

July 12, 1966

E. H. PERSON

3,260,188

AIR DIFFUSER

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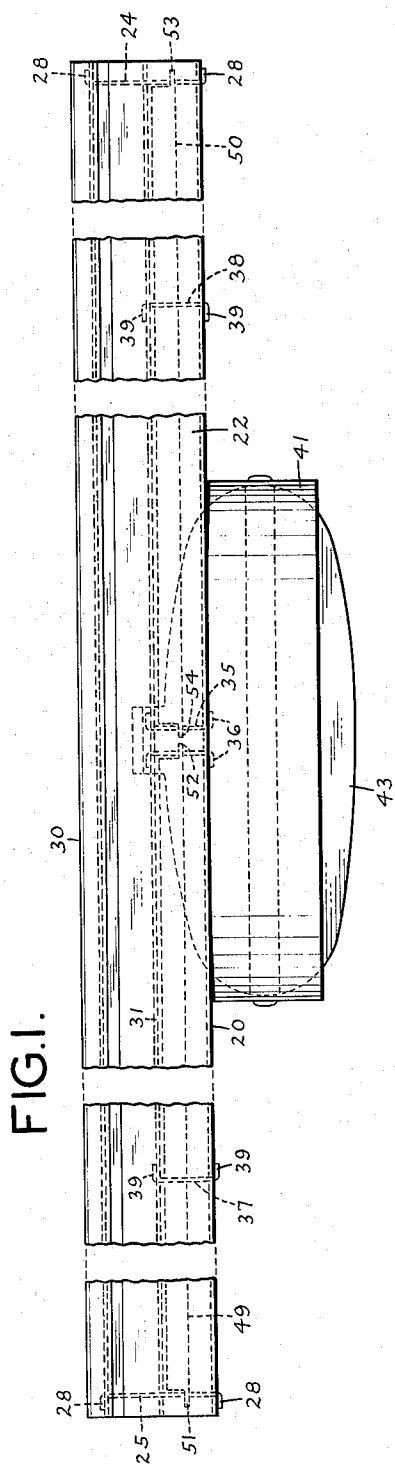


Fig. 1

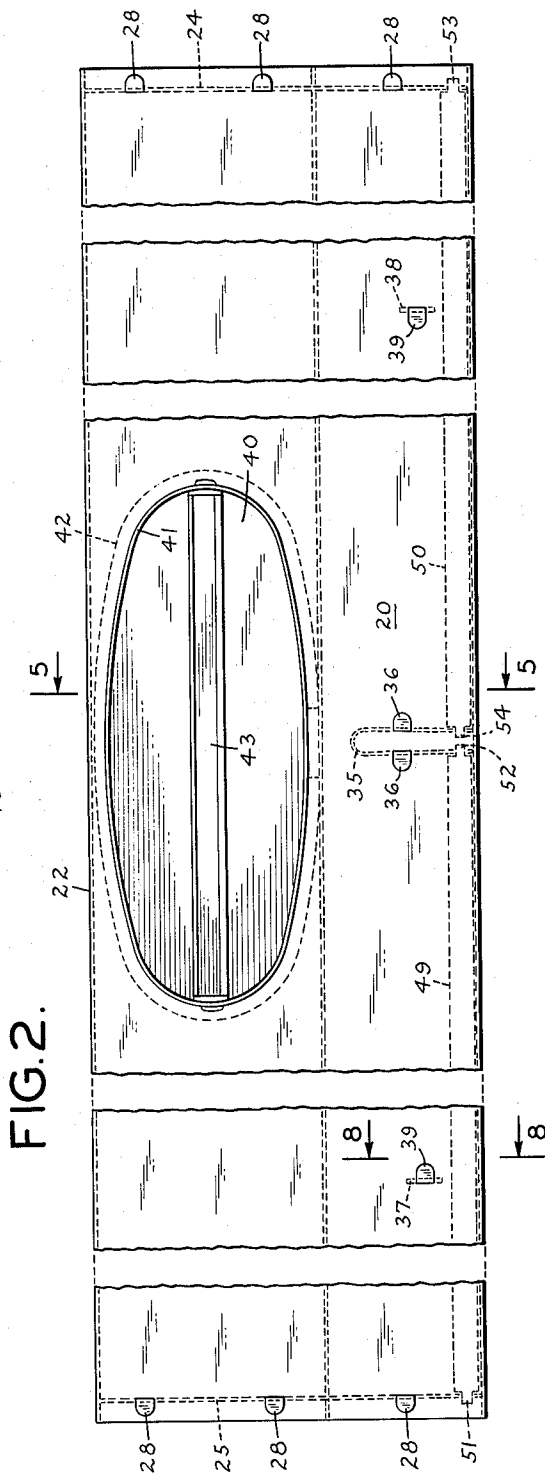


FIG. 2.

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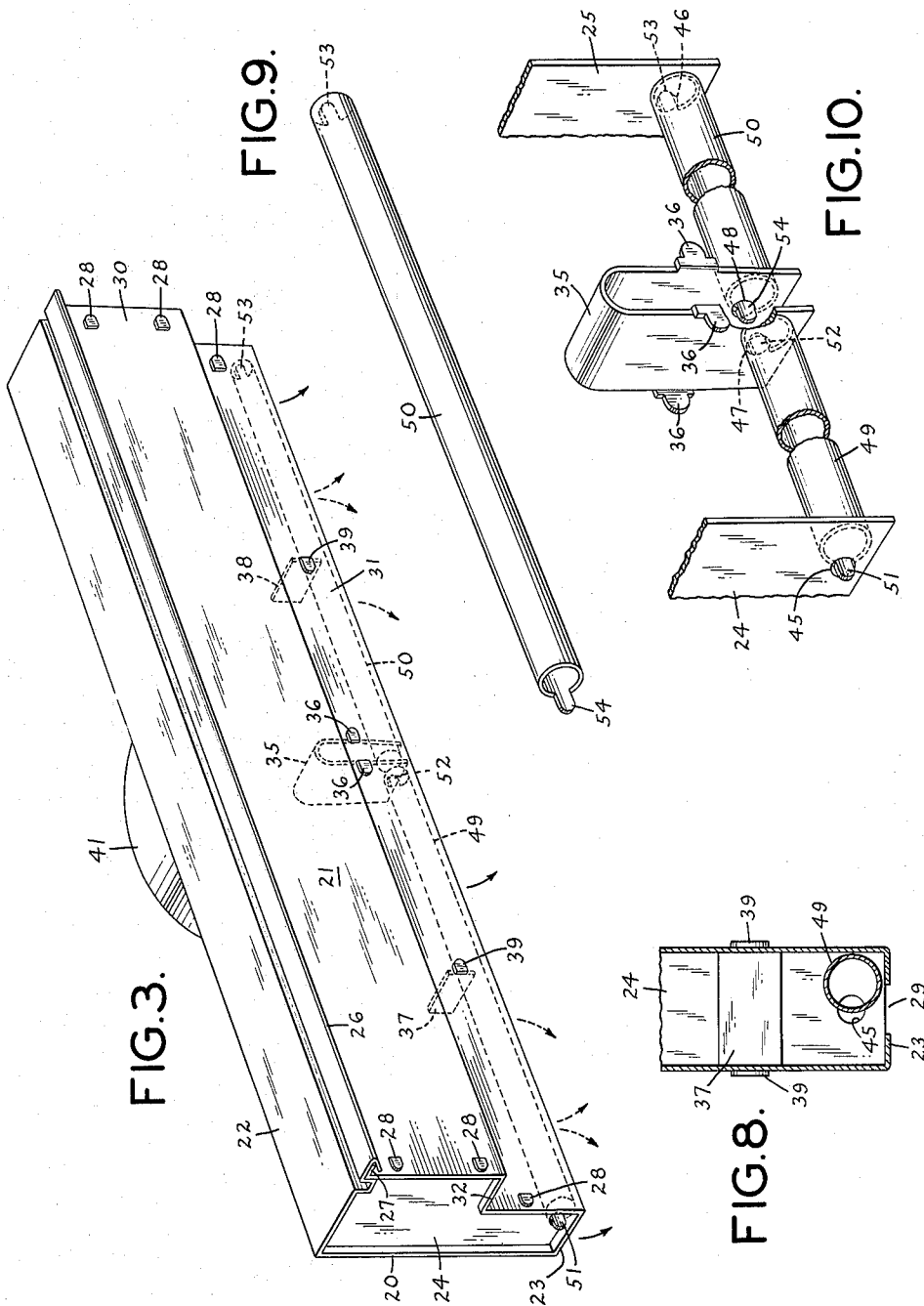
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FIG. 4.

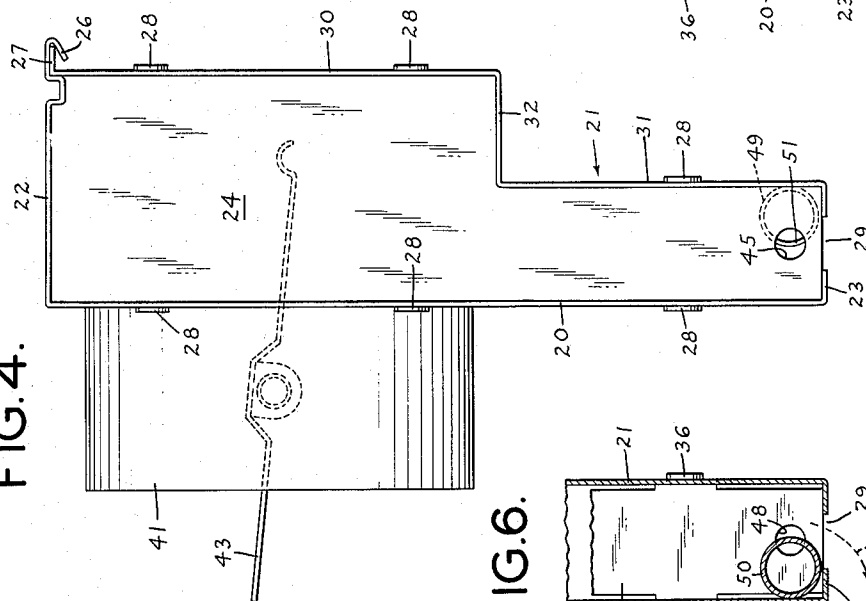


FIG. 5.

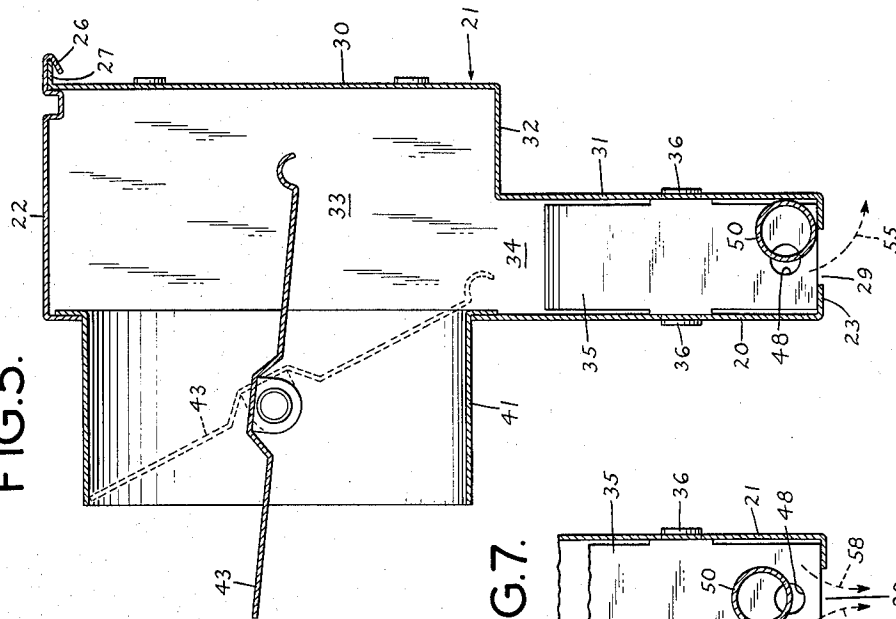


FIG. 6.

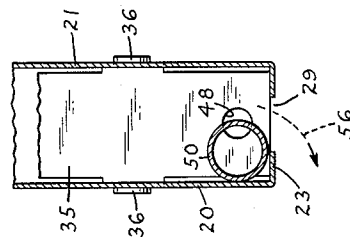
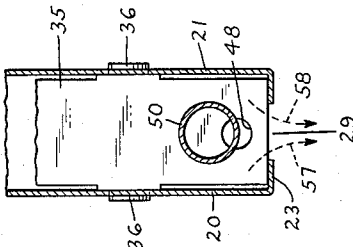


FIG. 7.



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AIR DIFFUSER

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9 Claims. (Cl. 98—40)

The present invention relates to air diffusers and more particularly to air diffusers of the slot type in which the air outlet is in the form of an elongated slot.

Many forms of air diffusing devices have been used to supply air from a heating or cooling system to a room. Slot-type diffusers in which the air emitting opening is an elongated slot have been found particularly desirable for certain types of installations, especially where the air outlet is to be flush with a ceiling surface or in association with a conventional troffer light fixture for diffusing air along the lateral edge of the fixture.

The principal object of the present invention has been the provision of a novel and improved slot-type air diffuser.

Another object of the invention has been the provision of a novel and improved slot-type air diffuser adapted for mounting with the air outlet flush or substantially flush with a ceiling or other wall surface and which permits convenient adjustment of the direction of air flow.

A further object of the invention has been the provision of such a diffuser which is readily adjustable with respect to the pattern of the emitted air and which permits simultaneous achievement of more than one pattern.

Another object of the invention has been the provision of such a diffuser in which the air pattern direction can be controlled within a range of approximately 180° by simple adjustments.

A further object of the invention has been the provision of such a diffuser which is especially adapted for use with a troffer lighting fixture.

Other and further objects, features and advantages of the invention will appear more fully from the following description taken in connection with the appended drawings, in which:

FIG. 1 is a top plan view of one form of slot-type air diffuser embodying the present invention;

FIG. 2 is a front elevational view of the diffuser of FIG. 1;

FIG. 3 is a perspective view, taken from the rear, of the diffuser of FIG. 1;

FIG. 4 is a right-side elevational view of the diffuser of FIG. 1;

FIG. 5 is a cross-sectional view taken along the line 5—5 of FIG. 2;

FIG. 6 is a fragmentary sectional view corresponding to a portion of FIG. 5 and showing one of the air pattern directing elements in a different position from that shown in FIG. 5;

FIG. 7 is a fragmentary sectional view corresponding to a portion of FIG. 5 and showing one of the air pattern directing elements in still another different position;

FIG. 8 is a fragmentary sectional view taken along the line 8—8 of FIG. 2;

FIG. 9 is a perspective view of one of the air pattern directing elements; and

FIG. 10 is a fragmentary perspective view illustrating the two air pattern directing units and their mounting brackets.

Referring now to the drawings, the air diffuser illustrated is of a type suitable for attachment to the side of a troffer lighting fixture or for independent mounting in the space above a false or suspended ceiling.

The diffuser has an elongated hollow housing or body,

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preferably made of sheet metal, and comprising a front wall 20, a rear wall 21, a top wall 22, a bottom wall 23, and a pair of end walls 24 and 25. The front and rear walls 20 and 21 may be considered as relatively long side walls joined by relatively short end walls 24 and 25. The walls 20—23 may be formed from a single strip of sheet metal, as shown, or from two or more strips suitably joined. The walls 20—23 are formed by suitably bending the sheet metal, the free ends being locked together by means of an intumed flange 26 on top wall 22 bent over a rearwardly projecting flange 27 of rear wall 21. The walls 20—23 may be of any desired length, but typically will be from 2 to 4 feet in length.

The end walls 24 and 25 are recessed slightly into the housing and are held in place in the housing by means of projecting tabs 28 which extend through corresponding holes in the housing and which are bent over, as best shown in FIG. 2 and 3.

An elongated, axially centered, rectangular slot 29 is provided in bottom wall 23. The slot 29 preferably extends continuously from end wall 24 to end wall 25. The slot 29 serves to discharge air from the diffuser and hence the diffuser is preferably mounted so that slot 29 is substantially flush with the ceiling surface of the room being ventilated. Of course, there may be a minor spacing between slot 29 and the ceiling, e.g., the thickness of the side flange of a troffer housing. Typically, the slot 29 might have a width of $\frac{7}{16}$ ", while the opposing portions of bottom wall 23 on opposite sides of slot 29 might each have a width of $\frac{1}{4}$ ". The foregoing and other dimensions set forth herein are given only by way of example and should not be taken as limiting the invention.

Rear wall 21 is divided into an upper portion 30 and a lower portion 31 by a horizontal shoulder 32, affording an upper chamber 33 and a lower chamber 34. Typically, the upper chamber 33 might have a width (front to back) of $1\frac{13}{16}$ ", while the lower chamber 34 might have a width of $1\frac{5}{16}$ ". Typically, the overall height of the housing might be $7\frac{7}{8}$ ", while the height of the chamber 34 might be $4\frac{3}{8}$ ".

A spacer 35, best shown in FIG. 10, is mounted between front wall 20 and rear wall 21 at the axial middle of the housing and is held in place by projecting tabs 36 which extend through holes in the front and rear walls and are bent over. The spacer 35 is U-shaped with the open end of the U facing downward. Preferably the spacer 35 rests on the upper surface of bottom wall 23.

Flat spacers 37 and 38 are provided between walls 20 and 21 intermediate spacer 35 and end walls 24 and 25, respectively. Spacers 37 and 38 are located above bottom wall 23 but below the level of shoulder 32. Spacers 37 and 38 are held in place by projecting tabs 39, which extend through holes in the front and rear walls and are bent over.

Front wall 21 is provided with a centrally located oval opening 40 in which is mounted an oval air inlet tube or duct 41. The duct 41 has a radially extending flange 42 which may be welded or otherwise affixed to front wall 21. The duct 41 is intended to communicate with a supply of conditioned air, e.g., a main or branch duct, by any suitable coupling (not shown). An adjustable damper 43 is pivotally mounted in duct 41 and may be shifted to any position between the open position shown in full lines in FIG. 5 and the closed position shown in dotted lines in FIG. 5. A hook formation 44 at one end of damper 43 facilitates adjustment of the damper by means of a tool inserted through slot 29. The damper 43 is retained tightly in duct 41 so that the damper will stay in whatever position it is placed.

End walls 24 and 25 are each provided with a centrally located round hole adjacent the bottom edge thereof, these holes being designated 45 and 46, respectively. Round

holes 47 and 48 are provided in the respective legs of spacer 35, the holes 47 and 48 being axially aligned with holes 45 and 46.

A pair of cylindrical deflectors 49 and 50 are mounted between end wall 24 and the facing leg of bracket 35, and between end wall 25 and the facing leg of bracket 35, respectively. The deflectors 49 and 50 are preferably hollow metal tubes. Deflector 49 has a pair of axially aligned lugs 51 and 52 projecting in an axial direction from opposite ends thereof, while deflector 50 has a similar pair of axially aligned lugs 53 and 54 projecting in an axial direction from opposite ends thereof. Lugs 51 and 52 fit into holes 45 and 47, respectively, while lugs 53 and 54 fit into holes 46 and 48, respectively. The lugs 51-54 acting in the respective corresponding holes serve to support the respective deflectors 49 and 50.

The length of the tubes 49 and 50 is slightly greater than the spacing between end walls 24 and 25 and the respective facing legs of spacer 35 when the latter are in an unstressed condition. Accordingly, the legs of spacer 35 must be forced toward each other to insert the deflectors 49 and 50, and will remain slightly stressed with the deflectors in position. In other words, spacer 35 acts as a spring urging the ends of deflectors 49 and 50 into contact with the end walls 24 and 25, respectively, so that the deflectors 49 and 50 will stay in whatever rotative position they are placed.

The lugs 51-54 are smaller in width than the corresponding holes 45-48 so that the deflectors may be rotated manually about axes joining the lugs 51 and 52 and 53 and 54, respectively. In FIG. 5, the deflector 50 is shown in contact with rear wall 21. In FIG. 6, the deflector 50 is shown in contact with front wall 20. FIGS. 5 and 6 thus represent opposite extreme positions for the deflector 50. The deflector 50 may be placed in any intermediate position, e.g., the one shown in FIG. 7, which represents an intermediate position midway between the FIG. 5 and FIG. 6 positions. The deflector 49 is independently positionable in positions corresponding to those described for deflector 50. It is not necessary that the deflectors 49 and 50 be placed in the same or similar positions, since each may be independently adjusted to obtain a desired air pattern, as will be described below.

Deflectors 49 and 50 have diameters equal to one-half the distance between front wall 20 and lower portion 31 of rear wall 21, so that the FIG. 5 and FIG. 6 extreme positions correspond substantially exactly. It is desirable that in the extreme deflector positions the deflectors contact both the rear or front wall, as the case may be, and the bottom wall 23 so that there will be two lines of contact between the deflector and the housing to minimize air leakage between the deflector and the adjacent housing wall in the extreme deflector positions. This contact is particularly desirable where two or more independently adjustable deflectors are provided, since, if the deflectors are adjusted differently, shear effects in the air stream must be overcome and these will be aggravated by air leakage behind the deflectors. However, where only a single deflector is provided, or where the deflectors are similarly adjusted, satisfactory operation will be achieved without contact of the deflector or deflectors with the rear or front wall and the bottom wall of the housing. In such case it is sufficient if the deflector or deflectors lie adjacent the rear or front wall, as the case may be, so as to prevent substantial air leakage behind the deflector.

Referring to FIG. 5, with the deflector 50 in the position shown, the air flow pattern is to the right horizontally along the ceiling, as shown generally by the arrow 55. Referring to FIG. 6, with the deflector 50 in the position shown, the air flow pattern is to the left horizontally along the ceiling, as shown generally by the arrow 56. Referring to FIG. 7, with the deflector 50 in the middle position shown, the air flow pattern is downward, as shown generally by the arrows 57 and 58. In any intermediate deflector position between FIGS. 5 and 7, the air flow will be intermediate the directions shown by arrows 55

and 57-58. In any intermediate deflector position between FIGS. 6 and 7, the air flow will be intermediate the directions shown by arrows 56 and 57-58. The air patterns obtainable with deflector 49 are adjustable in the same manner as described for deflector 50. The deflectors may be moved from position to position by insertion of an appropriate tool through slot 29 and pivoting of the deflector as desired.

An important advantage secured by the construction of the invention is that, irrespective of the air pattern selected, the effective area or discharge area of the diffuser will be substantially constant. That the air discharge areas for horizontal right and horizontal left patterns are identical will be evident from a comparison of FIGS. 5 and 6. The air discharge areas for the downblow position of FIG. 7 or for intermediate positions is not readily determinable except by a measurement of the amount of static pressure required to force a given volume of air through the diffuser. However, such static pressure measurements show that the air discharge areas remain substantially unchanged between the horizontal patterns of FIGS. 5 and 6 and the downblow pattern of FIG. 7.

The results of actual static pressure measurements are shown below. In these measurements the diffuser had the dimensions and shape described above except that the overall diffuser height was 6", while the height of chamber 34 was 2½". The height of inlet duct 41 was 3". The inlet static pressure (in inches of water) was measured in duct 41, the drop in pressure (ΔP) was measured across an orifice. Air volume was in cubic feet per minute.

Vol., c.f.m.	Inlet S.P.	ΔP	Direction
80.....	.11	.079	Down (Fig. 7).
80.....	.108	.079	One Way (Fig. 6).
80.....	.122	.079	One Way (Fig. 5).
80.....	.112	.079	Two Way (Figs. 5-6).
100.....	.178	.125	Down (Fig. 7).
100.....	.175	.125	One Way (Fig. 6).
100.....	.193	.125	One Way (Fig. 5).
100.....	.182	.125	Two Way (Figs. 5-6).
120.....	.25	.182	Down (Fig. 7).
120.....	.246	.182	One Way (Fig. 6).
120.....	.275	.182	One Way (Fig. 5).
120.....	.257	.182	Two Way (Figs. 5-6).

When it is considered that the volume varies essentially as the square root of the pressure change so that a 10% change in static pressure would correspond approximately to a 3% ($\pm 1\frac{1}{2}\%$) change in volume, the effective area of the slot diffuser for different deflector positions shown in the table is remarkably constant. For the purposes of measurement, the two deflectors were identically adjusted except for the two-way condition. In that condition one deflector was adjusted as in FIG. 5 and the other as in FIG. 6.

If desired, the lower chamber 34 may be connected directly to an air duct or other source of air, thus eliminating the chamber 33 and associated parts.

While the invention has been described in connection with a specific embodiment thereof and in a specific use, various modifications thereof will occur to those skilled in the art without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. An air diffuser, comprising a housing having a pair of relatively long side walls, a pair of relatively short end walls connecting said side walls and a bottom wall, said bottom wall having an elongated slot extending substantially from one end wall to the other end wall and being located substantially midway between said side walls, the portions of said bottom wall on each side of said slot forming an elongated lip, means in said housing for admitting conditioned air under pressure into said housing whereby air will be discharged from said housing through said slot in said bottom wall, and means selectively to alter the pattern of air discharged through said slot comprising an elongated cylindrical deflector element having

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a diameter approximately equal to one-half the width of said bottom wall, means to mount said deflector element in said housing generally above said slot and shiftable between a first position in which said deflector element is in substantially sealing contact with one of said side walls and the adjacent lip of said bottom wall and a second position in which said deflector element is in substantially sealing contact with the other of said side walls and the adjacent lip of said bottom wall, said mounting means being arranged to permit manual shifting of said deflector element between said first and second positions and to retain said deflector element in any of said first position, said second position and any intermediate position.

2. An air diffuser, comprising a housing having a pair of relatively long side walls, a pair of relatively short end walls connecting said side walls and a bottom wall, said bottom wall having an elongated slot located between said side walls, at least the portion of said bottom wall on one side of said slot forming an elongated lip, means in said housing for admitting conditioned air under pressure into said housing whereby air will be discharged from said housing through said slot in said bottom wall, and means selectively to alter the pattern of air discharged through said slot comprising an elongated cylindrical deflector element, means to mount said deflector element in said housing generally above said slot and shiftable between a first position in which said deflector element lies adjacent one of said side walls and a second position in which said deflector element lies adjacent the other of said side walls, said mounting means being arranged to permit manual shifting of said deflector element between said first and second positions and to retain said deflector element in either of said first position and said second position.

3. An air diffuser, comprising a housing having a pair of relatively long side walls, a pair of relatively short end walls connecting said side walls, a top wall and a bottom wall, said bottom wall having an elongated rectangular slot extending substantially from one end wall to the other end wall and being located substantially midway between said side walls, the portions of said bottom wall on each side of said slot forming an elongated lip, means in said housing for admitting conditioned air under pressure into said housing whereby air will be discharged from said housing through said slot in said bottom wall, and means selectively to alter the pattern of air discharged through said slot comprising an elongated cylindrical deflector element, means to mount said deflector element in said housing generally above said slot and shiftable between a first position in which said deflector element is in substantially sealing contact with one of said side walls and a second position in which said deflector element is in substantially sealing contact with the other of said side walls, said mounting means being arranged to permit manual shifting of said deflector element between said first and second positions and to retain said deflector element in any of said first position, said second position and any intermediate position.

4. An air diffuser, comprising a housing having a pair of relatively long side walls, a pair of relatively short end walls connecting said side walls, a top wall and a bottom wall, said bottom wall having an elongated rectangular slot extending substantially from one end wall to the other end wall and being located substantially midway between said side walls, the portions of said bottom wall on each side of said slot forming an elongated lip, means in said housing for admitting conditioned air under pressure into said housing whereby air will be discharged from said housing through said slot in said bottom wall, and means selectively to alter the pattern of air discharged through said slot comprising a pair of axially aligned elongated cylindrical deflector elements each having a diameter approximately equal to one-half the width of said bottom wall, means to mount said deflector elements in said housing generally above said slot and in-

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dependently shiftable between a first position in which each said deflector element contacts one of said side walls and the adjacent lip of said bottom wall and a second position in which each said deflector element contacts the other of said side walls and the adjacent lip of said bottom wall, said mounting means being arranged to permit independent manual shifting of said deflector elements between said first and second positions and to retain said deflector elements selectively in any of said first position, said second position any intermediate position.

5. An air diffuser, comprising a housing having a pair of relatively long side walls, a pair of relatively short end walls connecting said side walls, a top wall and a bottom wall, said bottom wall having an elongated rectangular slot extending substantially from one end wall to the other end wall and being located between said side walls, the portions of said bottom wall on each side of said slot forming an elongated lip, means in said housing for admitting conditioned air under pressure into said housing whereby air will be discharged from said housing through said slot in said bottom wall, a generally U-shaped spacer joining said side walls at a point intermediate said end walls, said spacer having the open end of the U facing downwardly and having the legs of the U substantially parallel to said end walls, said end walls and said legs of said spacer each having a hole spaced above the plane of said bottom wall, the centers of said holes being located in a line parallel to and aligned with the axial center line of said slot, and a pair of elongated cylindrical deflector elements each having an axially aligned axially projecting lug extending from each end of the periphery thereof, the lugs of one of said deflector elements extending into and being rotatably retained in respective ones of said holes in one of said end walls and the facing one of said legs and the lugs of the other one of said deflector elements extending into and being rotatably retained in respective ones of said holes in the other one of said end walls and the other one of said legs, said deflector elements being independently shiftable between a first position in which said deflector elements contact one of said side walls and a second position in which said deflector elements contact the other of said side walls, said spacer exerting an axial force on said deflector elements whereby said deflector elements are retained independently and selectively in any of said first position, said second position and any position intermediate said first and second positions.

6. An air diffuser, comprising a housing having a pair of relatively long side walls, a pair of relatively short end walls connecting said side walls, a top wall and a bottom wall, said bottom wall having an elongated rectangular slot extending substantially from one end wall to the other end wall and being located substantially midway between said side walls, the portions of said bottom wall on each side of said slot forming an elongated lip, means in said housing for admitting conditioned air under pressure into said housing whereby air will be discharged from said housing through said slot in said bottom wall, a generally U-shaped spacer joining said side walls substantially midway between said end walls, said spacer having the open end of the U facing downwardly and having the legs of the U substantially parallel to said end walls, said end walls and said legs of said spacer each having a round hole spaced above the plane of said bottom wall, the centers of said holes being located in a line parallel to and aligned with the axial center line of said slot, and a pair of elongated cylindrical deflector elements each having an axially aligned axially projecting lug extending from each end of the periphery thereof, the lugs of one of said deflector elements extending into and being rotatably retained in respective ones of said holes in one of said end walls and the facing one of said legs and the lugs of the other one of said deflector elements extending into and being rotatably retained in respective ones of said holes in the other one of said end walls and

the other one of said legs, said deflector elements being independently shiftable between a first position in which said deflector elements contact one of said side walls and the adjacent lip of said bottom wall and a second position in which said deflector elements contact the other of said side walls and the adjacent lip of said bottom wall, said spacer exerting an axial force on said deflector elements whereby said deflector elements are retained independently and selectively in any of said first position, said second position and any position intermediate said first and second positions.

7. An air diffuser, comprising a housing having a pair of relatively long side walls, a pair of relatively short end walls connecting said side walls and a bottom wall, said bottom wall having an elongated rectangular slot extending substantially from one end wall to the other end wall and being located between said side walls, at least the portion of said bottom wall on one side of said slot forming an elongated lip, means in said housing for admitting conditioned air under pressure into said housing whereby air will be discharged from said housing through said slot in said bottom wall, and means selectively to alter the pattern of air discharged through said slot comprising an elongated cylindrical deflector element, means to mount said deflector element in said housing generally above said slot and shiftable between a first position in which said deflector element lies adjacent and in substantially sealing relationship with one of said side walls and a second position in which said deflector element lies adjacent and in substantially sealing relationship with the other of said side walls, said mounting means being arranged to permit manual shifting of said deflector element between said first and second positions and to retain said deflector element in either of said first position and said second position.

8. An air diffuser, comprising a housing having a pair of relatively long side walls, a pair of relatively short end walls connecting said side walls and a bottom wall, said bottom wall having an elongated rectangular slot extending substantially from one end wall to the other end wall and being located substantially midway between said side walls, the portions of said bottom wall on each side of said slot forming an elongated lip, means in said housing for admitting conditioned air under pressure into said housing whereby air will be discharged from said housing through said slot in said bottom wall, and means selectively to alter the pattern of air discharged through said slot between directions substantially parallel to the plane of said bottom wall and substantially perpendicular to the plane of said bottom wall comprising a pair of axially aligned elongated cylindrical deflector elements each having a diameter approximately equal to one-half the width of said bottom wall, means to mount said deflector elements in said housing generally above said slot and independently shiftable between a first position in which each said deflector element contacts one of said side walls and the adjacent lip of said bottom wall and a second

position in which each said deflector element contacts the other of said side walls and the adjacent lip of said bottom wall, said mounting means being arranged to permit independent manual shifting of said deflector elements between said first and second positions and to retain said deflector element selectively in any of said first position, said second position and any intermediate position.

9. An air diffuser, comprising a housing having a pair of relatively long side walls, a pair of relatively short end walls connecting said side walls and a bottom wall, said bottom wall having an elongated rectangular slot extending substantially from one end wall to the other end wall and being located between said side walls, the portions of said bottom wall on each side of said slot forming an elongated lip, means in said housing for admitting conditioned air under pressure into said housing whereby air will be discharged from said housing through said slot in said bottom wall, a generally U-shaped spacer joining said side walls at a point intermediate said end walls, said spacer having the legs of the U substantially parallel to said end walls, said end walls and said legs of said spacer each having a hole spaced above the plane of said bottom wall, the centers of said holes being located in a line parallel to and aligned with the axial center line of said slot, and a pair of elongated cylindrical deflector elements each having an axially aligned axially projecting lug extending from each end of the periphery thereof, the lugs of one of said deflector elements extending into and being rotatably retained in respective ones of said holes in one of said end walls and the facing one of said legs and the lugs of the other one of said deflector elements extending into and being rotatably retained in respective ones of said holes in the other one of said end walls and the other one of said legs, said deflector elements being independently shiftable between a first position in which said deflector elements lie adjacent and in substantially air sealing relationship with one of said side walls and the adjacent lip of said bottom wall and a second position in which said deflector elements lie adjacent and in substantially air sealing relationship with the other of said side walls and the adjacent lip of said bottom wall, said spacer exerting an axial force on said deflector elements whereby said deflector elements are retained independently and selectively in any of said first position, said second position and any position intermediate said first and second positions.

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