

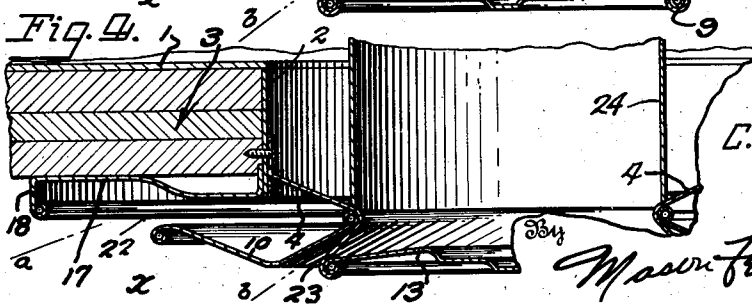
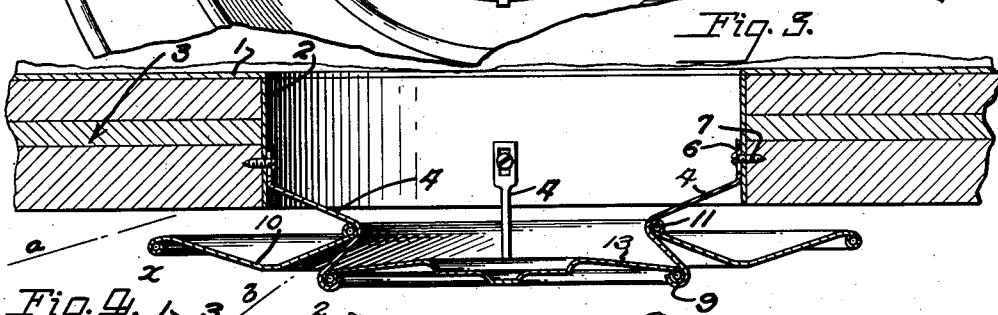
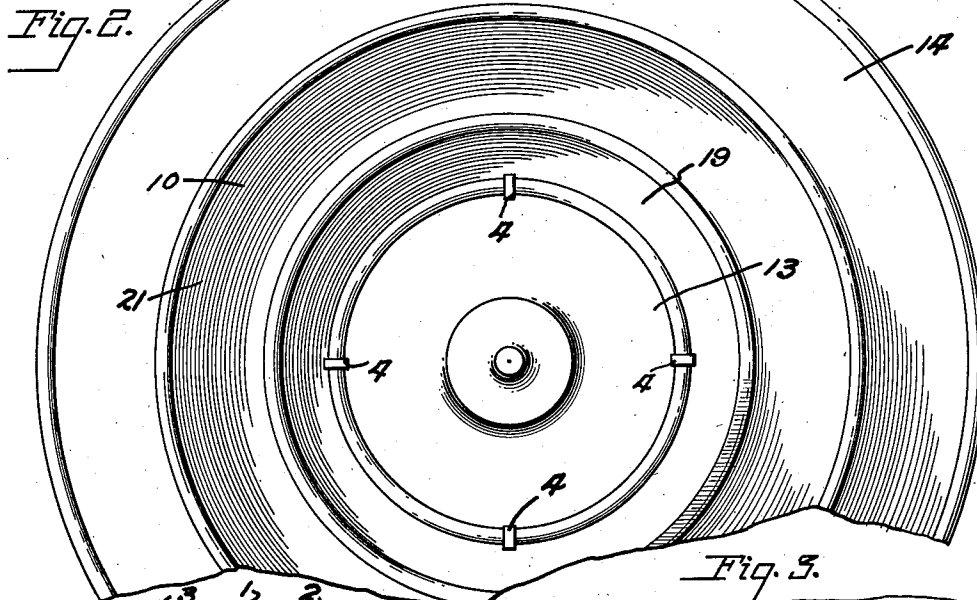
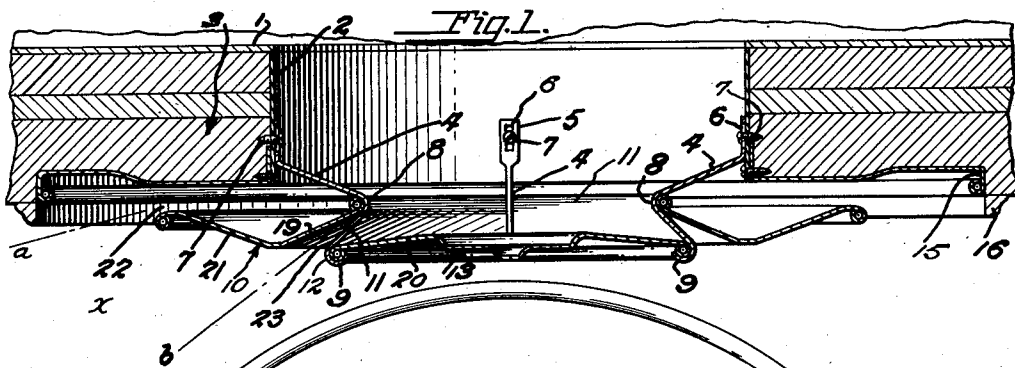
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# DIFFUSER FOR THE OUTLETS OF AIR DUCTS

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## UNITED STATES PATENT OFFICE

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## DIFFUSER FOR THE OUTLETS OF AIR DUCTS

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This invention relates to diffusers particularly designed for the room outlets of ceiling ducts in air conditioning systems.

The general object of the invention is to provide a diffuser which shall answer the problems that attend the admission of conditioned air to rooms by way of outlets from overhead conduits. Some of these problems are as follows:

1. When there are two or more hot or cold air outlets from a duct, it is generally necessary to employ some means to regulate the amount of air discharged from each outlet, to ensure equal or desired proportionate distribution of the air. It is, therefore, becoming more generally recognized that some form of damper is required behind ceiling outlets, in order to properly regulate the quantity of air discharged from the plural outlets of a duct system to proportionately distribute the conditioned air.

However, in order to quickly mix the incoming hot or cold air with the room air, turbulence is necessary, and the amount of turbulence varies directly with the velocity of the introduced air. Consequently, when mere dampers are relied upon to effect equal or proportionate distribution of the air to the several outlets, the one which is the more throttled by the damper will have the velocity of the incoming air reduced. This change in velocity at the outlet may be sufficient to prevent proper turbulence and interfere with the mixing of the incoming air with the room air to an extent sufficient to cause drafts and cold spots in the space served.

2. The volume of the conditioned air admitted in a unit of time by way of the duct outlets is another important factor in the proper temperature equalization in a given space. This is also a factor of the velocity at which the air enters the room or space.

3. The required volume of introduced conditioned air, to give the desired freshness or temperature to the room, depends upon many factors, such as the temperature differential between the conditioned air and the room temperature, the occupancy of the room, etc.; so that it is readily seen that there are many chances of error in sizing a ceiling diffuser, to produce the desired condition of the room air, unless the diffuser is of such construction that the velocity as well as the volume of the conditioned air issuing from an outlet can be adjustably increased or decreased after the diffuser is installed.

With the solution of the above and other problems in view, the present invention has for its more specific objects:

(a) To provide a ceiling diffuser in connection with the duct outlet, so constructed that the velocity of the introduced conditioned air shall be at a maximum at the outlet or outlets of the diffuser.

(b) To provide an adjustable diffuser by means of which the diffuser can be set, after installation, to increase or decrease the velocity or/and volume of the introduced air, to obtain the desired condition of the room air;

(c) To provide a diffuser in which the velocity of the discharged air can be increased or decreased, when a damper is used in the outlet behind the diffuser;

(d) To provide a diffuser in which the conditioned air is introduced with relatively high velocity in divergent curtains which create a low pressure area therebetween, for the purpose of introducing turbulence in said area which is essential to the rapid mixing of the introduced air with the air of the room.

Another object of the invention is the provision of a diffuser including a ceiling plate having a surrounding flange against which the introduced air or a portion thereof impinges, nullifying its velocity, or a part thereof, to prevent excessive air movement or draft, and deflecting the air downward to any desired extent according to the depth of the flange or the diameter of the ceiling plate.

Still another object of the invention is the provision of a diffuser having annular outlets or nozzles, one of which may be adjusted in width so as to vary the velocity and volume of the air discharged therefrom.

A further object of the invention is to provide a diffuser of the type described which can be shipped knocked down, and assembled on the job.

Other objects of the invention will appear as the following description of a preferred and practical embodiment thereof proceeds.

In the drawing which accompanies and forms a part of the following specification, and throughout the several figures of which the same characters of reference have been employed to designate identical parts:

Figure 1 is a vertical section through a diffuser, embodying the principles of the present invention and the adjacent portions of the conduit of the outlet wall and ceiling;

Figure 2 is a plan view, part being broken away;

Figure 3 is a view similar to that of Figure 1,

showing the diffuser installed without the employment of the ceiling plate; and

Figure 4 is a vertical section, part being broken away, of a modified form of the invention.

Referring now in detail to the several figures, the numeral 1 represents the wall of a conduit such as is employed for the conveyance of warm or cold air, and which opens into a room space by means of outlets, the wall of one of said outlets being indicated by the reference character 2. The ceiling structure and which is not important to the present invention, is represented in general by the reference character 3; the conduit 1 being shown lying in a horizontal position above the ceiling, and the outlets penetrating the ceiling.

The diffuser comprises a plurality of hangers 4. The number of these is variable, three or four being suggested as the preferable number, the hangers being arranged at equal angular intervals about the circumference of the outlet. The hangers consist of resilient metal rods or strips, the upper ends 5 of which are provided with longitudinal slots 6, for receiving a screw 7, which is screwed through the side wall of the outlet and into the ceiling structure, securing the hangers in place.

The hangers are bent inwardly and then outwardly so as, taken together, to form a spider structure having a narrow neck at the angles 8. The lower or free ends of the hangers are preferably bent up to form a hook or bead 9, preferably of circular cross-section.

The diffuser includes a baffle plate 10 which, as shown, is of annular shape, although the exact shape is immaterial to the invention. The baffle plate 10 is formed with a large opening 11 forming an air passage. This opening is of such a size as to fit around the neck of the spider constituted by the several hangers. By virtue of the resilience of the hangers the lower flaring portions 12 may be squeezed together sufficiently to enable the baffle plate 10 to be telescoped thereupon up to the plane of the angles 8. When the hangers are released they expand against the edge of the opening 11, holding the baffle plate 10 firmly in place. It will be noted that for the sake of rigidity as well as finish, the baffle plate 10 is provided with a reinforcing bead along its inner and outer edges.

A central baffle plate 13 is provided which, as shown, is circular in shape, although the shape may be other than circular and still be within the purview of the invention. The outer edge of the central baffle plate 13 is formed with a reinforcing bead of such size and shape as to fit within the hooks 9 at the ends of the hangers. The central baffle plate 13 is of such size as to require the separating of the lower portions 12 of the hangers, in order to fit the central baffle plate into place, and therefore the central baffle plate may be regarded as a key for holding the various parts of the diffuser in rigid assembly. It is obvious from the above description that the diffuser is shipped in knocked-down condition and is assembled on the job. The saving in transportation thus materially reduces the cost of its installation.

The diffusers shown in Figures 1, 3 and 4 are substantially the same in structure, and as above described. The difference between these figures is that in Figure 1 a ceiling plate 14 is provided, which is set into the ceiling, having a peripheral downwardly extending flange 15. In Figure 1 the plaster is molded into a flange 16 which en-

compasses the flange 15 and extends to a distance below said flange.

In Figure 3 there is no ceiling plate, and in Figure 4 the ceiling plate 17 rests against the ceiling with the depending flange 18 and without the benefit of the plaster dam.

Referring once again to Figure 1, it will be noted that the baffle plate 10 has an inner band or zone 19, which slopes in a downward and outer direction, and that the central baffle plate 13 has a peripheral zone 20 which slopes downwardly and outwardly, the central baffle plate underlying the opening 11 and underlapping the zone 19 of the baffle plate 10. The two baffle plates cooperate, in the zones 19 and 20, to form a nozzle 23 the cross-section of which throughout its circumferential extent is convergent outwardly, being narrowest at its outlet. This increases the velocity of the air at the point at which it is introduced into the room body of air.

It will be noted also, that the baffle plate 10 is provided with a circumferential band or zone 21 extending upwardly toward the ceiling plate in Figures 1 and 4, and toward the ceiling itself in Figure 3, forming with the surface which it approaches, a surrounding nozzle 22, the cross-section of which is outwardly convergent. This also increases the velocity of the air as it enters the room. This is a most important feature of the invention, for it is necessary that the air jets have a relatively high velocity upon entering the room atmosphere to produce the necessary turbulence for quick mixing and equalization of temperature. The dotted lines *a* and *b* in Figures 1, 3 and 4, indicate that preferably the direction of the nozzles is such as to cause the air to be introduced in the form of divergent jets or curtains. This creates an area of low pressure *x* between them, drawing the air together from each of these curtains, and producing the turbulence essential for quick mixing.

The flange 15 and plaster dam in Figure 1 confronts the jet issuing from the nozzle 22, the air impinging against said flange and dam, thereby losing most of its velocity, and being directed downwardly. This has an effect of enhancing the rate of diffusion and at the same time preventing drafts and cold or hot spots in the room atmosphere. The same effect is produced by the flange 18 in Figure 4.

As has been stated in connection with the relating of the objects of the invention, it is impossible to forecast precisely the conditions which will determine the proper sizing of the diffuser so that some means of adjustment is necessary. This is provided by the screw and slot connections between the hangers 4 and the side walls of the outlet 2. If an increase in velocity is required, the screws may be loosened and the entire diffuser pushed upwardly, bringing the baffle plate 10 closer to the ceiling, reducing the size of the nozzle 22, and increasing the velocity of the air issuing from said nozzle. This adjustment is required, particularly when there are a plurality of outlets opening from the duct or conduit 1, and where dampers are used in the outlets back of the diffusers for producing equal or proportionate distribution of air to the several conduits. If one damper is closed more than another it means an initial relatively low velocity of the air entering the outlet so restricted. This velocity, therefore, is boosted by adjusting the diffuser so as to bring it closer to the ceiling.

Sometimes it may be found necessary to reduce the velocity according to room conditions,

which is easily done by loosening the screws 7, and drawing the diffuser farther away from the ceiling so as to increase the outlet area of the nozzle 22.

In all of these forms of the invention it will be observed that the nozzle 23 formed between the baffle plate 10 and the central baffle plate 13 is not adjustable.

For very low ceilings it may be found necessary to adjust the diffuser so that the baffle plate 10 touches the ceiling or ceiling plate. This, of course, reduces the effective operation of the diffuser to the single nozzle 23.

In Figure 4 is shown a modified form of the invention in which the nozzle 22 may be employed as the air inlet and the nozzle 23 as the air outlet, the latter being connected to an exhaust pipe 24.

While I have in the above description disclosed what I believe to be a preferred and practical embodiment of the invention, it will be understood to those skilled in the art that various changes in shape, arrangement of parts, and details of construction may be employed without transcending the scope of the invention which is defined in the appended claims.

What I claim as my invention is:

1. Diffuser for the room outlets of air ducts comprising in combination with the wall of the outlet and the adjacent ceiling wall, hangers extending from spaced points downwardly from said outlet, a baffle plate supported by intermediate parts of said hangers arranged transversely of the direction of air flow through said outlet, encompassing an air passage communicating with said outlet, said baffle plate comprising a downwardly inclined inner band bounding said air passage and an upwardly inclined peripheral band convergent toward the ceiling, forming therewith a peripheral nozzle of converging cross-section, increasing the velocity of air discharging through said nozzle, and a central baffle plate supported by the lower parts of said hangers, underlying said air passage and underlapping the downwardly inclined band of said encompassing baffle plate, the lapping portions of said baffle plates being cooperably outwardly convergent, forming a peripheral nozzle for increasing the velocity of the air discharged between said baffle plates.

2. Diffuser for the room outlets of air ducts comprising in combination with the wall of the outlet and the adjacent ceiling wall, hangers extending from spaced points downwardly from said outlet, a baffle plate supported by intermediate parts of said hangers arranged transversely of the direction of air flow through said outlet, encompassing an air passage communicating with said outlet, said baffle plate comprising a downwardly inclined inner band bounding said air passage and an upwardly inclined peripheral band convergent toward the ceiling, forming therewith a peripheral nozzle of converging cross-section, increasing the velocity of air discharging through said nozzle, and a central baffle plate supported by the lower parts of said hangers, underlying said air passage and underlapping the downwardly inclined band of said encompassing baffle plate, the lapping portions of said baffle plates being cooperably outwardly and downwardly convergent, forming a peripheral nozzle for increasing the velocity of the air discharging between said baffles.

3. Diffuser as claimed in claim 1, said hangers being adjustably supported to bring said encompassing baffle plate closer to or farther from the ceiling wall.

4. Diffuser as claimed in claim 1, said hangers being adjustably secured to the wall of said duct outlet by a screw and slot connection, permitting said encompassing baffle plate to be brought closer to or farther from the ceiling wall.

5. Combination as claimed in claim 1, including means forming a flange depending from said ceiling wall into the path of air discharged from the first mentioned peripheral nozzle.

6. Combination as claimed in claim 1, including a ceiling plate having a downwardly directed flange extending into the path of air discharged from the first mentioned nozzle.

7. Diffuser for the room outlets of air ducts comprising in combination with the wall of the outlet and the adjacent ceiling wall, hangers extending from spaced points downwardly from said outlet, an annular baffle plate supported by intermediate parts of said hangers arranged transversely of the direction of air flow through said outlet, said baffle plate comprising a downwardly inclined inner band bounding the opening in said annular baffle plate, and an upwardly inclined peripheral band convergent toward the ceiling wall, forming therewith a peripheral nozzle of convergent cross-section, increasing the velocity of the air discharging through said nozzle, and a central baffle plate supported by the lower parts of said hangers, underlying the opening in said annular baffle plate and underlapping the downwardly inclined band of said baffle plate, the lapping portions of said baffle plates being cooperably outwardly convergent forming a peripheral nozzle for increasing the velocity of the air discharging between said baffle plates.

8. Combination as claimed in claim 1, the relative angle of deflection between said nozzles being such as to produce divergent curtains of air in the room, forming between them low pressure areas which create the turbulence essential for rapid mixing.

9. Diffuser for the room outlets of air ducts comprising a plurality of resilient hangers adapted to be secured in spaced angular relation to the surrounding wall of an air outlet, said hangers together constituting a baffle plate supporting spider, said hangers being bent angularly inward at an intermediate point and having in-turned lower ends, the troughs of said angles together, forming an intermediate narrow neck affording a seat for an annular baffle plate, which is seated by drawing together the ends of the hangers and passing them through the hole in the annular baffle plate, and a base baffle plate somewhat larger than the base defined between the free ends of said hangers, seated on the in-turned ends of said hangers and maintaining the lower portions of said hangers in spread relation under tension.

10. Diffuser as claimed in claim 9, the upper ends of said hangers being longitudinally slotted, providing longitudinal adjustment for said diffuser in cooperation with means passing through said slots for securing said diffuser to the wall of an air duct outlet.

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