June 27, 1967 J. F. NEWELL ET AL 3,327,608

DIFFUSER

Filed Oct. 23, 1965 2 Sheets-Sheet 1

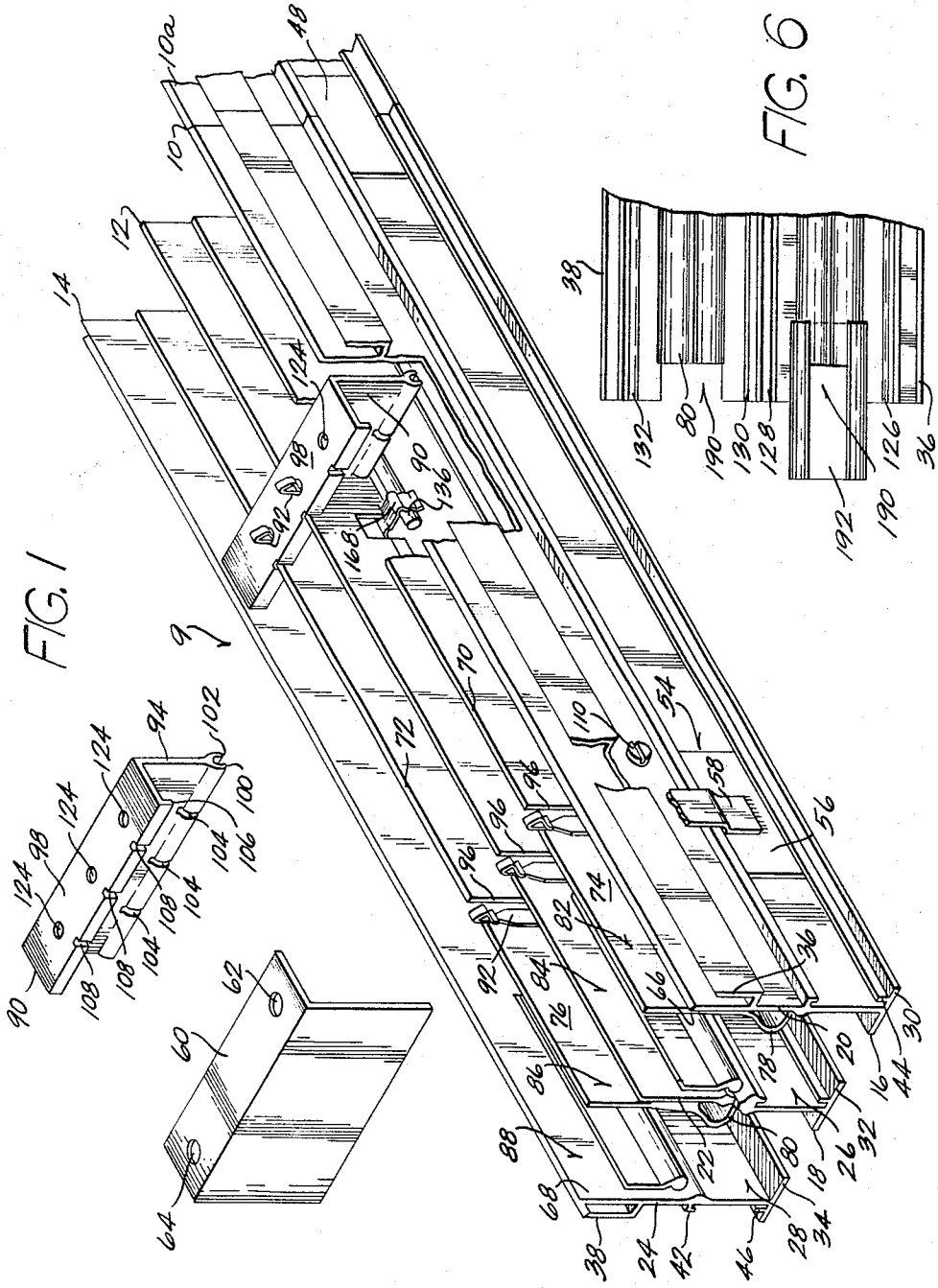

FIG. 1

FIG. 6

INVENTORS
JOHN F. NEWELL
JOSEPH W. SPRADLING

By Joseph A. Semprini
ATTORNEY

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DIFFUSER

Filed Oct. 23, 1965 2 Sheets-Sheet 2

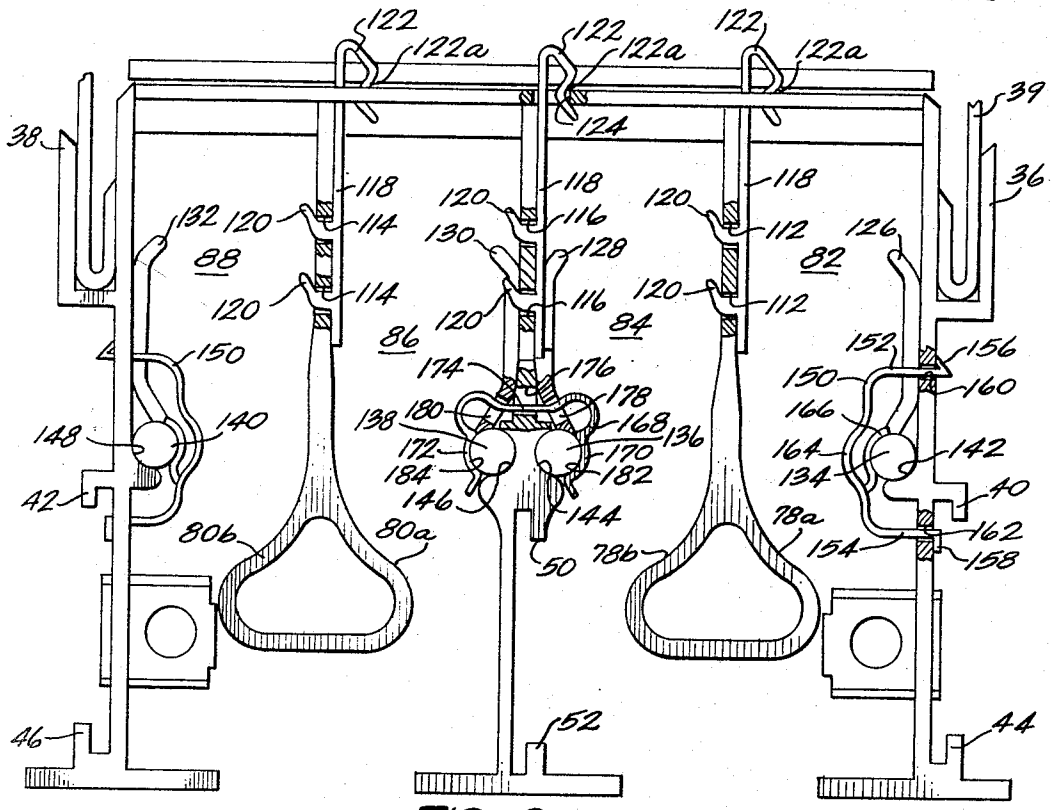

FIG. 2

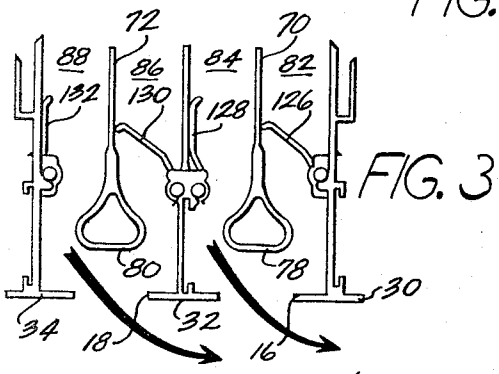

FIG. 3

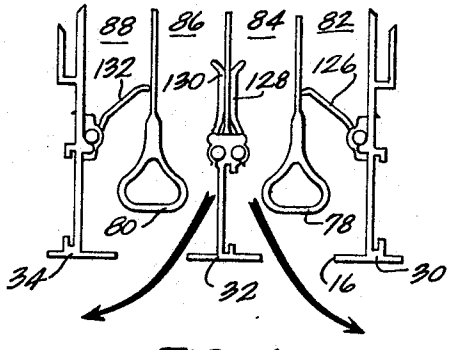

FIG. 4

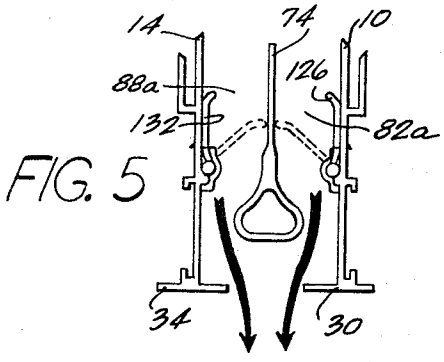

FIG. 5

INVENTORS
JOHN F. NEWELL
JOSEPH W. SPRADLING
BY Joseph D. Lanzigini
ATTORNEY

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DIFFUSER

John F. Newell, Verona, and Joseph W. Spradling, Madison, Wis., assignors to Wehr Corporation, Milwaukee, Wis., a corporation of Wisconsin

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18 Claims. (Cl. 98—40)

This invention relates to air diffusers and, more particularly, to diffusers of the slot-type which are commonly used to control the pattern of air discharge into a room from a central delivery system. Diffusers of this type are commonly used in, but are not limited to, ceiling constructions.

A general object of this invention is to provide improved pattern control for diffusers of this type.

Another general object of this invention is to combine improved pattern control with an effective damper control which does not affect the selected pattern.

A still further object of this invention is to provide a pattern control and damper which is effective through a complete range of adjustment without altering the outer appearance of the diffuser.

A further specific object of this invention is to provide a construction for a diffuser and pattern control which is relatively simple in construction and lends itself to facile assembly without decreasing the versatility of the diffuser pattern control from the standpoint of ganging diffusers to increase delivery volume while maintaining adequate pattern control.

Other objects and advantages will be pointed out in, or be apparent from, the specification and claims, as will obvious modifications of the embodiments shown in the drawings, in which:

FIG. 1 is a perspective view, partially exploded, of a diffuser section constructed in accordance with this invention;

FIG. 2 is an end view of the diffuser of FIG. 1 with portions broken away to expose internal connections of the diffuser.

FIGS. 3 and 4 are generally schematic illustrations of the diffuser section of FIGS. 1 and 2 illustrating two of the flow patterns available from the diffuser section;

FIG. 5 is a generally schematic illustration of an alternative embodiment of this invention and illustrating a further available air flow pattern; and

FIG. 6 is a plan view of an end of the diffuser section of FIG. 1.

As stated above diffusers of this type have particular application to, but are not limited to, ceiling constructions where the ceiling is to include outlets for an air distribution system and where the diffuser is to control the discharge of air into a particular room. It will also be appreciated that although the invention is to be described in a vertically oriented diffuser other orientations can be used and, therefore, the terms vertical and horizontal are used in the following discussion in a relative and not a limiting sense. Moreover, the diffuser can be used to control flowing media other than air but since its major application will be in air systems it will be described in that environment.

Typically a pair of adjacent T-bars, or other suitable frame members, are used in the ceiling frame work to define an elongated slot through which air is discharged. This invention is concerned with the problem of controlling the discharge through the slot. As illustrated in the drawings, diffuser section 9 includes three T-bars 10, 12 and 14 which are relatively spaced to define a pair of elongated slots 16 and 18. As will be described hereinafter center T-bar 12 can be eliminated and end T-bars 10 and 14 moved closer together to provide a single slot.

T-bars 10, 12 and 14 include vertical, parallel sections 20, 22 and 24. The inner walls of sections 20 and 24 face the opposite walls of section 22 so that the walls cooperate to define two main air passages 26 and 28 therebetween. Each of the vertical sections of the T-bars terminate in a transverse flange 30, 32 and 34 arranged in relative horizontal alignment but spaced from each other to define the slots 16 and 18 at the exit ends of the main air passages. Flanges 30, 32 and 34 form the outer face of the diffuser and constitute the portion of the diffuser section which is visible in the ceiling.

The outer walls of sections 20 and 24 are provided with L-shaped in cross section strips 36 and 38 adjacent the upper or inner end of the T-bars. The L-shaped strips cooperate with the section walls to define channels opening outwardly, or in the same direction as the inlet ends of main passages 26 and 28 open, to receive the edges of suitable duct work 39 (see FIG. 2 where a portion of the duct work is illustrated in the channels). This provides a simple and effective manner of connecting the duct work to the diffuser section and moreover assures proper alignment of the duct work at the diffuser section inlet to provide efficient delivery of air to the diffuser section.

At this point it should be noted that second L-shaped elements 40 and 42 are also provided on the outer walls of sections 20 and 24. These elements face toward projections 44 and 46 on the uppersides of flanges 30 and 34 and define a guideway for receipt of a suitable joint member 48 which is used to connect two adjacent diffuser sections in end-to-end relations, such as is partially illustrated in FIG. 1, to permit ganging the diffuser sections to achieve a desired slot length. It will be noted that T-bar 12 also includes L-shaped element 50 facing toward element 52 on flange 32 to provide a similar guideway for receipt of a similar joint member (not shown). For convenience only one T-bar 10*a* of the next diffuser section has been illustrated in FIG. 1 as it will be appreciated that each diffuser section is identical to that illustrated and also for convenience only one joint member is illustrated as the connection is the same at T-bars 12 and 14.

The guideways defined by elements 40–44 and 42–26 provide an additional function in that they provide a simple point of connection for hanger bracket 54. Hanger bracket 54 preferably includes a base portion 56 which slides into the guideway and a connection member 58 to which a conventional attachment (not shown) can be made to suspend the diffuser section in the ceiling frame work. One or more hanger brackets can be similarly mounted on each side of the diffuser section as may be required to provide stable support and depending on the length of the diffuser section.

Suitable end brackets 60 can be provided at the inner longitudinal ends of the diffuser sections. These end brackets lend rigidity to the diffuser section and also provide a point at which the duct work can be anchored to the diffuser section for example by passing screws (not shown) through openings 62 and 64 and suitably connecting the screws to the duct.

With this arrangement T-bars 10, 12 and 14 define main air passages 26 and 28 having inlet openings 66 and 68 connected with the duct and exit openings 16 and 18 through which the air is discharged into the room.

The pattern of discharge into the room through the diffuser section is controlled by air flow pattern controls disposed in each of the main air passages 26 and 28. Fixed deflectors 70 and 72 are arranged in air passages 26 and 28 and structurally include partition portions 74 and 76 and deflector portions 78 and 80. Partition portions 74 and 76 are arranged parallel to the direction of air flow through passages 26 and 28 and extend generally the

length of diffuser section, terminating short of at least one of the longitudinal ends of the diffuser section for a purpose to be discussed hereinafter. The partition portions divide each of the main air passages into two separate control air passages, namely 82–84 in passage 26 and 86–88 in passage 28. Deflector portions 78 and 80 have an extension which is generally transverse to the direction of air flow and cooperate in achieving pattern control. Specifically deflectors 78 and 80 extend coextensively with partition portions 74 and 76 and have a tear-drop shape in transverse cross section and the dimension through their broadest point is transverse to the air flow path or normal to the partition portions and the vertical sections of the T-bars. Preferably the transverse extension of the deflector portions directly overlies slots 16 and 18.

Deflectors 70 and 72 are held in fixed position in the diffuser section through cooperation between spacer and support members 90 and snap fasteners 92. Two identical support members 90 are used in each diffuser section and three snap fasteners are used in combination with each support member, the support members and snap fasteners cooperating to connect T-bar 12 in the diffuser section as well as the deflectors. For better and more complete illustration, one support member is illustrated assembled and the other removed from its position. More specifically, support members 90 each include a vertical leg 94 which fits into slots 96 provided in the upper ends of the fixed deflectors and T-bar 12 so that the support members fit into the diffuser section and when so assembled their horizontal legs 98 are generally flush with the upper ends of the T-bars and deflectors. The lower ends of vertical legs 94 are bifurcated with bifurcations 100 and 102 extending the length of the support member but periodically interrupted by slots 104 on both sides thereof and spaced to fit over the deflectors and T-bar 12. When assembled the bifurcations engage and provide lateral support for the deflector and T-bars. Similarly the horizontal legs are provided with turned down flanges 106 including slots 108 spaced to engage and provide lateral support for the deflectors and T-bars. The bifurcated ends of the supports serve an additional function in that they are adapted to receive fastening screws 110 which extend through both T-bars 10 and 14 and thread into the support members to hold them in place.

Snap fasteners 92 achieve the vertical connection of the deflectors and T-bar 12 to the support members, this is perhaps best illustrated in FIG. 2. Deflector partition portions 82 and 84 are provided with openings 112 and 114 and T-bar 12 is provided with openings 116. The snap fasteners 92 are made of spring material and are of identical configuration, each including an elongated body portion 118 having tabs 120 formed from the body portion. The tabs extend angularly from the body portions and away from the lower or exit end of the diffuser section and fit into openings 112, 114 and 116. The upper ends of the snap fasteners are turned back on themselves forming an S-shaped spring member 122 which extends through openings 124 in horizontal leg 98 of each support member. Depressions 122*a* of the S-shaped spring members snap into engagement with the walls of openings 124 to complete a connection whereby the deflectors and T-bar 12 are suspended in the diffuser section from support members 90 with a releasable snap-in type connection.

Adjustably mounted control blades 126–128 and 130–132 are connected to the T-bars in such a manner as to be capable of influencing air flow through passages 82, 84, 86 and 88, respectively. The adjustable control blades cooperate with flanges 30, 32 and 34, and the fixed deflectors, to determine the pattern of air discharge from the diffuser section. The control blades extend coextensively with the fixed deflectors and are pivoted on a respective one of the T-bars. More specifically blades 126, 128, 130 and 132 each includes a cylindrical base portion 134, 136, 138 and 140 engaged in semicylindrical seats 142, 144, 146 and 148, respectively, formed in the vertical sections of T-bars 10, 12 and 14. The blades connected to outer T-bars 10 and 14 are supported by identical snap fasteners 150 each of which includes arms 152 and 154 which are formed with tabs 156 and 158 and snap into openings 160 and 162 in T-bars 10 and 14. The arms 152 and 154 are connected by a web 164 in which a resilient finger 166 is formed and engages and biases blade base portions 134 and 140 into engagement with their respective seats. It will be appreciated that at least two such snap fasteners are used to connect each control blade to its respective T-bar. Since control blades are supported on both sides of T-bar 12 a snap fastener 168 of different configuration is used in their connection to the T-bar. Snap fastener 168 is generally U-shaped having formed arms 170 and 172 connected by web 174. Web 174 extends through opening 176 in T-bar 12 and openings 178 and 180 in blades 128 and 130. Arms 170 and 172 are formed with semicylindrical seats 182 and 184 arranged to engage base portion 136 and 138 and bias them into engagement with seats 144 and 146 in T-bar 12. Again at least two snap fasteners are used to connect the blades 128 and 130 to T-bar 12.

At this point it should be noted that the major portion of the assembly of the diffuser section is accomplished with a releasable snap in connection for ease of assembly and versatility. It should also be noted that a single slot can be provided by merely eliminating T-bar 12, one of the fixed deflectors and moving the end T-bars 10 and 14 together and using a different type of support member 90. Otherwise the basic components are the same, likewise additional slots can be added by merely adding T-bars such as 12, deflectors and changing the length of the support member 90. The snap fastener connection and the construction of the basic elements provide virtually unlimited versatility in diffuser section arrangements, both in length of slot and number of slots.

With the structural details of the diffuser section in mind the pattern control afforded by this construction will now be described.

Reference will be made to FIGS. 3–5 for a description of the various patterns which are available. It will be noted that FIGS. 3 and 4 follow the two slot diffuser section construction described to this point whereas FIG. 5 illustrates, in somewhat schematic form, the modified version which affords only a single slot. In FIG. 5 the central T-bar 12 has been eliminated and T-bars 10 and 14 have been moved closer together with a single deflector 74 therebetween. The structural details described above as to the connection of the deflector, and control blades, etc. is applicable to this modified version and will not be repeated.

In FIGS. 3 and 4 two air patterns are illustrated to explain the basic operation of the diffuser, the other available patterns will be discussed but have not been illustrated as it is believed that with an appreciation of the basic operation principles a discussion only of the patterns should be sufficient and specific illustration of each available pattern should not be necessary to an understanding thereof.

The direction of air flow as it leaves the diffuser section is affected by the combined effect of the air flowing past transverse portions 78 and 80 and flanges 30, 32 and 34 with the volume of flow through passages 82, 84, 86 and 88 being determined by the position of the control blades. With reference to FIG. 3, the control has been set to produce a horizontal discharge to the right as viewed in the drawings. Blades 126 and 130 have been pivoted to engage along deflectors 70 and 72 thereby closing off passages 82 and 86 and causing all air flow to be through passages 84 and 88. Transverse portions 78 and 80 of deflectors 82 and 84 cause the air flow to undergo a first change of direction toward T-bars 12 and 14. In this regard the tear-drop configuration provides

smooth arcuate walls 78*a*–78*b* and 80*a*–*b* to produce this change in air flow direction with a minimum of turbulence. Similarly flanges 32 and 34 cause another change in direction in the air flow pattern before the air passes through exit slots 16 and 18. Thus, air flow is turned toward T-bars 12 and 14 by deflectors 70 and 72 and to be discharged from the diffuser it is again caused to change direction by flanges 32 and 34 resulting in a generally horizontal discharge to the right of the diffuser section. Extension of deflector portions 78 and 80 over slots 16 and 18 is preferred as it prevents direct vertical passage of air through the slots and insures that all air flow is redirected by flanges 32 and 34. Closure of blades 128 and 132 and opening of blades 126 and 130 (not shown) will produce horizontal flow from both slots in a direction to the left of the diffuser section. Closure of blades 126 and 132 and opening of blades 128 and 130 produces, in the same general manner, horizontal flow in opposite horizontal directions, to the right and left, of the diffuser section as illustrated in FIG. 4.

FIG. 5 illustrates a setting to produce vertical discharge through the slot and this pattern is illustrated in connection with a single slot diffuser section but is a pattern which can be achieved in the multiple slot arrangement and the patterns discussed in connection with the multiple slot diffuser section can also be had in a single slot diffuser section. As can be seen both blades 126 and 132 are open so that flow divides equally between passages 82*a* and 88*a*. The horizontal throw at each flange 30 and 34 is equal and they tend to cancel each other and the resultant discharge is vertical as indicated. With further analysis of FIG. 5 it will also become evident that discharge from any given slot can be adjusted from horizontal in one direction through 180° to horizontal in the other direction. Starting with the condition in FIG. 5, if blade 126 is gradually closed, the volume of air through passage 82*a* is gradually reduced and correspondingly so is the force of its horizontal throw so that the horizontal throw through passage 88*a* becomes the more dominant factor and discharge proceeds from vertical through 90° to horizontal when blade 126 is fully closed on the deflector. Adjustment in the opposite direction takes place if blade 126 is left open and blade 132 is gradually closed.

It will further be appreciated that with flow through only one passage, or with vertical discharge, the volume of flow can be varied without changing the pattern of discharge by gradually closing the open blade. The control can also produce a full dampered condition. This is illustrated in FIG. 5 with blades 126 and 132 in their full closed position, interrupting all flow through the diffuser section.

It will be appreciated that with the deflector, particularly transverse portions 78 and 80 thereof, and the control blades being spaced inwardly of exit opening slots 16 and 18 the diffuser is adjustable through its full range without altering the outer appearance of the diffuser section.

A suitable tool (not shown) is used to vary the position of the control blades. To provide access to the blades of the diffuser section the deflectors terminate short of the ends of the T-bars thereby leaving an opening 190 through which the tool can be extended to either pull down or push up the blades (see FIG. 6). In order to minimize the adverse effect such a gap might have in the air flow control pattern after the pattern is adjusted a deflector plate 192 is snapped onto the tear-drop shaped portion of the deflector and in the case of end-to-end diffuser sections the deflector plate extends between the deflectors of adjacent diffuser sections and across the joint between sections as illustrated in FIG. 6. Should readjustment be necessary the deflector plate can be snapped out, the desired adjustment made and the deflector plate reinserted. It will be appreciated that the showing in FIG. 6 is not complete as to the structural details of the diffuser section, only that portion of the diffuser section necessary to an understanding of adjustment feature having been illustrated.

Although this invention has been illustrated and described in connection with particular embodiments thereof, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

We claim:

1. A diffuser comprising, in combination,

first and second relatively spaced members including walls facing toward each other and defining a main passage therebetween having inlet and exit ends to permit flow through said main passage, said first and second members each including flange means extending laterally of said walls into said main passage adjacent said exit end and terminating in relative spaced relation to permit flow therebetween,

a deflector mounted in fixed relation between said walls and including a first portion extending in the direction of flow through said main passage and dividing said main passage into first and second flow passages, said deflector also including a second portion connected to said first portion and extending transversely from both sides of said first portion into each of said first and second flow passages but terminating in spaced relation from said walls to permit flow therebetween, said second deflector portion being spaced upstream of said flange means and being in the path of flow through said first and second passages to cause a change in flow direction upstream of said flange means,

first and second control blades,

and means connecting one of said blades to each of said first and second members in each of said first and second passages supporting said blades for independent pivotal movement in said first and second passages into and out of a first position extending between said first and second members and said deflector to selectively interrupt flow through said first and second passages and open said first and second passages to flow.

2. The diffuser of claim 1 wherein said first and second members are elongated and said first and second deflector portions and said first and second blades are also elongated and extend generally coextensively with said first and second members.

3. The diffuser of claim 2 wherein said connecting means supports one of said blades on each of said walls for pivotal movement toward and away from engagement with said deflector.

4. The diffuser of claim 3 wherein said first and second members each terminate in transverse portions projecting inwardly of said first and second members to provide said flange means and define said exit end of said main passage,

5. A diffuser comprising, in combination,

first and second relatively spaced elongated members defining a main flow passage therebetween, said first and second members each having a first portion extending in the direction of flow through said main passage and a flange portion extending transversely of said direction of flow but terminating in spaced relationship to define an exit opening from said main passage,

an elongated deflector extending generally coextensively with said first and second members,

means supporting said deflector in fixed relation in said main passage and in spaced relation from the first portions of both of said first and second members,

said deflector including a first portion extending in the direction of flow through said main passage to divide said main passage into first and second passages and a second portion extending transversely from

both sides of said first deflector portion but terminating in spaced relationship from said first and second members, said second deflector portion spaced upstream from said flange portions to cause a change in flow direction upstream of said flange portions,

first and second blades,

and means connecting one of said blades to and for independent pivotal movement on each of said first and second members toward and away from engagement with said deflector at a point upstream of said second deflector portion to selectively interrupt flow through said first and second passages and open said first and second passages to flow.

6. A diffuser comprising, in combination,

first and second relatively spaced elongated members defining a main flow passage therebetween, said first and second members having a general T-shape in transverse cross section with the cross portions of each of said T-shaped members terminating in relative spaced relation to define an exit end for said main flow passage,

an elongated deflector extending generally coextensively with said first and second members,

means supporting said deflector in fixed relation in said main passage and in spaced relation from both of said first and second members,

said deflector including a first portion extending in the direction of flow through said main passage to divide said main passage into first and second passages and a second portion extending transversely from both sides of said first portion toward but terminating in spaced relationship from said first and second members, said second deflector portion spaced upstream of said cross portions of said first and second members to cause a change in flow direction upstream of said cross portions,

first and second blades,

and means connecting one of said blades to and for independent pivotal movement on each of said first and second members toward and away from engagement with said deflector at a point upstream of said second deflector portion to selectively interrupt flow through said first and second passages and open said first and second passages to flow.

7. The diffuser of claim 6 wherein said deflector terminates in spaced relation from at least one of the longitudinal ends of said diffuser and said blades extend generally the length of said diffuser and beyond the termination of said one deflector end to be accessible through said exit end for adjustment.

8. The diffuser of claim 6 wherein said transverse portions of said deflector are formed by a portion at the termination of said first deflector portion and having a tear-drop configuration in transverse cross section.

9. The diffuser of claim 6 wherein said cross portions of said first and second members are disposed in relative alignment and the extension of said transverse portion of said deflector overlies the space between said cross portions.

10. The diffuser of claim 6 including:

means defining openings through said first and second members at the point of connection of said first and second blades to said first and second members,

and wherein said blade connecting means comprises spring members engaging and biasing said blades into engagement with said first and second members and each including leg portions having a releasable snap connection in said openings in said first and second members.

11. The diffuser of claim 6 including

a support member connected to and extending between said first and second members,

said deflector including means defining an opening,

and a spring member having a releasable snap connection with said support member and extending

therefrom toward said diffuser exit end, said spring member including at least one tab extending angularly from said spring and away from said exit opening and engaged in said deflector opening.

12. A diffuser comprising, in combination,

first and second relatively spaced elongated members and a third elongated member positioned between and cooperating with said first and second members to define two main flow passages, said first, second and third members having a general T-shape in transverse cross section with the cross portions of each of said T-shaped members terminating in relative spaced relation to define the exit ends of said main flow passages to permit flow from said main passages,

first and second elongated deflectors,

means supporting said first and second deflectors in fixed relation in said first and second main passages and in spaced relation from and extending generally coextensively with said first, second and third members,

said deflectors each including a first portion extending in the direction of flow through said main passages to divide each of said main passages into first and second passages and a second portion extending transversely from both sides of each of said first portions toward but terminating in spaced relation from respective one of said first, second and third members, said second deflector portions spaced upstream from said cross portions of said first, second and third members to cause a change in flow direction upstream of said cross portions,

a plurality of blades,

and means connecting one of said blades to and for pivotal movement on the wall portions of said first, second and third members which face toward said first and second main passages and for pivotal movement toward and away from engagement with said first and second deflectors at a point upstream of said second defletcor portions to selectively interrupt flow through each of said first and second passages and open each of said first and second passages to flow.

13. The diffuser of claim 12 wherein said transverse portions of each of said deflectors are formed by a portion at the termination of said first deflector portions and having a tear-drop configuration in transverse cross section.

14. The diffuser of claim 12 wherein said cross portions of each of said first, second and third members are disposed in relative alignment and the extension of the transverse portions of each of said deflector members overlies the space between respective ones of said cross portions.

15. The diffuser of claim 12 including means defining openings through said first, second and third T-shaped members at the point of connection of said blades to said first, second and third members,

and wherein said blade connecting means comprises spring members engaging and biasing said blades into engagement with said first, second and third T-shaped members and each spring member includes leg portions having a releasable snap connection in said openings in said first, second and third members.

16. The diffuser of claim 12 including a support member connected to and extending between the said first and second T-shaped members,

said deflectors each including means defining openings therethrough,

and at least two spring members having a releasable snap connection with said support member and extending therefrom toward said diffuser exit end, said spring members each including at least one tab extending angularly from said spring and away from

said exit end and engaged in the opening in each of said deflectors.

17. The diffuser of claim 12 including a support member connected to and extending between said first and second T-shaped members,

and spring means operatively disposed between and providing a releasable snap connection between said deflectors and said support member.

18. The diffuser of claim 6 including a support member connected to and extending between said first and second members,

and spring means operatively disposed between and

providing a releasable snap connection between said deflector and said support member.

References Cited

UNITED STATES PATENTS

3,126,811	3/1964	Kennedy	98—40
3,185,067	5/1965	Batchelor	98—40
3,223,019	12/1965	Schuh	98—40
3,242,847	3/1966	Averill et al.	98—40

ROBERT A. O'LEARY, *Primary Examiner.*

MEYER PERLIN, *Examiner.*

W. E. WAYNER, *Assistant Examiner.*