

United States Patent

[11] 3,566,923

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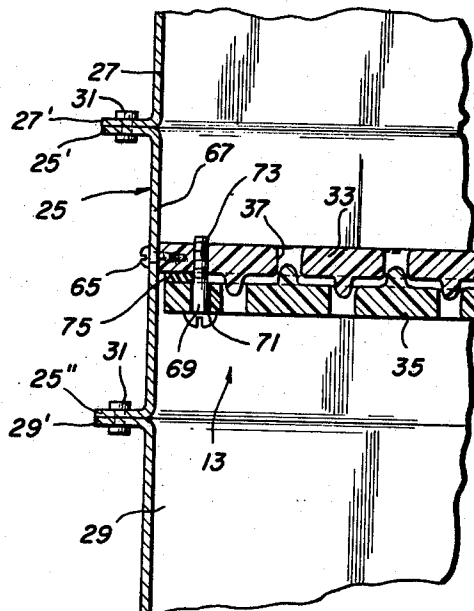
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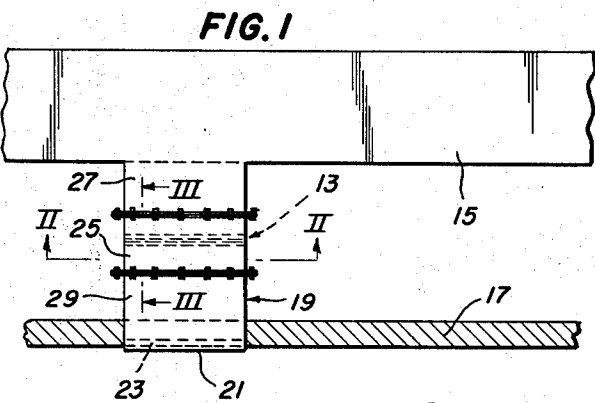
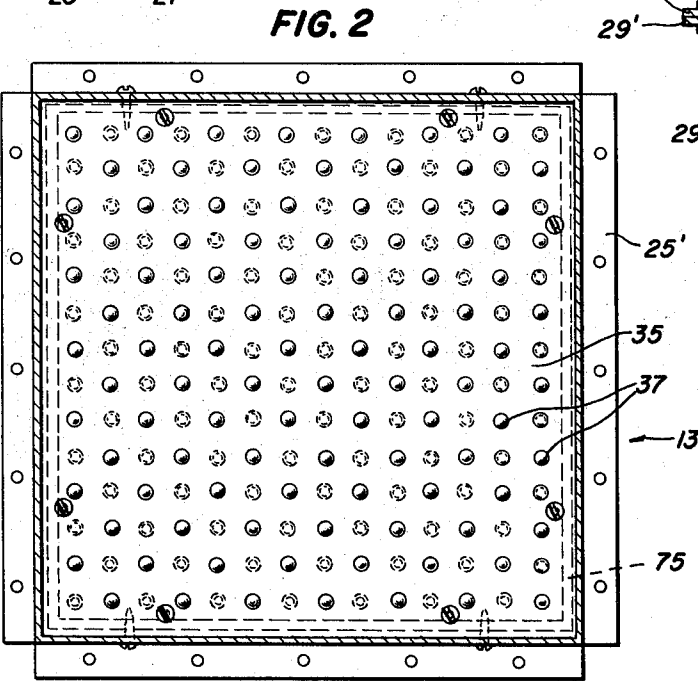
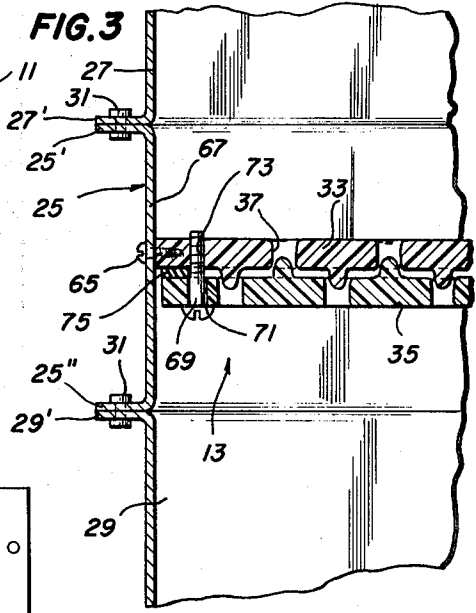
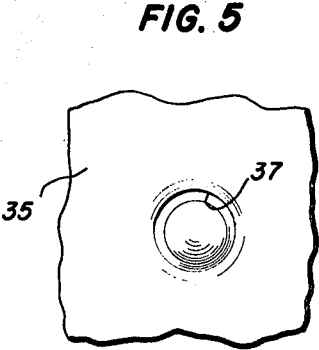
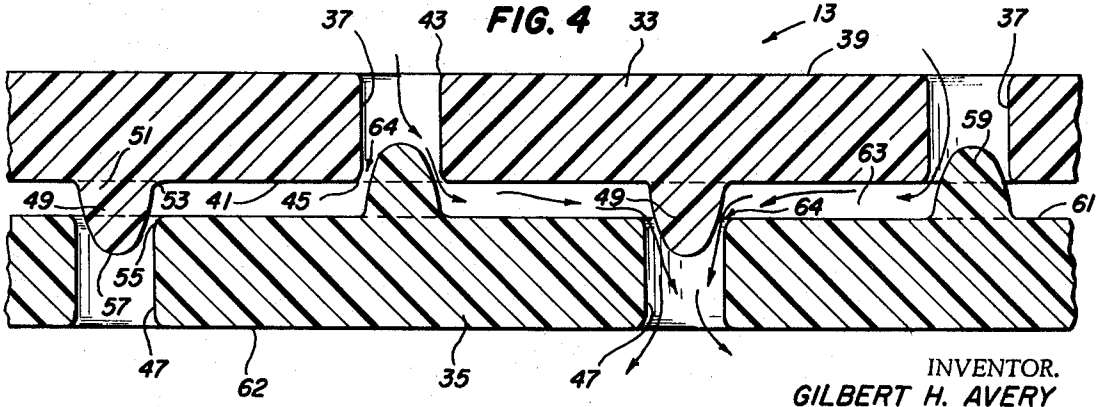
[54] **AIR VOLUME AND PRESSURE REDUCING MEANS
IN AN AIR CONDITIONING MEANS**
11 Claims, 5 Drawing Figs.

[52] U.S. Cl. 138/43,
137/599
[51] Int. Cl. F15d 1/10,
F16l 55/00
[50] Field of Search 138/40, 42,
43; 137/599, 601

[56] **References Cited**
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ABSTRACT: A valve, located in the conduit of an air-conditioning system which leads to a room to be conditioned by the air, for dissipating the velocity and reducing the volume and pressure of the air entering the room. The valve includes an upper plate and a lower plate spaced in parallel relationship below the upper plate. The plates are provided with a multiplicity of small apertures, the apertures of the lower plate being laterally offset from those of the upper plate. Each of the plates are provided with smooth parabolic shaped protrusions which coact with the apertures in the other plate. A mechanism is provided for moving one of the plates relative to the other of the plates to valve the flow of air therethrough.





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AIR VOLUME AND PRESSURE REDUCING MEANS IN AN AIR CONDITIONING MEANS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to means for reducing the volume and pressure of the air flowing through a conduit of an air conditioning system.

2. Description of the Prior Art

The typical type of damper in an air-conditioning system, which the valve of the present invention is adapted to replace or be substituted for, is of the blade type. There are many disadvantages of this type of damper among them being the following: (1) Poor air distribution over the face of the diffuser. Most of the air comes out of the downstream side of the outlet. (2) High sound level created by blade edges. (3) Requires long takeoff between duct and diffuser to install the damper. (4) Low pressure drop means they are hard to balance. (5) Expensive to produce. (6) Limited to low-pressure systems unless used in conjunction with sound attenuators.

Another type of damper is shown in U.S. Pat. No. 2,082,335. This latter type of damper has a plurality of slots therethrough which causes angularly disposed sheets of air that are arranged in pairs, with the sheets of air of each pair intersecting downstream of the damper. This particular damper creates large jets which does not give an even air distribution across the face of the damper. In addition, this damper has a great many moving parts to provide for adjustment and support of the individual baffles and thus would be relatively expensive to manufacture. Also, the sound characteristics of this type damper leaves something to be desired.

SUMMARY OF THE INVENTION

The present invention is a highly effective valve which is simple in construction and overcomes the above-mentioned and other disadvantages of prior devices. Thus, some of the advantages of the valve of the present invention are as follows:

(1) Even air distribution across the face of the outlet; (2) low sound level; (3) higher pressure drops than conventional blade dampers, which makes the system easy to balance; (4) simple and inexpensive to mass produce. It can be die-formed of plastic or the like and cut on the job as required. (5) It can be used on conventional high- or low-pressure air distribution systems.

The structure of the present invention which provides the above-mentioned advantages and overcomes previous disadvantages basically includes a pair of plates with each of the plates being provided with a multiplicity of small apertures and each provided with smooth protrusions which coact with the apertures in the other plate. Because of the many small apertures the velocity of the air is dissipated rapidly so that it doesn't create sound by impinging on the outlet face. In addition, the air is diffused so that at least as close as about two inches from the downstream side of the valve and with typical high pressures, the air is substantially completely diffused so that no jet effect is felt. It is thus a concept of the present invention to provide as many apertures as possible in the plates so that there will be a multiplicity of small jets of air which diffuse rapidly, which give even air distribution and provide a low sound level. Also, the apertures can be made small enough so that the natural frequency produced will be of such high frequency that it will be out of the range of the human ear.

DESCRIPTION OF THE DRAWING

FIG. 1 is an environmental view showing the present invention in combination with an air conditioning system (a portion only of the air conditioning system being shown).

FIG. 2 is an enlarged sectional view through the valve of the present invention and taken as on the line II-II of FIG. 1.

FIG. 3 is an enlarged fragmentary sectional view taken as on the line III-III of FIG. 1.

FIG. 4 is a further enlarged portion of that shown in FIG. 3, illustrating the flow of air through the valve of the present invention.

FIG. 5 is a fragmentary enlarged view of a portion of that shown in FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1 is shown a typical air-conditioning system 11 with which the valve 13 of the present invention is particularly adapted to be used. The air-conditioning system includes a source, not shown, of either heated or cooled air under pressure, which is led adjacent the various spaces to be either heated or cooled by means of the main conduit 15. The ceiling 17, of one of the spaces to be conditioned with the air, is shown with the vertical conduit portion 19 leading from the main conduit 15 and through the ceiling 17 or wall of the space and into the space to be conditioned. In typical fashion the discharge end 21 of conduit portion 19 is preferably provided with a suitable grille 23 through which the air flows. The valve 13 of the present invention is preferably provided in a section 25 of conduit portion 19 so that the valve 13 can first be installed in section 25 and thence the section 25 installed with the remaining sections of the conduit portion 19, that is, with the upper section 27 and lower section 29. Adjacent the upper and lower ends of section 25 flanges 25' and 25'' are provided which mate with the flanges 27' and 29' respectively provided on the adjacent ends of upper and lower sections 27 and 29. The flanges 25', 27' and 25'', 29' are joined together by suitable means as the bolt-nut fasteners 31.

Valve 13 basically includes a substantially horizontal first or upper plate 33 and a substantially horizontal second or lower plate 35 closely spaced below upper plate 33 and coacting therewith.

Upper plate 33 is provided with a multiplicity of substantially cylindrical vertical apertures 37 extending through the upper plate and through the upper surface 29 and lower surface 41 thereof. Upper plate 33 around the upper and lower ends of each of the apertures 37 is rounded as at 43, 45 respectively. The apertures 37 are preferably evenly spaced and preferably cover as much of upper plate 33 as possible. The apertures are preferably small, that is, less than one-inch in diameter, and the diameter is preferably about one-half inch, although this is given for purposes of illustration and not limitation. In other words, it is preferable that the maximum number of small apertures be provided in upper plate 33. Also, it will be understood that in the drawing, for purposes of simplicity and clarity, the maximum number of apertures 37 are not depicted, but approximately twice that number are preferably provided in the upper plate. Apertures 47 are provided in lower plate 35 with the apertures 47 being arranged in a manner like that of apertures 37 and being substantially identical in shape, size, etc. However, the lower plate 35 is arranged in such a manner relative to upper plate 33 that the apertures 47 are not in line with apertures 37 but are offset therefrom. In other words, the apertures 47 are preferably placed substantially halfway between adjacent pairs of apertures 37.

Upper plate 33 is provided with a multiplicity of upper protrusions 49 which are preferably integrally formed with or attached to upper plate 33 on the lower surface 41 thereof and depend therefrom. Upper protrusions 49 preferably correspond in number to apertures 47 and are respectively in alignment with the apertures 47. Each of the protrusions 49 are preferably alike in construction and are preferably shaped substantially in the form of a paraboloid. It will be understood that the protrusions are circular in horizontal cross section with the diameter of the circles decreasing from adjacent surface 41 downwardly. The length or vertical extension of each protrusion 49 is preferably substantially the same as the width of each aperture 47, that is, preferably though not necessarily one quarter inch. The diameter across the base 51 of protrusions 49 is preferably slightly smaller than aperture 47 and is flared outwardly as at 53 to conform to the rounded portion

55 of each aperture 47. The lower end of each protrusion 49 is rounded as at 57 so that there is a smooth air flow without any sharp corners to cause noises. Plates 33, 35 are each preferably substantially thin and preferably although not necessarily in the order of .375 inches when used with protrusions and apertures of the dimensions hereinabove given.

Lower plate 35 is provided with a multiplicity of lower protrusions 59 preferably identical in size and shape to upper protrusions 49 except that lower protrusions 59 extend upwardly from upper surface 61 of lower plate 35 and are in alignment respectively with apertures 37. It will be seen that a large sheet containing apertures and protrusions like those heretofore described for upper and lower plates 33, 35 can be cut to form separate pieces like upper plate 33 and lower plate 35. In other words, the pattern of the protrusions and apertures are the same in both plates and can be cut from the same piece of material and formed by the same dies. All that is necessary is that the sheets be cut properly and turned upside down relative to each other with the protrusions 49 being in alignment with apertures 47 and protrusions 59 being in alignment with apertures 37 in the manner shown in the drawing.

The plates 33, 35 are mounted in section 25 so that they extend across the air passage therethrough to establish the valve 13 of the present invention. It will be understood that the air above the valve 13 is of substantially high pressure, and higher than that below the lower surface 62 of plate 35 and in the space to be conditioned so that the air will flow in the manner shown by the arrows in FIG. 4, that is, downwardly through apertures 37, horizontally in the space 63 between the upper and lower plates 33, 35, and thence downwardly through apertures 47 towards the space or room to be air conditioned. The protrusions 49, 59 normally extend into the respective apertures 47, 37 so that in passing through the apertures the air passes through the air passages 64 established between the protrusions and the walls of the apertures. The plates 33, 35 are preferably movable relative to one another to vary the sizes of air passages 64 and space 63 and therefore the amount of air passed by valve 13. The valve 13 is shown approximately half open in the drawing with the space between the plates 33, 35 being shown as approximately one-eighth inch, as for example, to conform with the examples of dimensions heretofore given. The plates are preferably adjustable from substantially closed to substantially open position with the plates being spaced, as for example, one-quarter inch.

The means for mounting and for adjusting the plates 33, 35 are preferably as follows:

Upper plate 33 is preferably made slightly larger than lower plate 35 and of a size to fit the inside dimensions of section 25, that is, upper plate 33 spans the space between walls 67 of section 25. The upper plate 33 is preferably fixedly supported horizontally in section 25 as by means of the screws 25 extending through apertures in walls 67 and into the side edges of the plate 33. The lower plate 35 is preferably supported from the upper plate 33 as by means of the screws 69 each of which preferably extends through a smooth bore 71 in lower plate 35 and into a threaded hole 73 in upper plate 33. Resilient means as the rubber gasket 75 is interposed between plates 33, 35 and screws 69 serve as variable clamping means for moving the plates together against the force of the resilient means and air pressure. In other words, to move lower plate 35 downwardly, the screws 69 are turned in one direction and to move the lower plate 35 upwardly the screws are turned in the opposite direction. The gasket 75 preferably extends around the plates 33, 35 adjacent the peripheries thereof so that the plates are sealed against air flow outwardly from between the plates.

Although a preferred embodiment of the present invention has been described, it will be understood that various modifications in the disclosed structure may be made without departing from the scope of the invention as defined in the claims.

I claim:

1. In an air-conditioning system including a conduit for passing air, an air volume and pressure reducing valve comprising a first plate and a second plate parallel with said first plate, said valve being interposed in said conduit in position for the air to flow therethrough, said plates being provided with a multiplicity of offset apertures substantially circular in cross section therethrough, at least one of said plates being provided with a plurality of protrusions in substantial alignment with at least some of the apertures in the other of said plates and extending towards and normally into the corresponding apertures in the other of said plates with sufficient clearance to establish air passages, means for moving one of said plates relatively towards and away from the other of said plates to positions in which said plates are parallel with one another to change the sizes of the air passages and vary the air flow around said protrusions and through the corresponding apertures and thereby maintain a uniform distribution of air flowing from the apertures.

2. The apparatus of claim 1 in which said other of said plates is provided with a plurality of protrusions in substantial alignment with at least some of the apertures in said one of said plates and normally into the corresponding apertures in said one of said plates to establish air passages.

3. The apparatus of claim 1 in which said protrusions are substantially paraboloid in shape.

4. The apparatus of claim 2 in which said protrusions are substantially paraboloid in shape.

5. The apparatus of claim 2 in which said apertures are no larger than one inch in diameter and in which said apertures are distributed over most of the area of said plates.

6. The apparatus of claim 1 in which said one of said plates is fixedly mounted in said conduit and the other of said plates is movably mounted relative thereto.

7. The apparatus of claim 6 in which said means for moving the movable one of said plates relative to the fixed one of said plates comprises resilient means operably interposed between said plates to urge said plates apart and variable clamping means engaging said plates for moving said plates together against the force of said resilient means.

8. The apparatus of claim 7 in which said resilient means extends between said plates around the peripheries thereof to seal the plates against the air flow outwardly from between said plates.

9. In an air-conditioning system including a conduit portion for passing air into a space, an air volume and pressure reducing means comprising a first substantially horizontal upper plate having upper and lower surfaces, a second substantially horizontal lower plate having upper and lower surfaces, said upper plate being provided with a multiplicity of substantially cylindrical vertical apertures extending through said upper plate and through said upper and lower surfaces thereof, said upper plate around the upper and lower ends of said apertures being rounded, said lower plate being provided with a multiplicity of substantially cylindrical vertical apertures similar to said apertures in said upper plate, means supporting said plates in said conduit portion with said lower plate arranged in spaced parallel relationship below said upper plate and with said apertures of said lower plate being offset relative to said apertures of said upper plate so that the air in said conduit portion above said upper plate is adapted to pass downwardly through said apertures in said upper plate, then horizontally in the space between said upper and lower plates and thence downwardly through said apertures in said lower plate towards the space to be air-conditioned, a multiplicity of upper protrusions integrally attached to said upper plate on the lower surface thereof and depending therefrom, said upper protrusions corresponding in number to said apertures in said lower plate and being respectively in alignment therewith, a multiplicity of lower protrusions integrally attached to said lower plate on the upper surface thereof and upstanding therefrom, said lower protrusions corresponding in number to said apertures in said upper plate and being respectively in alignment therewith, said protrusions being smooth and rounded to allow a smooth flow of air therearound.

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10. The apparatus of claim 9 in which means is provided for moving one of said plates relatively towards and away from the other of said plates, and in which each of said protrusions is smaller than its corresponding aperture whereby said protrusions are adapted to be moved in said apertures by said

relative movement of said plates to vary the air flow through said apertures.

11. The apparatus of claim 10 in which said protrusions are substantially paraboloid in shape.

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