

April 28, 1953

H. A. MEYER ET AL

2,636,668

AIR DIFFUSING DEVICE

Filed Sept. 9, 1950

2 SHEETS—SHEET 1

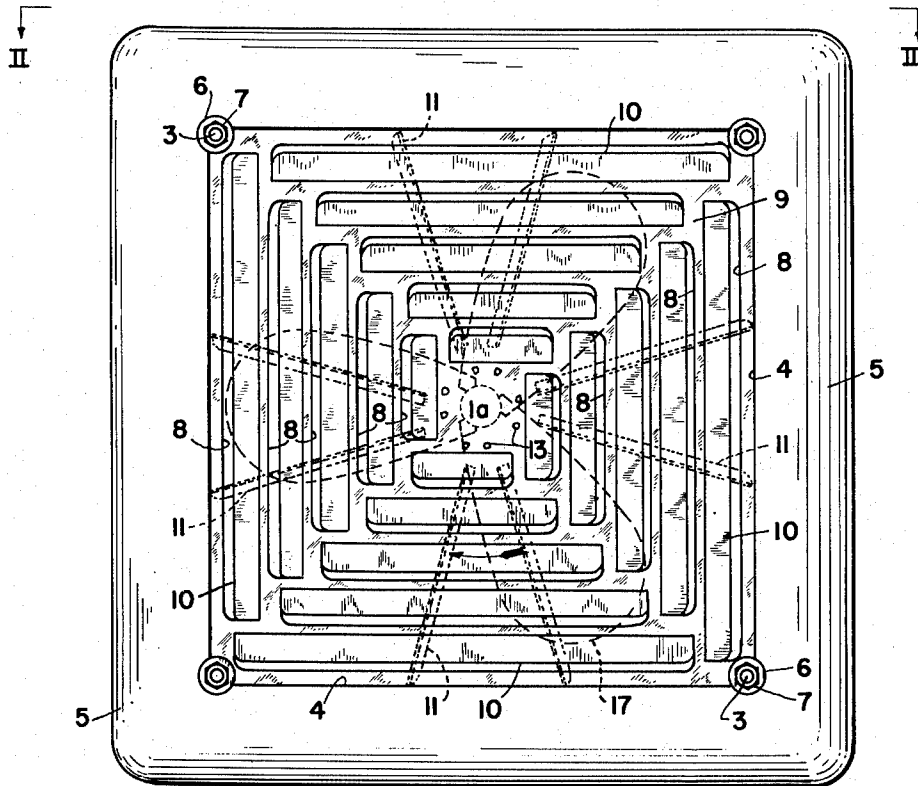


Fig. 1

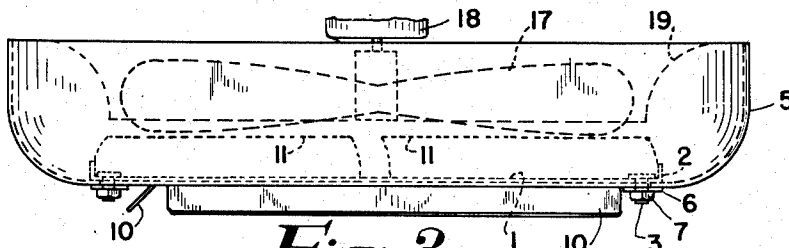


Fig. 2

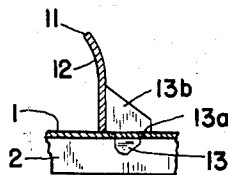


Fig. 7



Fig. 9

Fig. 8

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2 SHEETS—SHEET 2

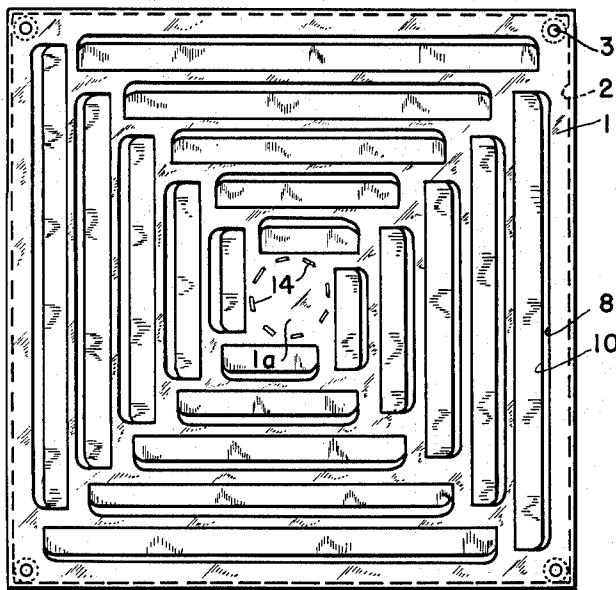


Fig. 3

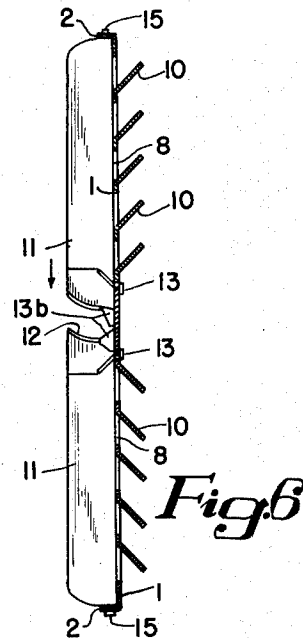


Fig. 6

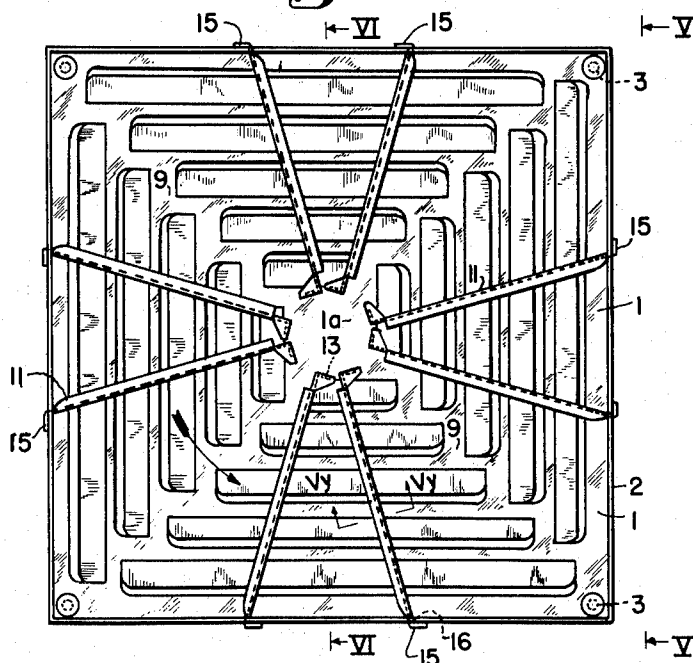


Fig. 4

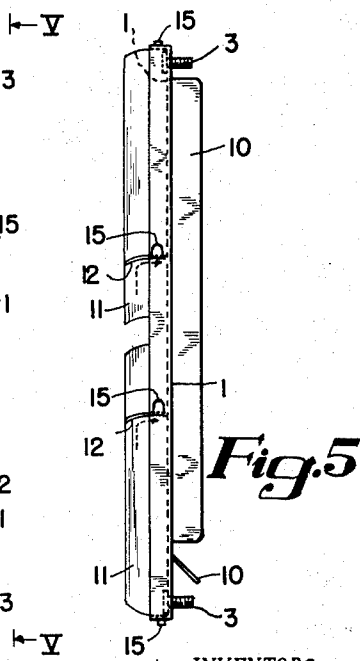


Fig. 5

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UNITED STATES PATENT OFFICE

2,636,668

AIR DIFFUSING DEVICE

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Application September 9, 1950, Serial No. 183,928

7 Claims. (Cl. 230-274)

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Our invention relates broadly and generally to new and useful improvements in air diffusing devices, and more particularly contemplates a unitary device which is adapted to be associated with, or assembled in connection with an air propelling fan for the purpose of intercepting the blast or stream of air delivered by a fan and thereby diffusing or spreading the air blast or stream in the room or other space served by the fan.

The invention particularly contemplates a device which will be efficient and simple in construction, and which may be located close to a fan and directly in front of and in a plane transverse to the blast or stream delivered by the fan, and will function to transform such blast or stream from a relatively high velocity, well-defined helical form in which it is projected from the fan, into a broader form or stream of relatively lower velocity so as to be spread and distributed throughout the space into which it is delivered instead of being projected through a limited portion of the space directly in front of the fan, or against persons or objects located in such limited space.

The invention is capable of many uses in connection with apparatus wherein a fan is employed for propelling a stream of air into a room space and it is desirable to disperse or spread the stream as delivered from the fan, but it will be found particularly desirable and efficient in connection with or as part of heat exchange apparatus of the circulatory or return type wherein such apparatus includes provision for attemping room air, and also includes a motor driven fan of the propeller type which operates to circulate room air into heat exchange relation to such provision and deliver the attemped air to the room, this operation being continuous to maintain desired temperature of the air in the room. Certain apparatus of this general type is sometimes located overhead and operates to deliver the circulated air from the apparatus downward into the room, in connection with which type our invention will be found particularly useful. In the type just mentioned, a diffuser embodying our invention will serve to deflect the air blast laterally into the room space instead of directly downward and thus prevent objectionable air blast directly onto persons or objects which may be located in the area beneath the exchanger.

The invention consists in the improved construction to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawings, we have shown a preferred form of our invention, and wherein:

Figure 1 is a front view of our invention showing the same assembled in relation to a fan

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shown in dotted lines, forming part of a heat exchanger.

Fig. 2 is a side elevation, as indicated by the line II-II of Fig. 1 showing the operative location of our diffuser relative to a fan.

Fig. 3 is a view in front elevation of the main plate of our diffuser with certain baffle members shown in Fig. 1 omitted.

Fig. 4 is a view in rear elevation of our diffuser.

Fig. 5 is a side elevation as indicated by V-V on Fig. 4.

Fig. 6 is a section on the line VI-VI of Fig. 4.

Figs. 7, 8 and 9 are detail views showing the construction of certain vanes located on the rear face of our diffuser, Fig. 7 being on the line Vg-Vg of Fig. 4.

The embodiment of our invention shown in the accompanying drawings comprises a rectangular substantially flat plate 1 made of suitable metal having sufficient rigidity to maintain its rectangular and flat form. This plate 1 is formed with a surrounding flange 2, at right angles to the plane of the plate and located preferably on the face of the plate which is disposed toward the fan in connection with which the diffuser is used. This face of the plate may be termed the inner face, or upstream face of the plate as it is this face which initially receives the air blast or stream which it is desired to diffuse or distribute in the room or other space into which the air propelled by the fan is to be delivered.

At each corner or angle of the plate 1 is located an outwardly projecting stud bolt 3, preferably welded to the plate so as to be rigid therewith. These stud bolts provide means for securing the diffuser in the air outlet opening 4 of a casing wall indicated at 5 in Figs. 1 and 2 of the drawings. The plate 1 is preferably located against the inner face of such casing wall 5 and is held in place by clamping washers and nuts 6, 7 on said bolts 3 and overlapping the outer face of the wall 5. The plate 1 is formed with a plurality of slots 8 for passage therethrough of the air stream from the fan and dividing said stream into a plurality of parts or portions. These slots are arranged in a plurality of groups, in the present embodiment, being four in number. As shown, each group comprises five such slots 8 which are parallel to each other in each group and to a side edge or perimeter of the plate, said slots in each group increasing in length from the innermost slot at the central portion of the plate to the outermost slot of the group, at the side edge of the plate, the several groups of slots being separated from each other by diagonal zigzag portions 9 of the plate. It will be seen that each of these groups of slots is substantially triangular in form with the apex formed by the shortest slot, disposed adjacent the central area of the

plate and the base formed by the longest slot adjacent a side edge of the plate so that said groups are located in sector-like arrangement around the central portion of the plate and are separated from each other by the zigzag diagonal portions 9 of the plate.

Along the inner edge of each of the slots 8 is an outwardly directed flange 10 located on the downstream or outer face of the plate when in operative position, said flanges serving as deflectors against the rear faces of which the air passing through said slots 8 from the upstream side of the plate strikes and is deflected laterally outwards toward and beyond the perimeter of the plate. The flanges are coextensive with the edges of the slots so that the deflected air from the groups of deflectors is caused to take a generally pyramidal form, the cross sectional area of which is fixed by the angle at which the flanges are made to the plane of the plate, and to the axis of rotation of the fan in connection with which the diffuser is employed.

It is to be noted that the groups of slots are so arranged that the slots and deflecting members of each group are at an angle to the corresponding slots and members of the next adjacent groups, and in such manner that starting with the innermost slot and member of one of the groups and proceeding clockwise as shown in Figs. 1 and 3, in a continuous spiral-like direction, each slot and its deflector flange delivers air at its end portion across the portions 9 into the path of the air from the nearest end of the slot next in the series, and against the back of the deflector of the second row of slots, and in a like manner from the second, third, etc. slots and deflectors toward the lateral boundaries of the plate 1.

This arrangement provides for passage of an ample volume of air through the plate and in equalizing or distributing the lateral flow of air in all directions into the space into which the air is to be delivered. It will be noted that this result is effected by offsetting each group so that a central transverse line therethrough lies to one side of and parallel to the diameter of the plate. Furthermore, the arrangement assures of prompt or free flow of air through the plate, so that the resistance of the plate to the air is reduced to a point as will not create such back pressure on a fan so as to cause the driving motor to overheat.

The vanes 10 are made by bending up the metal cut out in forming the slots 8 in the plate 1.

Arranged on and secured to the rear face or upstream side of the plate 1 are a plurality of baffles 11 which serve to intercept the air stream delivered by a fan and turn or guide the air downward toward and through the slots 8 in the plate 1. There are two of these baffles for each of the groups of slots 8 said baffles for each group extending radially from the central portion of plate 1 to the flange 2, and across all of the slots in the group. Each pair of baffles diverge from each other from the inner ends thereof to the outer ends thereof, see Figs. 1 and 4, and each baffle for a group of slots diverges relative to the next adjacent baffle for an adjoining group of slots. These baffles are so spaced around the center of the plate and relate to the groups of slots as to cause the air from the fan to be delivered substantially in equal proportions to the groups of slots and cause a uniform discharge of air through the slots in all directions.

The baffles are curved concavely toward the direction of the rotating air stream delivered by

the fan as shown at 12, and thus serve to turn the air stream toward the rear face of the plate and the slots 8.

The baffles are preferably secured in place by forming the inner ends thereof with bendable ears 13, inserted through slots 14 in the central portion 1a of the plate 1 and bent over to form a rigid connection, the outer ends of said baffles being secured to the said flange 2, by bendable ears 15 inserted through slots 16 in the flange, and bent over on the outer face of the flange. The ear 13 on each baffle is formed on the edge 13a of a triangular part 13b, which when bent over on the dotted line (see Fig. 9) brings the edge 13a into contact with the inner face of plate 1, thereby bracing the inner end of the baffle and assisting in holding the baffle in the operative position described, when the ear 13 is bent over as indicated in Fig. 6. In Figs. 1 and 2, we have shown our diffuser assembled in an outlet opening 4 of the wall 5 of a heat exchange apparatus which for example, includes a propeller type fan 17 for propelling air through said opening, the fan being driven by an electric motor 18 and surrounded by shroud-ring 19, to direct the air toward the opening 4. It will be noted, from Fig. 2, that our diffuser constructed as above described, has the advantage that it may be located in close proximity to a fan, and that the air stream in helical form and moving in the direction indicated by the arrow in Fig. 4 will in part pass directly through the slots 8, and a portion of such stream will strike the baffles 11 as indicated by the dotted arrows in Fig. 5 and be deflected to the groups of slots. The radial arrangement of the baffles 11 also serves to cause the air to be directed toward the side edges of the plate. Thus the baffles 11 not only serve to equalize the delivery of air to the portions of the several groups of slots 8 located between said baffles, and to the groups individually with the result that there will be a substantially uniform discharge of air in all directions.

It is to be noted that the air issuing from each of the slots 8 in each of the groups of slots and deflected by the member 10 on the inner edge of the slot will be generally fan-shaped in form due to the fact that the air will not only flow outward from the central portion of the slot but will also flow laterally from the ends of the slots in a direction across the parts 9 at the ends of the slot. This is true of each of the slots 8 and its associated deflector 10. By arranging each of the slots of a group so that the delivery ends of the outermost slot of each group overlaps the adjacent delivery end of the outermost slot of one adjacent group, and the delivery end of the second slot in the other adjacent group, and in a like manner respecting each successive slot in each group, the air from the delivery ends of the slots in each group is delivered across the parts 9 and mixes with the air delivered by the ends of the slots in the next adjacent groups. This arrangement has the advantage of contributing to the equalizing of the air stream in all directions from the diffuser. Further, the arrangement provides for slots of ample width and length to enhance free flow of air through the diffuser and reduce objectionable back-pressure on the fan.

What we claim is:

1. A diffuser for air propelling fans, comprising a flat plate adapted to be located in a plane transverse to and intercepting the air stream delivered by a fan, said plate having a plurality of sector-like groups of slots for passage of the

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air, the slots of each group being parallel to each other and the side edge of the plate, and each of said slots having at its inner longitudinal edge a deflector member on the outer face of the plate and disposed at an angle to the plate to deflect air toward the outer edge of the plate, the air delivery ends of certain of the slots in each group being positioned in substantially overlapping laterally spaced relation to adjacent slots to deliver air toward the delivery ends of certain of the slots in a next adjacent group of slots.

2. A diffuser for air propelling fans, comprising a flat plate adapted to be located in a plane transverse to and intercepting the air stream delivered by a fan, said plate having a plurality of sector-like groups of slots for passage of the air, the slots of each group being parallel to each other and the side edge of the plate, said groups being separated from each other by diagonal portions of the plate, and each of said slots having at its inner longitudinal edge a deflector member on the outer face of the plate and disposed at an angle to the plate to deflect air toward the outer edge of the plate, the air delivery ends of certain of the slots in each group being positioned in substantially overlapping laterally spaced relation to adjacent slots to deliver air across said diagonal portions of the plate and toward the delivery ends of certain of the slots in a next adjacent group of slots.

3. A diffuser for air propelling fans, comprising a flat plate adapted to be located in a plane transverse to and intercepting the air stream delivered by a fan, said plate having a plurality of sector-like groups of slots for passage of the air, the slots of each group being parallel to each other and the side edge of the plate, and each of said slots having at its inner longitudinal edge a deflector member on the outer face of the plate and disposed at an angle to the plate to deflect air toward the outer edge of the plate, the air delivery ends of certain of the slots in each group being positioned in substantially overlapping laterally spaced relation to adjacent slots to deliver air toward the delivery ends of certain of the slots in a next adjacent group of slots, and a plurality of baffles secured on the rear plane face of said plate, said baffles extending radially from the central portion of the plate and traversing said slots to distribute the air to said slots.

4. A diffuser for air propelling fans, comprising a flat plate adapted to be located in a plane transverse to and intercepting the air stream delivered by a fan, said plate having a plurality of sector-like groups of slots for passage of the air, the slots of each group being parallel to each other and the side edge of the plate, and each of said slots having at its inner longitudinal edge a deflector member on the outer face of the plate and disposed at an angle to the plate to deflect air toward the outer edge of the plate, the air delivery ends of certain of the slots in each group being positioned in substantially overlapping laterally spaced relation to adjacent slots to deliver air toward the delivery ends of certain of the slots in a next adjacent group of slots, and a plurality of pairs of baffles secured on the rear plane face of said plate, said baffles extending radially from the central portion of the plate, one of said pairs of baffles traversing each of said groups of slots.

5. A diffuser for air propelling fans, comprising a flat plate adapted to be located in a plane transverse to and intercepting the air stream delivered by a fan, said plate having a surrounding flange and having a plurality of sector-like groups of

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slots for passage of the air, the slots of each group being parallel to each other and the side edge of the plate, and each of said slots having at its inner longitudinal edge a deflector member on the outer face of the plate and disposed at an angle to the plate to deflect air toward the outer edge of the plate, the air delivery ends of certain of the slots in each group being positioned in substantially overlapping laterally spaced relation to adjacent slots to deliver air toward the delivery ends of certain of the slots in a next adjacent group of slots, and a plurality of baffles on the rear plane face of said plate, said baffles extending radially from the central portion of said plate to said flange and having the ends thereof secured to said central portion and said flange, and traversing said slots.

6. A diffuser for air propelling fans, comprising a flat plate adapted to be located in a plane transverse to and intercepting the air stream delivered by a fan, said plate having a plurality of sector-like groups of slots for passage of the air, the slots of each group being parallel to each other and the side edge of the plate, and each of said slots having at its inner longitudinal edge a deflector member on the outer face of the plate and disposed at an angle to the plate to deflect air toward the outer edge of the plate, the air delivery ends of certain of the slots in each group delivering air toward the delivery ends of certain of the slots in a next adjacent group of slots, the slots in adjacent sectors being positioned in progressively overlapping spaced relation so that tracing from the center outward there is formed a substantially spiral shaped series of discharge openings, and a plurality of baffles secured on the rear face of said plate, said baffles extending radially from the central portion of the plate and traversing said slots to distribute the air to said slots, said baffles being concavely curved transversely toward the direction of an air stream delivered to said plate.

7. A diffuser for air propelling fans, comprising a flat plate adapted to be located in a plane transverse to and intercepting the air stream delivered by a fan, said plate having a plurality of sector-like groups of slots for passage of the air, the slots of each group being parallel to each other and the side edge of the plate, said groups being separated from each other by zigzag diagonal portions of the plate, each of said slots having at its inner longitudinal edge a deflector member on the outer face of the plate and disposed at an angle to the plate to deflect air toward the outer edge of the plate, the air delivery ends of certain of the slots in each group delivering air across said diagonal portions of the plate and toward the delivery ends of certain of the slots in a next adjacent group of slots, and the slots in adjacent sectors being positioned in progressively overlapping spaced relation so that tracing from the center outward there is formed a substantially spiral shaped series of discharge openings.

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