

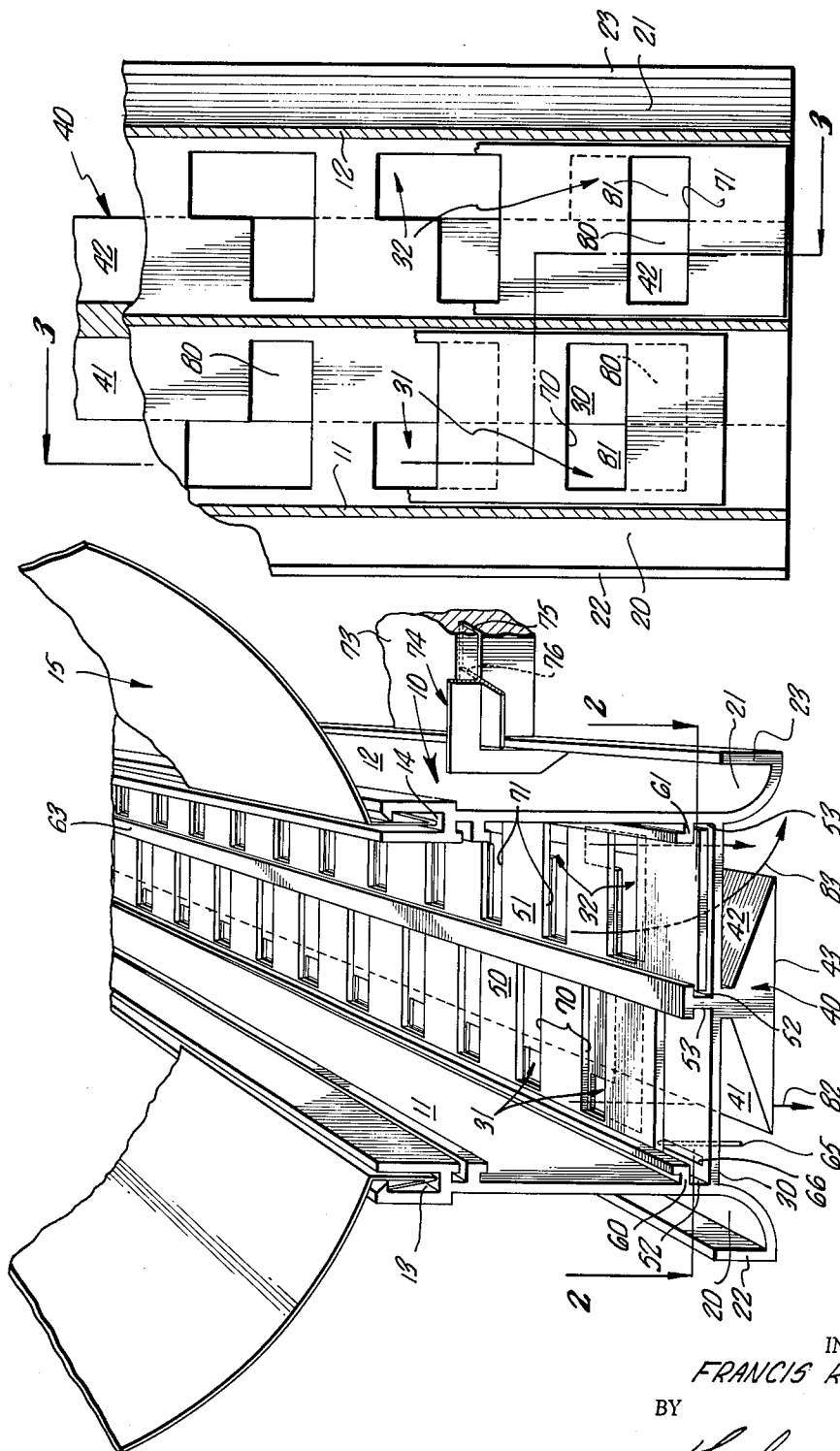
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F. R. SCHUH
LINEAL AIR DIFFUSER

3,223,019

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

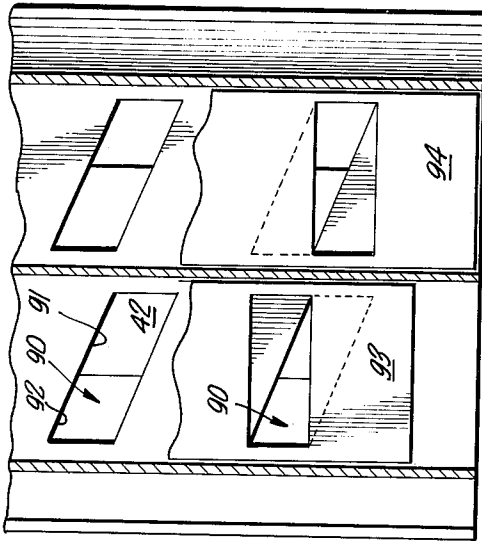


FIG. 5

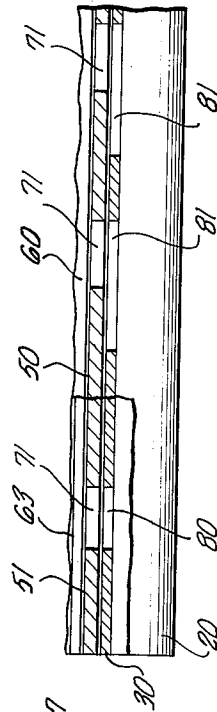


FIG. 3

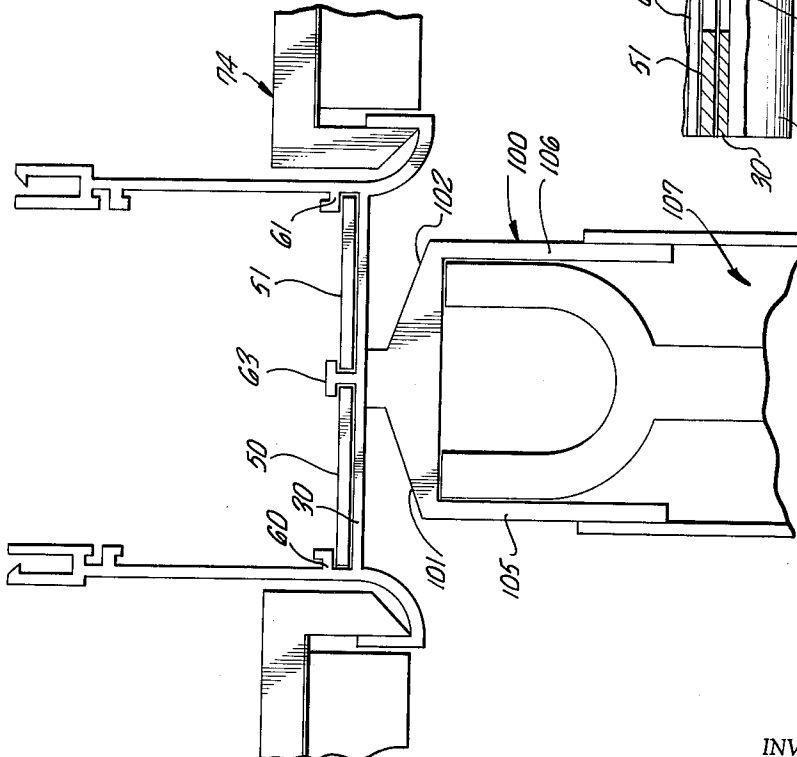


FIG. 4

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LINEAL AIR DIFFUSER

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The present invention relates to an improved air distribution system and in particular a system wherein both the volume and direction of air flow may be selectively varied.

Air distribution systems constructed according to the present invention provide a ceiling mounted air diffusion wall through which the volume, velocity and direction of air flow may be modified to satisfy the particular air requirements of the room occupants. A particular feature of the present invention is that a room may be divided into a plurality of zones in each of which the air volume, velocity and direction may be tailored to the demands of the person occupying the zone. By way of example, an executive and his secretary having desks in the same room may be individually supplied totally different cooling or heating flows.

Another object of the present invention is to provide an air distribution system which assures delivery of equal volumes of air from the source at the main duct, the end of the run, and all points in between.

Still another object of the invention is to provide an air distribution system which may be very easily adjusted to change both the velocity and direction of the effluent air stream.

Other and further objects, features, and advantages of the invention will become apparent as the description proceeds.

Briefly, in accordance with a preferred form of the present invention, an air distribution system comprises an elongated air supply duct having one wall serving as an air diffuser. An air deflector having a tapered upper surface is disposed adjacent this air diffusion wall. A plurality of spaced openings in the diffusion wall are aligned with the air deflector and an additional plurality of spaced openings are disposed outwardly of the deflector. A control or damper plate is slidably engaged on the diffusion wall and includes a plurality of openings therein arranged to register with the outwardly disposed openings of the diffusion wall when the plate is in a first position and to register with the aligned openings when the plate is slid to a second position along the diffusion wall.

Translation of the control plate effects a change in the volume, velocity and direction of the air flowing through the diffusing wall. In the first position described above, the air is out of the supply duct onto the tapered air deflector, thereby causing the effluent air stream to be deflected in a substantially horizontal direction. In the second position, the air flows outwardly of the air deflector; accordingly, the undeflected effluent air stream is in a substantially vertical direction. Positions of the control plate intermediate these first and second positions provide varying quantities of effluent air in the selected direction; also, a combination of both horizontal and vertical air flow components may be selected.

Movable control plates are preferably provided for each few feet of supply duct so that different zones of a given floor space may be supplied different volumes of air and different air flow directions. Also, a pair of dampers are preferably located side by side to provide distinct air distribution control zones on opposite sides of the supply duct.

A more thorough understanding of the invention may be obtained from the following detailed description taken

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in connection with the accompanying drawings in which:

FIG. 1 is a fragmented perspective view of an air distribution system constructed in accordance with this invention;

FIG. 2 is a sectional view taken along line 2-2 of FIG. 1;

FIG. 3 is a sectional view taken along line 3-3 of FIG. 2;

FIG. 4 is an end elevation view of an alternative embodiment of the invention wherein a partition wall is installed parallel to and directly beneath the air diffuser wall; and

FIG. 5 is a plan view illustrating an alternative diffuser wall structure.

Referring now to FIG. 1, the air distribution system comprises an elongated channel 10 serving as a supply duct and having oppositely disposed elongated side walls 11, 12. The upper side wall portions terminate in respective elongated grooves 13, 14 adapted to engage respective ends of a generally cylindrical plenum chamber or duct means 15. This plenum chamber is supplied with air and a positive plenum pressure maintained therewithin. The lower side wall portions are outwardly curved at 20, 21 and terminate in respective upwardly directed flanges 22, 23. As described below, these flanges are adapted for supporting ceiling panels having ends proximate the air distribution system.

The air duct 10 further includes a bottom diffusion wall 30 having a first set of spaced openings 31 and a second set of spaced openings 32.

An air deflector member 40 is affixed along the central longitudinal axis of the diffusion wall. This member preferably has the general cross-sectional configuration of an isosceles triangle and includes a pair of tapered upper surfaces 41, 42 and a substantially planar underside surface 43 aligned with the bottom edges of the walls 11, 12. The vertex of the triangular shaped deflector 40 is integral with the central longitudinal axis of the diffusion wall 30 so that the surfaces 41, 42 taper downwardly from this axis and divert streams of air to opposite sides thereof.

A pair of dampers or control plates 50, 51 slidably engage on the upper surface of the diffusion wall 30 and are retained laterally in respective grooves 52, 53 and 54, 55. These plates have portions cut away in FIG. 2 to expose the upper surface of the diffusion wall. Grooves 52, 55 are provided by flanges 60, 61 which protrude inwardly from the side walls 11, 12 and a T-shaped flange member 63 retained along the center longitudinal axis of the diffusion wall 30. Control plates 50, 51 are regulated from below the ceiling and adjusted at any time by means of a control rod 65 extending downwardly from the damper through an elongated slot 66 formed in the diffusion wall 30.

Each of the control plates includes a plurality of apertures adapted to cooperate with one set of apertures of the diffusion wall 30. Thus, control plate 50 includes apertures 70 and control plate 51 includes apertures 71.

Channel 10 and plenum chamber 15 generally form a part of a ceiling suspension system wherein these members are mounted at the ceiling and in turn support ceiling panels 73 along the respective edges of the channel 10. As shown in FIG. 1, these ceiling panels are supported by a split spline 74 having a horizontal flange 75 concealed in the kerf 76 of the panel 73. These splines engage the upwardly directed flanges 22, 23 formed integral the channel 30. Convenient accessibility to the plenum chamber is thus provided by simply pushing up on any particular panel member.

Control over the volume and direction of air flow is obtained in the following manner: Referring now to FIG. 2, each set of apertures 31, 32 in the diffusion plate in-

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cludes an opening portion 80 aligned with the deflector member 40 and another portion 81 outwardly disposed of this deflector member. In the preferred embodiment shown, the apertures 31, 32 are generally L-shaped wherein the horizontal legs are outwardly disposed and the vertical legs substantially aligned with respect to the rectangular apertures 70, 71 of each control plate. In a first position shown for aperture group 31 of FIG. 2, the aligned openings 80 are completely closed. In this position, the air flowing through the diffusion plate avoids the air deflector 40 and accordingly is directed downwardly in a vertical direction to the floor (arrow 82 of FIG. 1).

In a second position shown for aperture group 32 of FIG. 2, the aligned openings are completely uncovered. The air flowing through opening portions 80 strikes and is deflected by the tapered surface 42 of the deflector, resulting in a horizontal air flow (arrow 83 of FIG. 1). Although a portion of the outwardly disposed opening 81 is also uncovered in the embodiment of FIGS. 1 and 2, in this second position the substantially greater volume of air diverted by the deflector also tends to divert the air flow through the portions 81 so that the air flow is substantially in a horizontal or near horizontal direction.

In a third position (not shown), both the aligned and outwardly disposed aperture portions 80, 81 are covered to completely block air flow through that portion of the diffuser wall.

In positions intermediate these first, second and third directions, both the direction and volume of air may be varied. Thus, the openings 80, 81 are suitably positioned with respect to the deflector plate so that both horizontal and vertical air flow components are obtained. Similarly, the openings 80 and 81 may be partially closed to selectively vary the volume of vertical or horizontally directed air flow.

An alternative aperture configuration for the diffusion wall is illustrated in FIG. 5 wherein these apertures comprise a plurality of spaced parallelograms 90 having portions 91 in alignment with the deflector plate 42 and portions 92 outwardly disposed from the deflector plate. The control plates 93, 94 (having portions cut away to expose the upper surface of the diffusion wall) contain a plurality of rectangular apertures arranged to register with the aligned portions 91 in one position (illustrated for the control plate 94) and to register with the outwardly disposed portions 92 in another position (illustrated for the control plate 93). Accordingly, the air may be directed through either the outwardly disposed portions of the apertures 92 or the inwardly disposed, aligned portions 91 in the manner described hereinabove.

In the embodiments of the invention described hereinabove, the apertures having portions aligned with and outwardly disposed of the deflector plate have been incorporated in the diffuser wall. Additional embodiments of the invention (not shown) incorporate these apertures in the control plate; the diffuser wall having spaced openings which register with first one and then the other opening portions as the control plate is translated upon the diffuser wall.

Air distribution systems constructed according to the present invention can be installed without regard to room partitions. When the partitions must be installed directly beneath and in the same direction as the diffuser wall, an alternative embodiment shown in FIG. 4 is used. In this embodiment, the triangular deflector plate 40 is not used; instead, a partition bracket 100 is affixed along the center longitudinal axis of the diffusion wall. This bracket includes a pair of tapered upper surfaces 101, 102 which function in the same manner as the analogous surfaces of the deflector plate, deflecting air into respectively opposite sides of the partition wall. In addition, depending side walls 105, 106 engage and support the partition wall 107.

This invention is particularly adapted for dividing any given area into a number of air distribution control zones.

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In each zone, both the heating and cooling can be individually tailored to suit the demands of the occupants of the particular zone. For accomplishing this end, separate control plates are provided for each few feet of diffuser wall 30. By way of specific example, it has been found desirable to incorporate a control plate for each four lineal feet of diffusion wall, thus providing individual air distribution control zones for each sixteen square feet of floor space. In each control zone, the air flow may be directed either vertically or in a substantially horizontal direction. Moreover, as described above, the air volume may be individually controlled in each such zone.

A further advantage derived from providing a given air distribution system with a plurality of individual control plates is that by simply graduating the openings of the dampers by appropriately setting each damper, an equal distribution of air can be provided from all portions of the system, from the source at the main duct to the end of the run.

Also, each damper plate of a given system may be individually adjusted to provide different flow resistances through the diffuser wall and thereby obtain different velocities of the respective effluent air streams. In a representative system the flow velocity can be doubled.

These relatively high velocity air streams moving vertically downwardly as described above are particularly effective in distributing heated air to where it is needed.

Although exemplary embodiments of the invention have been disclosed and discussed, it will be understood that other applications of the invention are possible and the embodiments and methods disclosed may be subjected to various changes, modifications and substitutions without necessarily departing from the spirit of the invention.

I claim:

1. An air distribution system wherein both the volume and direction of air flow may be selectively varied, said system comprising

an air supply duct which includes

opposite disposed elongated side walls whose lower portions are outwardly curved and terminate in an upwardly directed flange and

a bottom air diffuser wall joined to said side walls proximate where said lower curved portions commence;

an air deflector member disposed adjacent said diffuser wall, said deflector member being somewhat narrower than said diffusion wall and having a substantially planar bottom surface aligned with the bottom edges of said side walls and a tapered upper surface; and

a damper control plate slidably engaged on said diffuser wall,

said diffuser wall and said damper control plate each having a plurality of openings therein, first ones of said openings being aligned with said air deflector member, second ones of said openings being disposed outwardly of said air deflector member, and third ones of said openings cooperating with said first and second openings so that (1) said third openings register with said first openings in one position of said control plate, (2) said third openings register with said second openings in another position of said control plate, and (3) said third openings do not register with either said first and second openings in still another position of said control plate along the diffuser wall.

2. In the air distribution system defined in claim 1, wherein two damper control plates are mounted on said diffuser wall for controlling the flow of air on opposite sides of the central longitudinal axis of said diffuser wall.

3. The air distribution system defined in claim 2 wherein

said air deflector member includes a pair of tapered surfaces located on opposite sides of the longitudinal

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center axis of said diffuser wall, said surfaces being tapered downwardly as they extend from said center axis.

4. The air distribution system defined in claim 3 wherein

said air deflector member includes means for engaging a room partition, said tapered edges being adapted for deflecting air into respectively opposite sides of said partition wall.

5. An air distribution device for selectively controlling both the volume and direction of flow of air comprising an air supply means provided with an apertured wall element, an air deflector means associated with said apertured wall element, an apertured damper control means associated with and movably mounted relative to said apertured wall element, said apertured damper control means and apertured wall element each having a plurality of openings therein, first ones of said openings being aligned with said air deflector means, second ones of said openings being offset relative to said air deflector means, and third ones of said openings cooperating with said first and second openings so that (1) said third openings register with said first openings in one position of said damper control means to provide a flow of air against said air deflector means and thence in a predetermined direction away from said air deflector means and (2) said third openings register with said second openings in another position of said damper control means to provide a flow of air in a second direction which is angularly disposed relative to said first mentioned direction.

6. The air distribution device defined in claim 5 wherein each of said first and second openings comprise respective segments of a generally L-shaped opening.

7. The air distribution device defined in claim 5 wherein each of said first and second openings comprise portions of a parallelogram.

8. The air distribution device defined in claim 5 wherein each of said third openings has a generally rectangular configuration.

9. The air distribution device defined in claim 5 wherein the central portion of said deflector means is disposed proximate the center axis of said apertured wall element so that streams of air can be diverted to opposite sides of said deflector means.

10. An air distribution device for selectively controlling the volume and direction of flow of air comprising air channel means provided with an air diffusion wall, an air deflector disposed adjacent the air diffusion wall, said air diffusion wall having a plurality of spaced openings therein, said openings having portions thereof aligned with said deflector and other portions thereof offset relative to the deflector, and a control plate movably mounted for translatable movement relative said diffusion wall,

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said plate having a plurality of openings therein which have a different configuration from the openings in the diffusion air wall, said control plate and diffusion wall openings being so arranged relative to each other and said air deflector whereby when said plate is in one position at least portions of the openings in said plate and wall are aligned with the air deflector so that air can be directed against said deflector and then diverted in a predetermined direction away from the deflector and whereby when said plate is in another position air can by-pass said deflector and flow in a direction angularly disposed relative to said first direction.

11. The air distribution device defined in claim 10 including means on the air channel means for supporting ceiling panels.

12. The air distribution device defined in claim 10 including a plenum chamber disposed adjacent to and communicating with said air channel means.

13. An air diffusion device comprising an air diffusion wall means, an air deflector disposed adjacent the air diffusion wall means, the diffusion wall means having openings therein, said openings having certain portions thereof aligned with the deflector and other portions thereof offset relative to said deflector and a control plate cooperating with and movably mounted relative to said diffusion wall means, said control plate having a plurality of openings therein which are of a different configuration from the openings in the air diffusion wall means, said control plate and diffusion wall openings being so arranged relative to each other and said air deflector whereby when said plate is in one position at least portions of the openings in said plate and diffuser wall means are aligned with the air deflector so that air can be directed against said deflector and then diverted in a predetermined direction away from the deflector and whereby when said plate is in another position air can by-pass said deflector and flow in a direction angularly disposed relative to said first direction.

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