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AIR MIXER FOR VENTILATING SYSTEMS

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Fig. 1

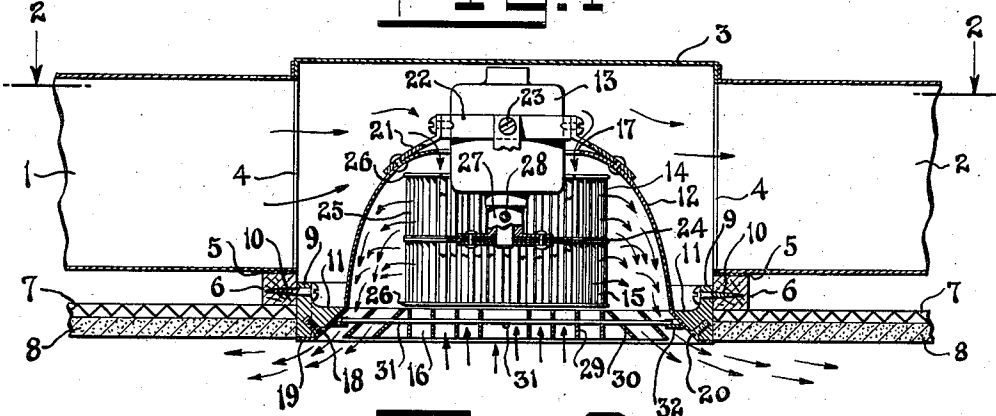


Fig. 2

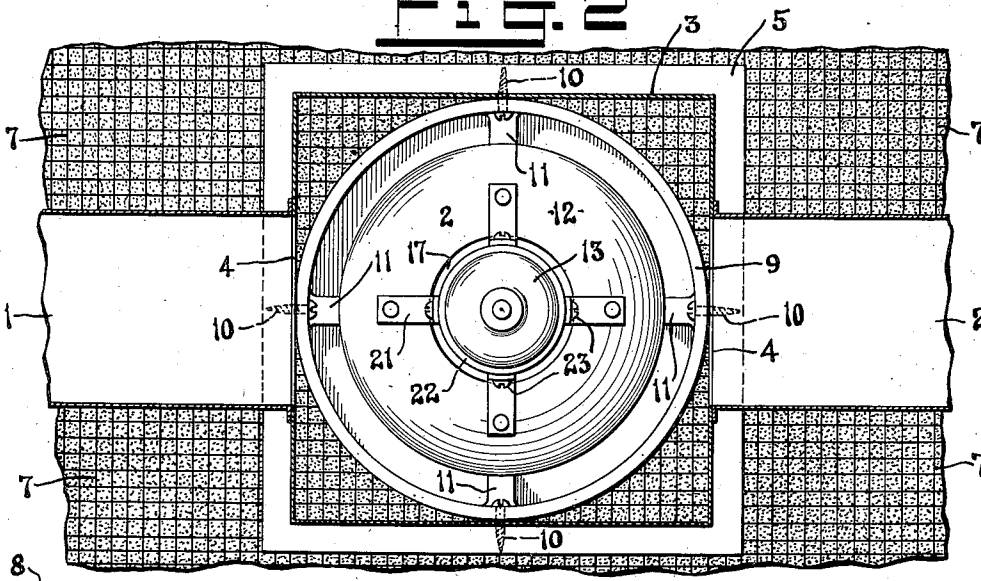


Fig. 3

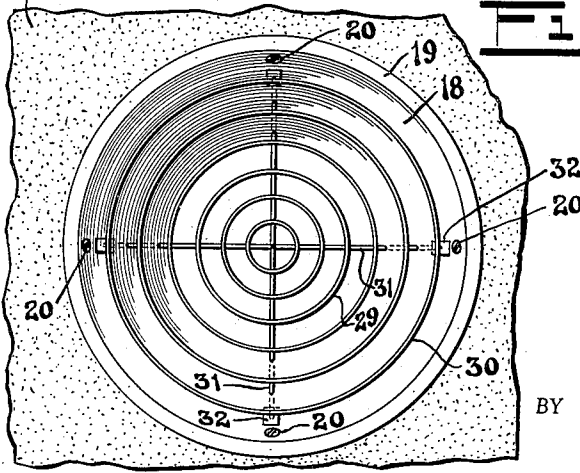
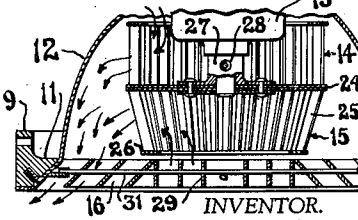


Fig. 4



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AIR MIXER FOR VENTILATING SYSTEMS

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6 Claims. (Cl. 98—38)

This invention relates to ventilating systems in which a building is furnished with air ducts leading from the exterior or from a central air blower to the rooms of the building, and the main object is to provide a mixer for each room which operates to draw air from a supply duct and from the room into a mixing chamber from which the mixed air is blown back into the room.

A further object is to provide an apparatus and method whereby the air of a room may be re-conditioned without objectionable draft or rapid air movement. A further object is to provide an apparatus of this character which may be housed within a wall or ceiling of a room directly in the air duct line and without projection into the room, and which apparatus will be light in weight, easily installed, inexpensive in construction, noiseless in operation, and capable of ornamental finish at or about the wall or ceiling opening.

My improved method of air re-conditioning consists in simultaneously creating suction at opposite openings in a chamber to draw air from a fresh air supply and from a room, causing such air currents to become mixed within the chamber, and ejecting the mixed or re-conditioned air into the room at an angle away from the current of air being drawn into the mixer from the room.

In carrying my method into effect I employ in the preferred form a mixer comprising a chamber, preferably in the form of a shell or dome having a small opening at the top and entirely open at its base, and which is preferably mounted within a junction box in an air duct line with the base of the dome flush with the wall or ceiling, and within this dome is housed a pair of fan-wheel blowers rotated by a small electric motor mounted upon or within the dome. These blowers are preferably mounted together in axial alignment, the upper blower, that is, the blower adjacent the opening at the top of the dome, drawing air from the air duct line and blowing it into the dome, and the lower blower drawing air from the room and blowing it into the dome, and the action of the two blowers causing the two air currents to circulate within the dome whereby the air drawn from the room is re-conditioned by mixture with the fresh air drawn from the air duct line. Due to the dome-like chamber the mixed air as it is caused to circulate is driven downward and out of the chamber at its base and into the room, and for the purpose of directing this air current I provide beneath the blowers and preferably within the base opening of the

dome a series of concentric louvres in the form of a grille, the central louvres directing the air current from the room into the lower blower, and the outer louvres being placed at an angle to deflect the re-conditioned air current at an angle away from the incoming air current from the room.

My invention is illustrated in the accompanying drawing, in which—

Figure 1 is a vertical section illustrating an air duct line within a wall or above the ceiling of a room, a junction-box, and my air mixer within the junction-box comprising an air dome having an air intake at the top, the mixed air outlet at the bottom having a grille with louvres for directing the air currents, a motor and fan-wheel blowers, the latter being partly broken away to show the partition between the blowers.

Figure 2 a horizontal section on the line 2—2 of Figure 1.

Figure 3 a plan view looking upward into the grille; and

Figure 4 a central vertical section of the fan-wheel blowers showing the vanes of the blower which draws air from the room set at an angle to the axis of the wheel instead of parallel therewith.

Referring to the drawing, 1 and 2 indicate the air duct line, and 3 the junction box which may be square as shown in Figure 2, or of any other shape, and open at the bottom as seen in Figure 1. The junction box has ports 4 at which ducts 1 and 2 are attached in any suitable manner, and the box has a flange 5 which is secured to a frame 6 of wood or other suitable material. The ducts, junction box and supporting frame 6 are let into the wall or ceiling as indicated in Figure 1, and below the frame and attached thereto is the usual metal or other lath 7 on which the plaster 8 is laid in the usual manner. Within the frame 6 and set so that its outer rim will be flush with plaster 8 is a metal ring 9 which is secured to frame 6 by woodscrews 10 at diametrically opposite points. Ring 9 has a number of lugs 11, four being shown, projecting radially toward the center of the ring and having the underside bevelled as seen in Figure 1.

The mixer comprises a chamber 12, which is preferably of dome-shape, a motor 13, fan-wheel blowers 14 and 15, and the grille 16. The dome 12 is a sheet metal shell with a circular opening 17 at the top and having an outward flare 18 at the base terminating in a circular flange 19 which seats against and covers the lower edge of supporting ring 9. The flare 18 has the same an-

gle as the angular louvres of the grille, hereinafter referred to, which fits the bevel on the underside of lugs 11 where the dome is secured by screws 20 to the ring 9. At the top the dome has secured thereto a set of brackets 21 to which a collar 22 is brazed or otherwise rigidly secured. The brackets and collar are drilled and tapped for set-screws 23. The inner diameter of the collar is such as to loosely fit the housing of motor 13 which is set within the collar to the desired depth with its shaft in vertical position and secured in adjusted position by the set-screws 23. It will be noted that the motor body projects into the dome through opening 17, thereby reducing the height of the mixing chamber, and that the diameter of the opening is such as to provide sufficient clearance for the entrance of air into the dome from the junction-box 3.

The blowers 14 and 15 are represented as fan-wheels of the usual type, each preferably having a base plate 24, angularly set vanes 25, and top ring 26. The two blowers are preferably secured together with the base plates 24 back-to-back as seen in Figure 1, thus providing a closed partition between them, and are provided with a hub 27, preferably within the wheel 14 for attachment to the motor shaft and to which it is secured by set-screw 28. By this arrangement of wheels 14 and 15 and supporting hub 27 it is possible to project the body and shaft of the motor within wheel 14 thereby reducing the height of the entire apparatus. It will be noted that the height of the dome from the inner edge of flare 18 is only sufficient to give clearance to the rims 26 of wheels 14 and 15 between the grille and dome.

In Figure 4 the vanes 25 of the fan-wheel 15 are shown set at an inward angle toward the axis of the wheel instead of parallel to the wheel axis as in Figure 1. With this arrangement the diameters of the concentric cylindrical louvres 29 will be decreased in order that the larger ring of the louvres 29 will not direct air outside of the wheel, but entirely within the rim 26 of the wheel. I find that this arrangement provides a much greater pull of air from the room and hence more rapidly mixes the room air with fresh air drawn from ducts 1—2 through the top of the dome by fan-wheel 14. If desired both fan-wheels may have the vanes set at an inward angle at the rims 26, or the combination may be varied by setting either set of vanes at an outward angle at the rim 26 to decrease the pull of either wheel.

Below the fan-wheel blowers and seated within the flare 18 of the dome is the grille 16 which is composed of two series of concentric rings. This grille is preferably seated within the base of the dome to reduce the height of the mixer and so that the grille may be flush with the ceiling, although in practice the grille may project therefrom for ornamental or other reasons without affecting the operativeness of the mixer. The central series of louvres 29 constitute short cylindrical louvres, the larger ring of the series being of a diameter preferably equal to or less than the inner diameter of wheel ring 26 of blower 15 so as to direct the air current to the interior of the wheel. The outer series of louvres or rings 30 are in the form of short truncated cones of approximately a forty-five degree angle with the smaller diameter inward, and the smaller ring of this series preferably making close contact at its upper edge with the upper edge of the larger of the rings 29 so that no air will be drawn up

around the outer circumference of such ring 29.

The louvre rings 29 and 30 are perforated at diametrically opposite points to receive supporting rods 31 to which the rings are brazed or otherwise secured to maintain them in concentric spaced relation. The rods project beyond the outer ring 30 and are adapted to seat in grooved lugs 32 brazed to the flare 18 of the dome as best seen in Figure 1. To place the grille in position it is inserted into the dome opening so that the ends of rods 31 will pass by the lugs and then the grille is rotated to bring the ends of the rods over the lugs and allowed to drop in place in the lug grooves. This arrangement permits easy removal of the grille for cleaning both the grille, the blowers and the inside of the dome. For removal of the mixer from the junction-box, screws 20 are removed and the dome with the motor, blowers and grille allowed to drop from the junction-box.

In the operation of the mixer, the air flowing through ducts 1—2 is drawn down through opening 17 at the top of the dome and into the fan-wheel 14 by the action of its vanes 25 and is driven out between the vanes into the space under the dome surrounding wheels 14 and 15, and at the same time air from the room is drawn up through louvres 29 into fan-wheel 15 and is driven out between its vanes 25 into the lower part of the dome. The circulation of the two air currents within the dome due to the action of vanes 25 causes the two air currents to mix and the re-conditioned air is driven out through louvres 30, the angle of the louvres deflecting the current of reconditioned air away from the axial center of the mixer so as not to mix with or affect the current of air being drawn into the mixer from the room.

It will be understood that a single fan-wheel without the base plate or dividing partition may be employed and that the operation will be similar to the double fan-wheel arrangement, although for most purposes will not be as efficient. When a single fan-wheel with open top and bottom is employed, the action of the vanes due to the rotation of the wheel will operate to eject air peripherally between the vanes, thereby reducing the volume or pressure at or about the wheel axis and cause air to flow axially into the wheel through the open ends and the two air currents become mixed and are ejected by the action of the vanes. The same action takes place when two fan-wheels with a dividing partition are employed, but I have found that with a dividing partition the movement of the air currents and mixing in the surrounding chamber is more effective.

It will also be understood that the proportioning of the air mixing, that is, the rate of pull from the fresh air ducts and from the room for re-conditioning of the room air, may be varied by proportioning the size, diameter or height, or angular set of the vanes of the two fan-wheels or fan-wheel sections, thereby varying the air flow through the fan-wheels. Or the mixture may be proportioned by varying the relative diameters of the intake openings of the mixing chamber.

It will also be observed that by the use of my improved air mixer, the mixing of fresh cold air with the heated air within a room is avoided, and that thereby objectionable effects of cold drafts within a room due to the common method of forcing fresh air into a room is avoided, and that my method of withdrawing heated air from

a room, mixing it with fresh cold air in a mixing chamber, and distributing such re-conditioned air in a room avoids the necessity for providing extra feed ducts commonly employed in ventilating systems for minimizing drafts of cold air into a room.

It will also be observed that my improved method of air conditioning is especially well adapted for rooms having low ceilings in that no perceptible air drafts are present, even at points within one foot vertically below the center of the mixer. This is due to the fact that the warm room air is exhausted from the room by a fan-wheel axially thereof and ejected peripherally into the mixing chamber from which the re-conditioned air is ejected at a deflected angle due to the louvres and thereby causing the re-conditioned air to spread outward into the room above the warm air of the room and away from the axial center of the mixer.

What I claim is:

1. In a ventilating system, the combination with an air duct, of a mixer comprising a chamber open at opposite ends and having imperforate sloping walls, the small end of the chamber communicating with the air duct and the large end opening into a room, a centrifugal blower within said chamber operating to draw air axially into the blower simultaneously from the air duct and room and to drive the two air currents peripherally therefrom and cause said air currents to circulate and mix within the chamber and to force the mixed air outward along the sloping walls of the chamber concentrically to the axis of the blower into the room.

2. In a ventilating system, the combination with an air duct, of a mixer comprising a chamber open at opposite ends and having imperforate side walls, the opening at one end communicating with the air duct and the other opening directly into a room, a centrifugal blower within the chamber operating to draw air axially into the blower simultaneously from the air duct and room and to drive the two air currents peripherally therefrom and cause said air currents to circulate and mix within the chamber, and to force the mixed air outward from the chamber into the room, and a deflector at the room end of the chamber for deflecting the mixed air ejected from the chamber away from the axial center of the chamber.

3. In a ventilating system, the combination with an air duct, of a mixer comprising a circular chamber open at opposite ends and having imperforate side walls, one opening being an inlet communicating with said duct and the other opening directly into a room, a multivaned fan-wheel rotating within said chamber and operating to draw air axially into the wheel simultaneously from the duct and room and ejecting the two air currents peripherally therefrom and causing said air currents to circulate and mix within the chamber and to force the mixed air outward from the chamber into the room, and concentrically arranged deflectors at the room opening of the chamber, the central deflector

being arranged to direct the room air axially into the fan-wheel, and the outer deflector serving to deflect the mixed air ejected from the chamber laterally away from the axial center of the mixer chamber.

4. In a ventilating system, the combination with an air duct, of a mixer comprising a chamber positioned adjacent said duct and communicating therewith and having an opening into a room, a motor mounted on said chamber, a pair of fan-wheel blowers within the chamber and rotated by said motor, one of said blowers having its vanes set to draw air from said duct into the chamber and the vanes of the other blower being set to draw air from the room into the chamber and whereby the two air currents are mixed within the chamber, and a grille over the the room opening of the mixing chamber composed of concentric ring louvres, the central rings of the grille being short cylindrical sections for directing the air drawn from the room, and the outer rings being short truncated conic sections for deflecting the mixed air driven from the chamber outward away from the axial center of the mixer.

5. In a ventilating system, the combination with an air duct, of a mixer comprising a dome-shaped casing adjacent said duct and communicating therewith through an opening at the top of the dome and entirely open at the base, a motor mounted on said dome and projecting through said opening at the top, a pair of fan-wheel blowers mounted together on the motor shaft and having a closed dividing partition, one of said blowers having its vanes set to draw air from said duct through said opening at the top of the dome, and the vanes of the other blower being set to draw air from a room into said dome, and whereby the two air currents are mixed within the dome, and a set of concentric ring louvres in the form of a grille over the base opening of the dome, the central rings of the grille being short cylindrical sections for directing the air drawn from the room, and the outer rings being short truncated conic sections for deflecting the mixed air driven from the dome outward away from the axial center of the mixer.

6. In an air mixer, the combination of a dome-shaped chamber having an opening at the top and a larger opening at the base, a motor mounted on said chamber, a fan-wheel blower within said chamber divided into two sections by a closed partition, one section drawing air through the top opening and the other section through the base opening, and both sections delivering air to the surrounding space in said chamber and causing same to mix, a hub within one of the blower sections for mounting the blower on the motor shaft, and a series of louvres in the form of a grille removably attached to the base of the dome and having a central set of louvres for directing air into the adjacent blower section, and an outer set of louvres set at an angle for deflecting the mixed air driven from the chamber away from the axial center of the mixer.

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