March 14, 1967 A. W. SCHACH 3,308,744

STRIP TYPE AIR DISTRIBUTOR

Filed Dec. 7, 1964

3 Sheets-Sheet 1

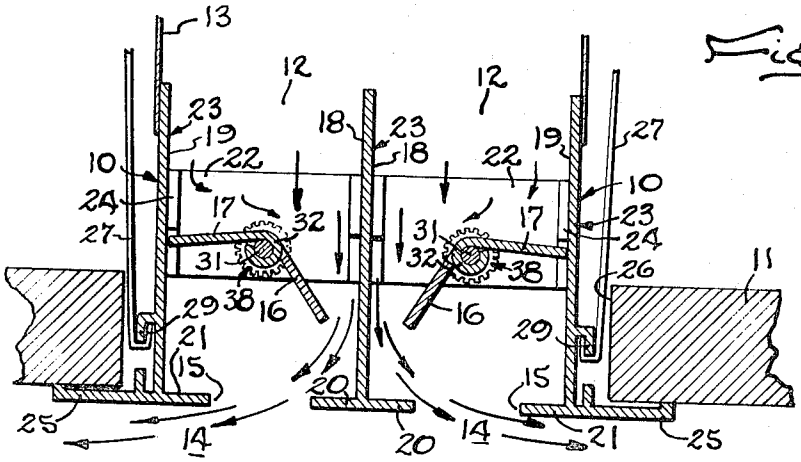

Fig. 1

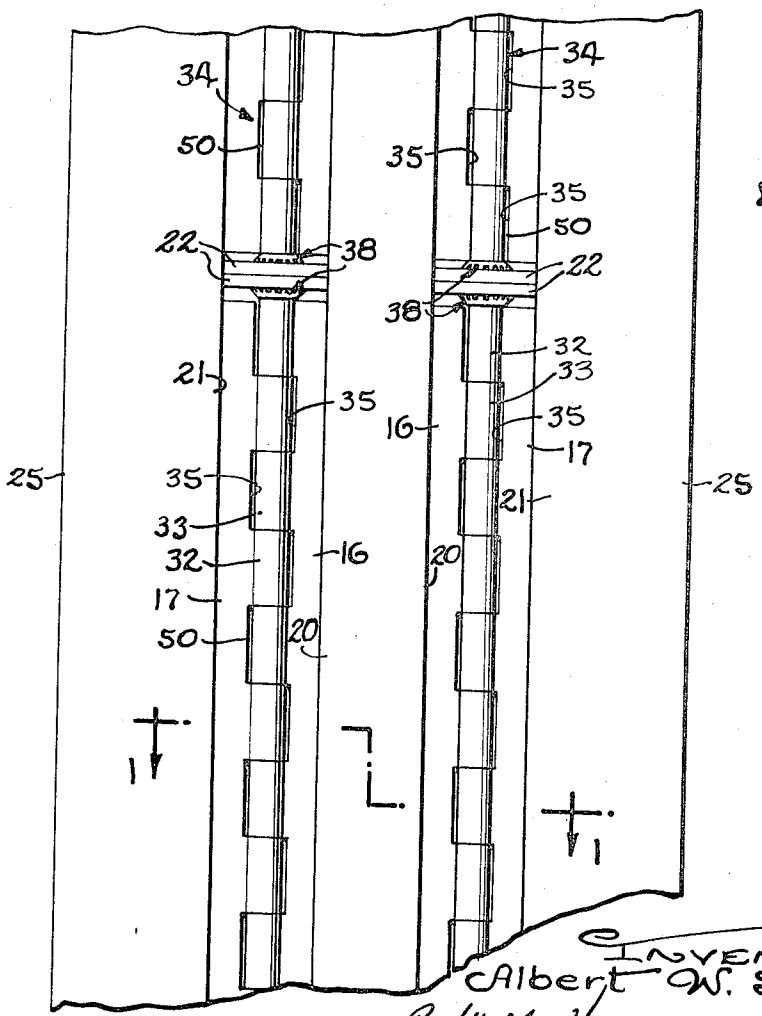

Fig. 2

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STRIP TYPE AIR DISTRIBUTOR

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Fig. 3

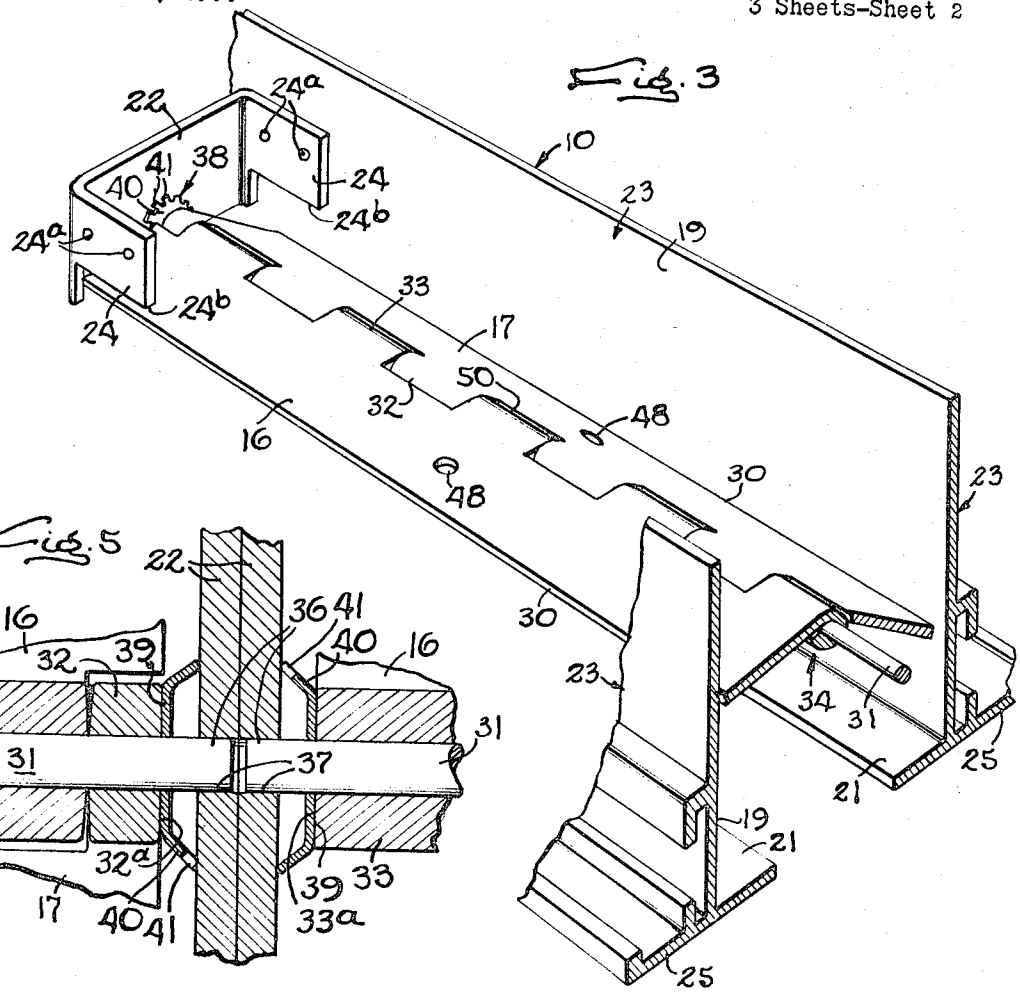
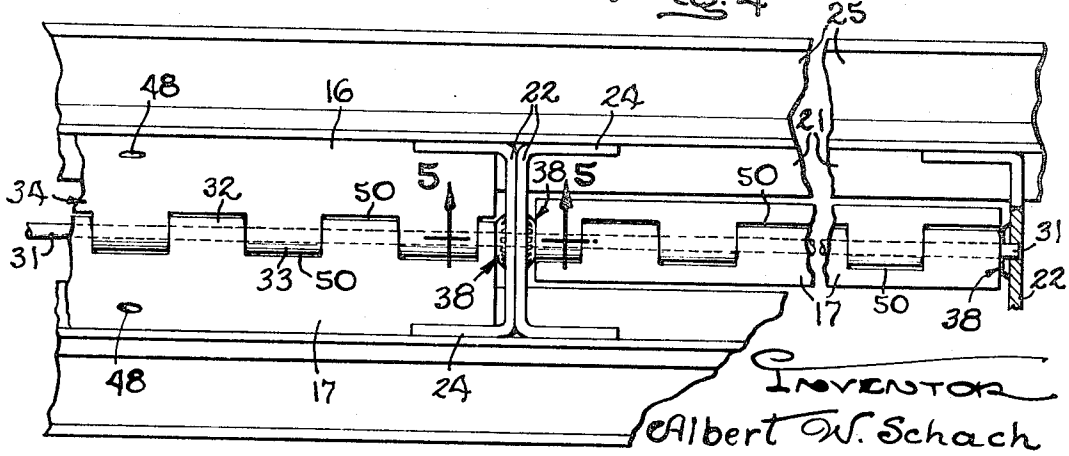


Fig. 5

Fig. 4



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ATTORNEY

March 14, 1967 A. W. SCHACH 3,308,744

STRIP TYPE AIR DISTRIBUTOR

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Fig. 6

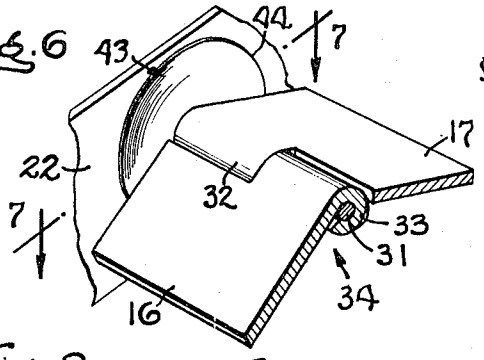


Fig. 7

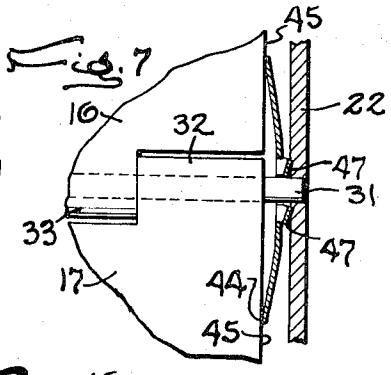


Fig. 8

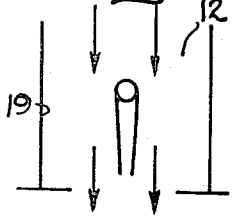


Fig. 12

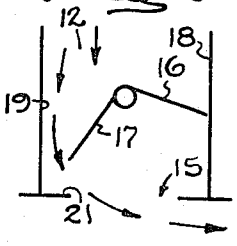


Fig. 16

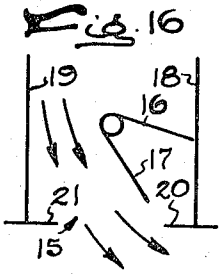


Fig. 20

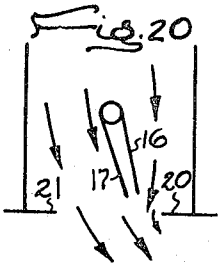


Fig. 9

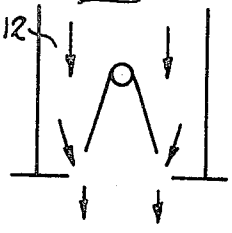


Fig. 13

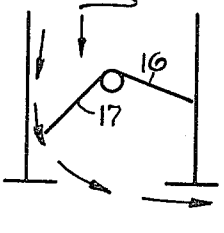


Fig. 17

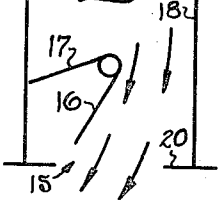


Fig. 21

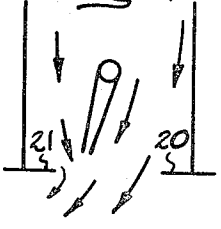


Fig. 10

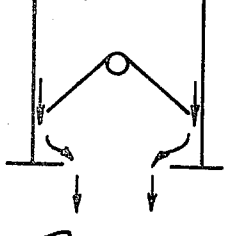


Fig. 14

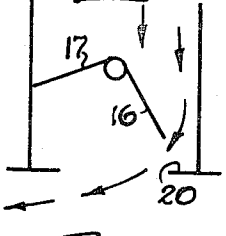


Fig. 18

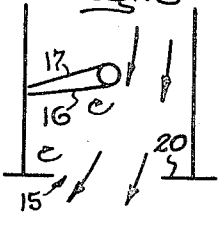


Fig. 22

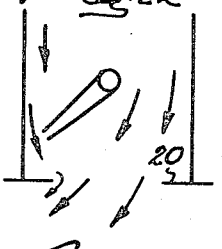


Fig. 11

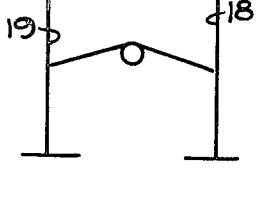


Fig. 15

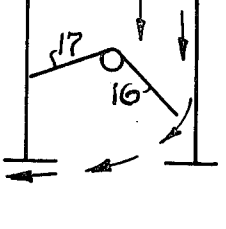


Fig. 19

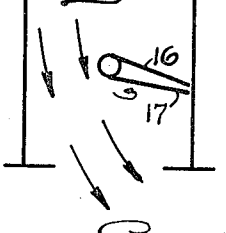
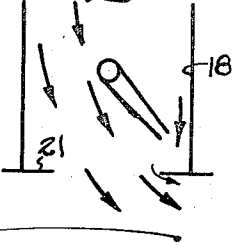


Fig. 23



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United States Patent Office 3,308,744
Patented Mar. 14, 1967

3,308,744

STRIP TYPE AIR DISTRIBUTOR

Albert W. Schach, Rockford, Ill., assignor to Barber-Colman Company, Rockford, Ill., a corporation of Illinois

Filed Dec. 7, 1964, Ser. No. 416,535
7 Claims. (Cl. 98—40)

This invention relates to air distributors of the so-called strip type in which air is delivered to a space to be conditioned through an elongated slot and the direction and pattern of the discharged air stream beyond the slot is determined by the position of one or more deflector vanes mounted within the distributor behind the slot.

The primary object of this invention is to provide a strip type air distributor which, as compared to prior constructions, may be manufactured at a substantially lower cost, which is substantially more versatile in the number of different air discharge patterns that may be produced, and which possesses a greater air delivery capacity for a given size.

Another object is to control the flow of air through a distributor of the above character by the joint action of two vanes selectively adjustable to provide alternatively for complete closure of the air passage, full opening or any degree of partial opening for straight outflow, and for a wide variety of different angles of discharge in either direction laterally of the discharge slot.

The invention also resides in the novel construction and mounting of the deflector vanes for easy access through the discharge slot in making and maintaining all of the different volume and pattern control adjustments.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

FIGURE 1 is a fragmentary section of a room wall equipped with an air distributor embodying the novel features of the present invention, the section being taken along the line 1—1 of FIG. 2.

FIG. 2 is a fragmentary face view of the distributor.

FIG. 3 is a fragmentary perspective view with certain parts broken away.

FIG. 4 is a fragmentary top view of the distributor shown in FIG. 1.

FIG. 5 is a fragmentary section taken along the line 5—5 of FIG. 4.

FIG. 6 is a fragmentary perspective view similar to FIG. 3 showing a modification.

FIG. 7 is a fragmentary section taken along the line 7—7 of FIG. 6.

FIGS. 8–23 are schematic views showing different positions of adjustment of the deflector vanes for controlling the air flow and the direction of discharge.

In the form shown in the drawings, the improved strip type air distributor comprises generally an elongated housing **10** adapted to be set into the ceiling **11** or other room wall and providing an elongated passage **12** through which conditioned air from a supply duct **13** into the inner edge of the housing is forced edgewise and discharged in a ribbon-like stream **14** through an elongated slot **15** in an exposed and relatively flat face which is substantially flush with the ceiling and presents a neat and artistic frontal appearance. In such distributors, the direction of discharge of the air stream outwardly beyond the slot is controlled by one or more deflector vanes, numbered **16**, **17** in the present instance, concealed within the housing and preferably accessible through the slot for manual adjustment. As shown in FIGS. 1 and 2, two of the housings **10** are arranged side by side where a diverging pattern of two air streams is desired. Also, several units may be assembled in end

to end relation as shown in FIG. 2 to provide an assembly of a desired overall length.

The housing defining each passage **12** and the outlet slot **15** preferably comprises two elongated members **23** of inverted T-shaped cross-section preferably formed as metal extrusions and providing opposed laterally spaced, parallel and flat internal side walls **18**, **19** terminating at right angular flanges **20**, **21** whose free edges are disposed in a common plane and define the slot **15** between them. The walls are rigidly joined at widely spaced points along their lengths by spacers in the form of relatively flat cross-bars **22** comprising sheet metal stampings having right angular end flanges **24** welded as indicated at **24a** or otherwise secured to the walls **18**, **19** and spaced inwardly from the flanges **20**, **21** about midway between the edges of these walls.

The other and outer flanges **25** of the T-shaped members **23** overlap the wall opening **26** in which the distributor unit is disposed. The unit is secured to the ceiling by suitable means such as wires **27** suspended from above the ceiling and hooked into T-slots defined by flanges **29** cast on the outer sides of the members **23**. Where a diverging air pattern is to be produced, three of the members **23** are arranged side by side as shown in FIG. 1 to provide two laterally spaced slots **15**, the intermediate member having opposite flat side walls **18** and oppositely projecting flanges **20** coacting with the flanges **21** to form the two slots.

In accordance with the present invention, the vanes **16**, **17** for each passage **12** are pivotally supported for more versatile adjustment than has been possible heretofore not only to increase the number of air discharge patterns obtainable as illustrated in FIGS. 6 and 10 to 20, but also to control the volumetric rate of air discharge without the necessity of using additional dampering vanes. To these ends, the vanes which are preferably flat, rectangular in shape and of equal widths and each is pivotally suspended along one longitudinal edge to swing about a common axis defined by an elongated rod or pintle **31** whose opposite ends are supported at points spaced along the passage **12**, preferably by two of the cross-bars **22**. The pintle is disposed midway between the walls **18** and **19** so that the vanes are swingable independently or together through substantially a half revolution and past the slot **15** and all the way across the passage **12**.

To minimize the overall cost of the distributor, the vanes are made as sheet metal stampings and formed along one edge with uniformly spaced and squared notches **35** separated by lugs in the form of curls **32** or **33** of circular cross-section. The curls on one vane quite closely interfit and aline with those on the other vane and loosely receive the pintle for turning of the vanes independently relative to each other and preferably relative to the pintle. A low cost piano type hinge **34** is thus formed. Opposite ends **36** of the pintle extend beyond the ends of the vanes and the ends **32a**, **33a** of the terminal curls and project into holes **37** at the centers of the adjacent ones of the cross-bars **22**.

The vanes are substantially narrower than the spacing of the hinge **34** inwardly from the slot **15**, and the widths are correlated with the horizontal width of the passage **12** so that the respective vanes may be swung outwardly far enough to bring their free edges **30** substantially into contact with the walls **18**, **19** (see FIG. 9) and thus fully close opposite side portions of the passage. The vane width may be made substantially half the width of the passage so that the vanes will be disposed substantially in a common plane when in the full closing positions in which case suitable stops (not shown) are provided to prevent further upwardly swinging of the vanes.

In the preferred form, the combined width of the two

vanes is somewhat greater than the width of the passage so that as each vane is swung outwardly and upwardly, its free edge **30** will, as shown in FIG. 11, come against the passage wall **18** or **19** short of the horizontal position, the flanges **24** of the supporting bars **22** being notched at **24b** (FIG. 3) to permit of such contact. The wall thus serves as a stop for limiting the upper or closed position of the vane. Manufacturing variations in the construction and mounting of the vanes are thus accommodated automatically and complete closing off of the passage achieved with the vanes positioned as shown in FIG. 9.

Means separate from the engagement between the vane curls **32** and **33** and the pintle **31** are provided for developing friction forces for maintaining each different position of adjustment of each of the vanes both during service operation of the distributor and during adjustment of the individual vanes. The forces may be developed in various ways preferably by one or more spring washers surrounding the pintle ends **36** and compressed between the end curls **32, 33** and the adjacent cross-bar **22**. Two such washers indicated at **38** are employed in the form shown in FIGS. 1 to 5 wherein the vanes are of such lengths that one of the end curls **32** and **33** of the different vanes form the opposite ends of the hinge **34**. Each washer **38** is dished to provide a relatively flat central portion **39** bearing against the exposed ends **32a, 33a** of the terminal curls. A coned outer edge portion **40** of the washer terminates in angularly spaced teeth **41** which bite into the cross-bars **22** and hold the washer against turning relative thereto. With the washer compressed axially, a substantial friction torque is developed and applied to the exposed end of the adjacent curl thus resisting turning of the vane integral therewith. While the spring pressure urges the curls of this vane axially and against the ends of one or more curls of the other vane, the friction forces thus developed are exerted between the adjacent curls at shorter radii as a result of the curl formation. Thus, the predominant friction torque exerted directly by the washers holds each vane effectually in its different positions of adjustment even during readjustment of the other vane supported by the common hinge.

FIGS. 6 and 7 show an alternative spring washer **43** which is preferred because only one serves to provide the holding forces for each vane of a pair of irrespective of which of the curls **32, 33** end up at the ends of the hinge **34** in forming a distributor of a selected length. As before, this washer is dished axially and compressed between one cross-bar **22** and the adjacent ends of the two vanes.

In this instance, the direction of dishing or coning is reversed and the washer is made substantially larger in diameter than the curls **32, 33** so that the outer peripheral edge **44** engages the ends **45** of the two vanes in all of the different angular positions thereof. If desired, the washer, which is composed of highly resilient material, may be square or of any other suitable peripheral shape. To hold the washer against turning relative to the cross-bar engaged thereby, angularly spaced teeth **47** are formed around the inner periphery and constructed to bite into the surface of the adjacent cross-bar.

With the washer thus constructed and compresed between one cross-bar and one end of the double vane assembly, the latter or end curl of the hinge thereof will be forced endwise against the other supporting cross-bar and separate friction forces will be exerted on the end **45** of each of the two vanes. Since each friction torque is applied to the vane at a substantial radius, a correspondingly high resistance will be offered to turning of either of the two vanes which are thus held independently and effectually in any selected position of adjustment and by a single washer of simple and inexpensive construction.

It will be observed that the free edges of both of the vanes are always conveniently accessible through the slot **15** and may be adjusted easily with the aid of a suitable tool inserted through the slot. Such adjustment is facilitated through the provision of one or more holes **48** in each vane preferably near the free edge thereof.

The vanes constructed and arranged as above described, may be disposed in the different relations with respect to each other, to the walls **18, 19** and to the flanges **20, 21** in order to control the volume and direction of the air discharge in the numerous ways illustrated in FIGS. 8 to 23. To provide for a straight outward discharge but with different flow rates, the vanes are disposed symmetrically but at different angles relative to the central plane of the slot and hinge. With the vanes swung together and nearly parallel as shown in FIG. 8, the passage **12** is fully open for a maximum rate of flow. Lesser flow rates while maintaining the straight outward discharge are obtained by swinging the vanes apart substantially equal distances as illustrated in FIGS. 9 and 10. By further outward swinging until the free edges of both vanes engage the walls **18** and **19** as shown in FIG. 11, the passage is fully closed.

Maximum deflection of the air stream **14** and discharge thereof substantially horizontally and along the ceiling **11** is achieved when the vanes are disposed in the positions shown in FIGS. 12 and 14. Thus, for maximum deflection to the right (FIG. 12) the vane **16** is swung against the wall **18** closing the right side of the passage **12** while the vane **17** is inclined outwardly and downwardly and pointed substantially to the corner between the wall **19** and the flange **21**. The air thus deflected to the left in impinging against the vane and flowing along the left wall **19**, encounters the diagonally extending surface of the vane **17** and is deflected thereby outwardly against the wall and toward the flange. The latter deflects the stream laterally and to the right, then at a small angle diagonally through the slot **15** and substantially horizontally along the ceiling indicated by the arrows in FIG. 12. A maximum flow for such a horizontal pattern is achieved with the vane **17** substantially intersecting the corner. For a lesser rate of flow but still with a horizontal discharge, the vane **17** is swung upwardly from the FIG. 12 position and to that shown in FIG. 13 thus narrowing the width of the passage between the wall **19** and the free edge of the vane.

A horizontal discharge of the stream in the opposite direction is achieved by reversing the positions of the vanes as shown in FIGS. 14 and 15, the vane **16** being swung upwardly into contact with the wall **19** while the vane **17** is extended downwardly and diagonally toward the corner above the flange **20**. Different rates of discharge are achieved by varying the angle of the vane **16** as shown in FIGS. 14 and 15.

Where a lesser deflection of the discharged air is desired and to the right, the vane **16** is closed against wall **18** while the vane **17** is swung counter-clockwise from the FIG. 12 position and across the slot **15** so as to point substantially toward the free edge of the flange **20** as shown in FIG. 16. Some of the air flowing along the wall **19** encounters the flange **21** and bends the entire stream toward the slot. But the vane **16** in this position guides the flow of the opposite side of the stream thus avoiding turbulence in the space between the vanes **16** and **17**. The deflection by the action of the flange **21** is thus controlled and substantial outward bending of the stream as discharged from the slot is achieved. Similar flow and deflection but the left is produced when the vanes are positioned as shown in FIG. 17.

Deflection to the left similar to but less than that of FIG. 17 is achieved as shown in FIG. 18 by swinging the vane **16** outwardly and upwardly beyond the slot **15** and substantially to the under side of the vane. As a result, some turbulence develops within the air passage below the vane **16** and above the flange **21** and its effect is to reduce somewhat the effect of the flange **20** in bending the discharged air stream to the left. The same angle of

discharge but to the right is produced when the vanes are positioned as shown in FIG. 19.

By adjusting the vanes to the positions shown in FIGS. 20 to 23, a deflection about the same as in FIGS. 16 and 19 is achieved but with a substantially greater rate of flow through the slot. In each of these instances, the vanes **16** and **17** are swung together substantially in face to face contact and then swung laterally to one side edge or the other of the slot depending on the angle and volume of discharge desired. Maximum volume but less deflection to the right and left is achieved with the vanes pointing to the free edges of the flanges **20** and **21** as shown in FIGS. 20 and 21. Then, the maximum flow through the fully open side of the passage effects a lateral bending beyond the slot of the stream of lesser volume flowing along the other wall and past the free edges of the inclined vanes. In a similar way, a somewhat greater deflection is produced by swinging the two vanes as a unit farther outwardly and toward the passage wall and above the flange as shown in FIGS. 22 and 23. Thus, the volume through this side of the passage and around the vane edges is reduced to such an extent that its bending effect is small as compared to that produced by the flange **20** (FIG. 22) or **21** (FIG. 23) on the fully open side of the passage.

With a piano type hinge constructed as above described, narrow clearance spaces **50** (FIGS. 3 and 4) are inherently formed between the opposed surfaces of the interfitting curls **32, 33**. These spaces are left open in the present instance and used to advantage in allowing for a limited flow of air from the inlet of the passage **12** downstream, through these spaces, and relieve the negative pressures which may tend to develop in any pockets formed by the side walls and the vanes **16, 17** on the downstream sides of the latter. Such a pocket, for example, is formed in the arrangement shown in FIG. 1 between the two vanes, the wall **19** and the flange **21**. A negative pressure developing in such area may influence and prevent the proper and intended flow pattern from being achieved.

It will be apparent from the foregoing that the improved construction, mounting and versatility of adjustment of the two vanes **16, 17** not only makes for economical manufacture but also greatly enlarges the number of discharge patterns obtainable as compared to prior constructions. In addition, all of the adjustments may be made after installation of the distributor by easy access to the vanes through the slot. Also, the vanes perform the additional functions of the second set of dampers which it has been necessary to provide for regulating the volume of the flow in prior strip type diffusers. Since the surfaces of the walls **18, 19** and the dampers **16, 17** are smooth and uninterrupted, the improved diffuser is quieter in operation and there is a lesser drop in the pressure of the air in flowing through the diffuser. Optimum flow capacity is thus achieved for a given length of the diffuser.

I claim as my invention:

1. An air distributor having, in combination, laterally spaced and substantially parallel sidewalls defining the sides of an air passage having an elongated outlet end, flanges extending inwardly from said walls at said outlet end substantially in a common plane and perpendicular to the walls with the adjacent edges of said flanges spaced apart to define an elongated air discharge slot generally centered in said outlet end, a pintle disposed within said passage generally parallel to said slot and overlying the latter midway between said walls, supports spaced apart along said passage longitudinally of said slot and secured to said walls with the opposite ends of said pintle mounted on said supports, two elongated vanes each having a longitudinal edge extending along said pintle and ends close to the respective supports, and means hingedly connecting each of said longitudinal edges to said pintle, said vanes being swingable about the pintle from blocking positions substantially closing said passage into side-by-side positions extending downstream from the pintle toward said slot, and being swingable both together and independently about said pintle into different selected angular positions to vary the angle of discharge of air through said slot.

2. An air distributor as defined in claim **1** in which said connecting means comprise spaced lugs on said longitudinal edges curled around said pin and interfitting with the lugs on the other vane to form a piano type hinge.

3. An air distributor having, in combination, laterally spaced and substantially parallel sidewalls defining the sides of an air passage having an elongated outlet end, flanges extending inwardly from said walls at said outlet end substantially in a common plane and perpendicular to the walls with the adjacent edges of said flanges spaced apart to define an elongated air discharge slot generally centered in said outlet end, a pintle disposed within said passage generally parallel to said slot and overlying the latter midway between said walls, supports spaced apart along said passage longitudinally of said slot and secured to said walls with the opposite ends of said pintle mounted on said supports, two elongated vanes each having a longitudinal edge extending along said pintle ends close to the respective supports, means hingedly connecting each of said longitudinal edges to said pintle, said vanes being swingable about the pintle from blocking positions substantially closing said passage into side-by-side positions extending downstream from the pintle toward said slot, and being swingable both together and independently about said pintle into different selected angular positions to vary the angle of discharge of air through said slot, and automatically acting means for exerting a separate force to each of said vanes and maintaining each position of adjustment of each vane during swinging adjustment of the other vane.

4. An air distributor as defined in claim **3** in which said connecting means comprise spaced lugs on said longitudinal edges curled around said pin and interfitting with the lugs on the other vane to form a piano type hinge.

5. An air distributor as defined in claim **4** in which the parts of the hinge are spaced to allow for a limited flow of air through the hinge to relieve negative pressure developing in said passage downstream from the vanes.

6. An air distributor as defined in claim **3** in which said automatically acting means includes a dished washer surrounding one end of said pintle and compressed axially between one of said supports and the adjacent end of one of the vanes, and means for holding the washer against turning relative to the support engaged thereby.

7. An air distributor as defined in claim **6** in which the means holding the washer against turning relative to the adjacent cross-bar support is located at the inner periphery of the washer.

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