one of the sound-absorbing tubes and illustrating another manner in which such tubes may be formed; and

Fig. 7 is a side elevation of the tube of Fig. 6 when unfolded for shipping or storage purposes.

In the embodiment illustrated in Figs. 1 and 2, the invention is incorporated in a system for ventilating and conditioning the air of a plurality of rooms or enclosures such as A and B of a suitable building 1. There may be any desired number of rooms, but

only two have been illustrated in order to simplify the description. In a suitable location, an air circulating device 2, such as a fan or blower, is arranged for operation by a

5 suitable motor or source of power 3, and two conduits 4 and 5 are connected to the discharge side of the fan or circulating device 2. The conduit 4 opens into the room A and the conduit 5 conveys air into the room B.

10 Air may be removed from the room A through a ventilator opening 7 at one end of a conduit 8 which conveys the removed air to one end of an air conditioning device 9, the other end of the conditioning device

15 being connected to the circulating device or blower 2. Similarly air is removed from the room B through a ventilator opening 10, which communicates with a return air pipe 11 by which the removed air is conveyed to

20 the conditioning device 9.

A branch 12 of the pipe 11 may extend exteriorly of the building 1 for adding any desired quantity of outside or fresh air to the air moving toward the conditioning device

25 9. The pipes 8 and 11 are both connected to the same end or side of the conditioning device 9, and each of the pipes 4, 5, 8 and 11 may have suitable dampers 13 by which the flow through each pipe may be individually

30 regulated or controlled. The branch 12 through which outside air is added to the circulating air may also have a suitable adjustable regulating damper 14.

An air relief pipe 15 opens into each of the rooms A and B and extends outside of the building as shown in Fig. 1, for permitting the displacement from the room of a quantity of air corresponding to the amount of outside air admitted to the circulating air

40 through the pipe 12. The pipes 15 may also have individual controlling dampers 16 if desired.

The conditioning device 9 may be of any suitable type, and by way of example is illustrated as of the type in which the air is treated by a spray of suitable liquid from the spray device 17 which is supplied with a spray liquid by pump 18. The liquid discharged as a spray collects in a reservoir 19

50 and is withdrawn and conveyed through a pipe 20 to a suitable treating or modifying device 21 in which it is heated, cooled or otherwise treated, and then conveyed to the intake side of the pump 18.

55 This conditioning and ventilating system as just described is intended as conventional only, and may be modified in any desired manner, as usual in the various applications of air conditioning systems to different enclosures. In accordance with this invention, however, the sound-absorbing means is arranged in the different pipes or conduits through which the air moves, so as to absorb any sound waves which travel along any of

65 the conduits to or from any room. The con-

ditioning device 9 is not always free from noises, even when a spray is used, and the rotating parts of the fan or blower 2 also cause some noises.

The conduits which distribute and circulate the air, heretofore have acted in the nature of conductors and conveyed these undesirable sounds into the various rooms. Where more than one room is supplied with conditioned air by the same system, various branch ducts leading to the different rooms act as conductors connecting the rooms, and there is a tendency for noises or sounds in one room to travel through these ducts into the other rooms. This is often very objectionable, and in accordance with this invention, sound absorbing means may be arranged in the conduits leading to and from each room, so as to absorb any sound waves which otherwise would reach the room from other rooms or outside sources.

Accordingly, each of the pipes or conduits 4, 5, 8, 11 and 15 is provided with a section 22 enlarged in cross section, and in each enlarged section the sound absorbing means

90 is arranged. In Fig. 2 the sound absorbing means disposed in the conduit 11 is illustrated on a larger scale.

The interior or passage of the enlarged section is subdivided into smaller passages by a plurality of tubes 23 which are arranged side by side in abutting relation to one another, with the tubes extending along the passage of the conduit 11, as shown in Fig. 2. The tubes 23 substantially fill the enlarged section of the conduit as shown in Fig. 4. The exposed inner surface of each tube along which the air travels is formed of good sound-absorbing material, so that any sounds conveyed by the air moving through the passages will be absorbed by such materials.

Any suitable sound-absorbing material may be employed for the tubes, but preferably fireproof, sound-absorbing material is utilized. If a fibrous material is utilized, which itself is not fireproof, it is preferably first treated in a well known manner to render it fire proof before insertion into the conduit. Materials which may be used with success are Cabot's quilt or Acoustifelt, molded clay or plastic composition, mineral wool, or hair felt, but there are many other materials available which have good absorbing properties and which may be satisfactorily employed.

These tubes may be cast or molded to the desired shape from this sound-absorbing material, or they may be assembled or formed on the job before insertion into the conduits. The conduits are commonly made rectangular in shape, and in such a case, the tubes are preferably polygonal in cross section, so that the tubes will fit along and line the inner surface or passage of the conduit as shown in

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Fig. 4. If the tubes 23 do not completely fill the conduit section in which they are placed, the remaining space between the tubes and the conduit wall may be filled with loose

5 sound-absorbing material 24 (Fig. 4).

If desired, the tubes may be formed upon an open mesh frame 25, Fig. 5, such as wire fencing bent into tubular form. Upon this frame a blanket 26 of sound-absorbing material may be wrapped. A plurality of

10 straps 27 may be disposed around the blanket and frame to secure the blanket firmly against the frame. The sound passing through such a tube will engage with the surface of the blanket exposed through the meshes of the frame 25, with the result that the sound waves will be absorbed before leaving the tubes.

The effectiveness of the tubes will vary somewhat with their length. The lengths selected will depend upon the character of the sound to be eliminated or absorbed, but for convenience the tubes may be made of standard lengths and any desired number of

25 lengths placed end to end, as shown in Fig. 3, in order to obtain a sound-absorbing device which is effective for any particular problem.

If desired, in order to facilitate the shipment of the tubes to the various localities where installations are to be made, the tubes may be formed of foldable material, which is normally shipped flat and folded or assembled into the shape of the tube at the time of assembly in the conduits. One example of such a tube is illustrated in Figs. 6 and 7. The tube or article before folding is shown in Fig. 7, and in this example comprises a series of strips 28 which are arranged side by side

40 in a common plane, with adjacent edges abutting one another.

The abutting edges of the strips are connected to one another by suitable hinges 29, and such a hinge may comprise a fabric or flexible sheet which forms a face lining secured to corresponding faces of all of the strips 28, as shown in Fig. 7. Such articles may be shipped flat in a very compact manner, as will be observed from Fig. 7, and

50 when a tube is to be formed, the blank or flat article is folded along the edges of the strips into a polygonal form, and suitable straps 30 similar to the strap 27 may surround such a form to prevent its unfolding or collapsing. One of the extreme side edges of the flat article of Fig. 7 may have a flap 31, which may be an extending edge or end of the flexible fabric or sheet that forms the hinges 29. The flap overlaps and may be secured to the opposite edge of the article when the article

60 if folded as shown in Fig. 6. The tubes may be made in various other ways as will occur to those skilled in the art.

The conduit 12 may also be provided with

65 an enlarged section 33, which is filled with

the tubes 23 in the same manner that the enlarged sections 22 are filled, and for the same purpose.

Each enlarged section 22 or 33 is preferably joined with the adjacent sections of the conduits by tapered walls or sections, so that the effective air-carrying capacity of the conduits will not be materially decreased by the insertion of the sound-absorbing devices. Inasmuch as the resistance to fluid flow will be greater by reason of the division of the conduit into smaller tubes or passages, the conduit section having such sub-divisions is made larger in cross section, so that the air carrying capacity of the sub-divided passages will equal that of the other sections of the conduits through which the same air is conveyed.

A ventilating or air conditioning system, such as here conventionally illustrated, will not be materially affected in its operation by the insertion of the sound absorbing devices, and inasmuch as the operation of such systems is well known in the art, a description of the same here will be omitted.

It will be observed, however, that every conduit leading to or from a room may have included therein a sound-absorbing device, so that sound waves cannot travel from one room to another through the action of the conduits of the ventilating or air conditioning system as sound conductors, and the same sound absorbing devices will prevent the transfer to the rooms of sounds from the air conditioning or circulating devices. Such sound-absorbing devices also prevent the entrance into such rooms of extraneous sounds through the air relief or inlet openings which are frequently a desirable part of such conditioning and ventilating systems.

These sound-absorbing devices may be provided in the various conduits, and branches thereof, at whatever points are necessary to absorb the sound waves which would otherwise travel through those sections, and may be arranged at any desired points along the conduits where they will be most effective.

The sizes of the tubes 23 which are inserted in the conduits may be varied in cross section and shape as found desirable, and the lengths of the same may also be varied in order to accomplish the complete absorption of any sound waves which may be encountered. In some instances, it may be necessary to make the tubes 23 quite long in order to remove all of the sound waves which are traveling in a conduit, and in some instances where the sound waves are not very pronounced, the shorter lengths of the tubes will be found to be sufficient. The tubes are, however, of substantial diameter, and more than 12 diameters long.

While tubes 23 may offer greater resistance to air flow therethrough, by reason of the sound absorbing surfaces with which they

are provided, the enlarged sections in which they are placed will be made of a size to compensate therefor and to provide the desired air carrying capacity.

- 5 It will be obvious that various changes in the details, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and
13 scope of the invention as expressed in the appended claims.

I claim:—

1. An acoustic device for use in ventilating systems, comprising a conduit through
15 which air may be conducted for ventilating purposes, and a plurality of separate tubes of substantial diameters, and many diameters long, each tube being formed of a plurality of plates flexibly connected together edge to
20 edge to form a strip, one face of said strip being formed of a material which is sound absorbent, each strip being bent at the flexible connections to bring the free edges together and complete a tube with said face
25 forming the wall of the tube, said tubes interfitting with one another side by side to substantially fill said conduit cross-sectionally thereof, whereby any air flowing in said conduit will be subdivided into a plurality
30 of smaller streams all of which pass through said tubes, and any sound waves travelling in the air of said tubes will be silenced.

2. An acoustic device for use in ventilating systems, comprising a conduit through which
35 rapidly moving air may be conducted for ventilating purposes, and a plurality of tubes of sound absorbing material disposed side by side, so as to substantially fill said conduit cross-sectionally thereof, and extending
40 endwise in a direction along the walls of said conduit, said tubes being substantially straight and free of baffles in their passages, of material diameter, and being rela-

tively long in proportion to their diameters, whereby any air flowing in said conduit will be subdivided into a plurality of smaller streams all of which pass through said tubes, and any sound waves travelling in the air
70 of said tubes will be silenced.

3. An acoustic device for use in ventilating systems, comprising a conduit through which rapidly moving air may be conducted for ventilating purposes, and a plurality of
75 substantially straight separate tubes of sound absorbing material free of baffles, engaging side by side and substantially filling said conduit cross-sectionally thereof, said tubes extending endwise in a direction
80 along the length of the conduit and each tube being at least several diameters in length and having the wall of its passage of sound absorbing material for silencing any sound waves that may be moving in the air that is
85 travelling through said tubes.

4. An acoustic device for use in ventilating systems, comprising a conduit through which rapidly moving air may be conducted for ventilating purposes, and a plurality of
90 separate tubes having imperforate walls of sound absorbing material engaging one another side by side, so as to substantially fill said conduit cross-sectionally thereof, and extending endwise in a direction along the
95 walls of said conduit, said tubes being substantially straight and free of baffles in their passages, of material diameter, and being relatively long in proportion to their diameters, whereby any air flowing in said conduit will be subdivided into a plurality of
100 smaller streams all of which pass through said tubes, and any sound waves travelling in the air of said tubes will be silenced.

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