Nov. 30, 1948. W. M. SIMPSON 2,455,196

AIR CONDITIONING

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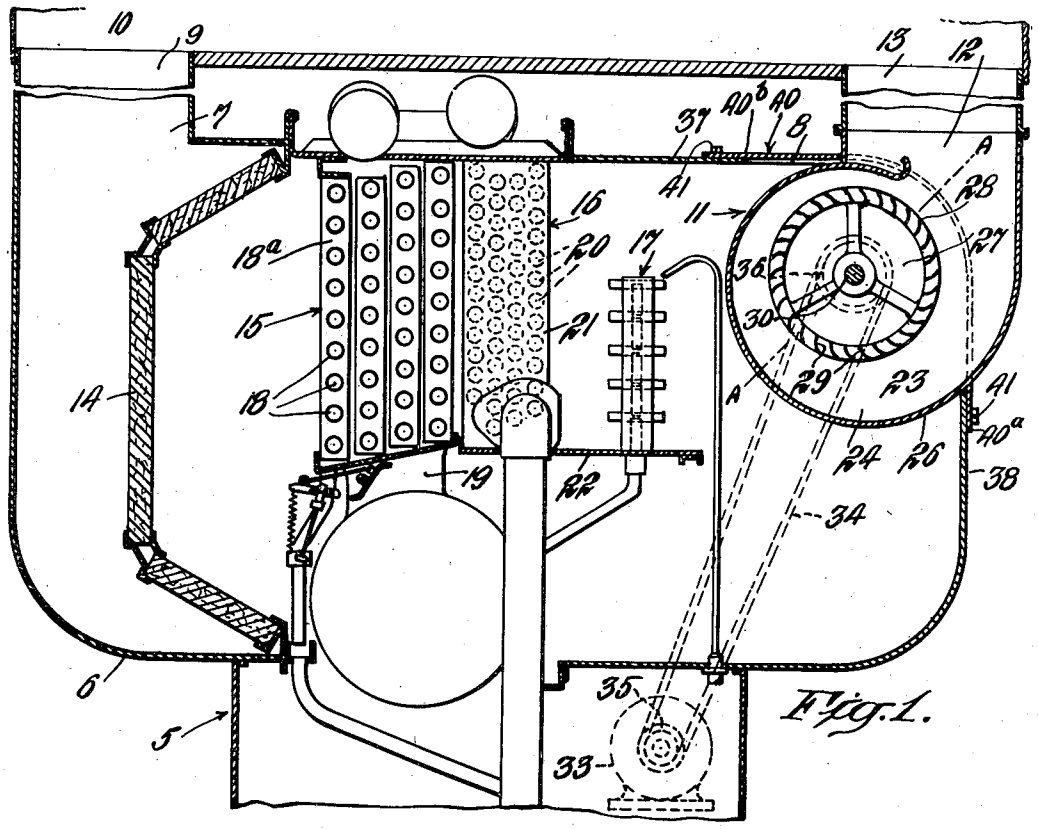


Fig. 1.

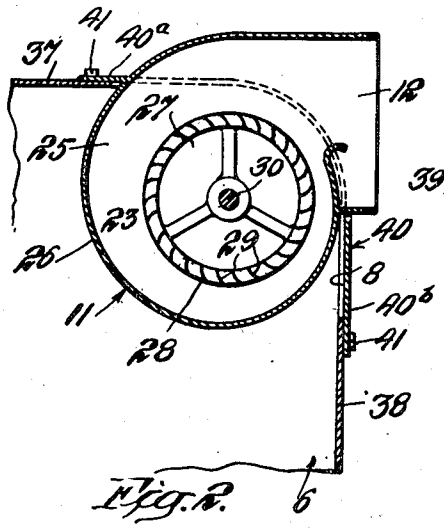


Fig. 2.

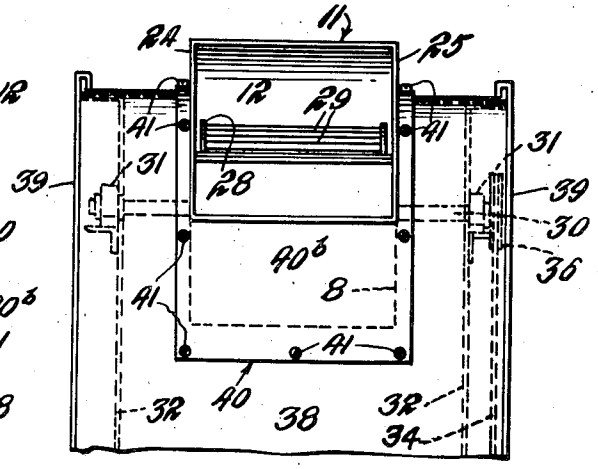


Fig. 3.

INVENTOR.
Walter M. Simpson
BY
Oliver S. Titcomb
His ATTORNEY

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AIR CONDITIONING

Walter M. Simpson, Evansville, Ind., assignor to Servel, Inc., New York, N. Y., a corporation of Delaware

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6 Claims. (Cl. 230—133)

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The present invention relates to air conditioning and more particularly to a construction and arrangement of elements for mounting a circulating fan on an air conditioning unit to deliver air in any of a plurality of directions to adapt it for particular conditions encountered in different installations.

Air conditioning units having a circulating fan for delivering conditioned air to an enclosure have been extensively used to heat the enclosure in winter or cool the enclosure in summer or both heat and cool the enclosure in winter and summer, respectively. Such air conditioning units are usually installed in the basement and connected by ducts to deliver conditioned air to the rooms to be conditioned. In some installations the conditioned air must be delivered vertically into riser ducts and in other installations the conditioned air must be delivered horizontally into laterally extending ducts depending upon the location of the air conditioner and the arrangement of the ducts.

The principal object of the present invention is to provide an air conditioning unit in which the circulating fan may be mounted in a plurality of positions to adapt it to deliver air in different directions and thereby increase the flexibility of the unit to accommodate different conditions of installations.

Another object is to provide an air conditioning unit with a conditioning chamber having an opening therein through which the circulating fan is movable into and removable from the air conditioning unit.

Another object is to provide an air conditioning unit of the type indicated in which the position of the circulating fan may be changed at the place of installation to adapt it for either horizontal or vertical air delivery by merely turning the fan bodily about an axis diagonal to the two directions of air flow.

Still another object of the invention is to provide an air conditioning unit of the type indicated in which a cover plate on the circulating fan overlies the conditioning chamber at the sides of the opening to mount the fan in the chamber for either horizontal or vertical air delivery.

These and other objects will become more apparent from the following description and drawing in which like reference characters denote like parts throughout the several views. It is to be expressly understood, however, that the drawing is for the purpose of illustration only and not a definition of the limits of the invention reference being had for this purpose to the appended claims. In the drawing:

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Fig. 1 is a front sectional view of the conditioning chamber of an air conditioner for either heating or cooling the air and showing the circulating fan mounted therein with its outlet projecting through an opening in the chamber for delivering air vertically.

Fig. 2 is the sectional view of a part of the conditioning chamber showing the circulating fan arranged with its outlet projecting through the opening in the chamber for horizontal air delivery, and

Fig. 3 is an end elevational view of the conditioning chamber showing the cover plate for mounting the circulating fan on the conditioning chamber for either horizontal or vertical air delivery and covering the opening in the chamber at the side of the fan.

The air conditioner illustrated in the drawing is of unitary construction enclosed in a generally T-shaped casing 5. The upper part of the T-shaped casing 5 comprises a generally rectangular conditioning chamber 6 having an inlet opening 7 at one end and an outlet opening 8 at its opposite end. A duct 9 connects the inlet opening 7 of the conditioning chamber 6 to an enclosure 10 to be conditioned and a circulating fan 11 in the chamber has a rectangular outlet 12 projecting through the opening 8 and connected to the enclosure by a duct 13. The circulating fan 11 draws air into the conditioning chamber 6 from the enclosure 10 through the duct 9 and delivers the air back to the enclosure through the duct 13. Mounted in the conditioning chamber 6 in the direction of air flow is a filter 14, cooling element 15, heating element 16 and humidifier 17. Thus, air in the enclosure 10 is filtered and then cooled and dehumidified or heated and humidified in accordance with requirements as it circulates through the conditioning chamber 6.

The cooling element 15 constitutes the evaporator of a suitable refrigeration system and as illustrated comprises a plurality of rows of tubes

18 extending between headers 19 adjacent the side walls of the conditioning chamber 6, the tubes of each row being provided with common heat transfer fins 18a. The heating element 16 is in the form of a radiator and also is illustrated as comprising a plurality of closely adjacent tubes 20 extending between headers 21 adjacent the side walls of the conditioning chamber 6. The heating element or radiator 16 is positioned closely adjacent the cooling element 15 in the conditioning chamber 6 and a wall 22 underlies the heating and cooling elements to direct air toward the circulating fan 11.

Cooling or heating media may be selectively supplied to the evaporator 15 or radiator 16, respectively, by apparatus in the base of the casing 5. In my co-pending application filed concurrently herewith and entitled Air conditioning, an arrangement is illustrated and described wherein heating steam is selectively supplied to the generator of a heat operated refrigeration system including the evaporator 15 or to a heating system including the heating element 16. Thus when steam is supplied to the refrigeration system the cooling element 15 will cool the air delivered through the conditioning chamber 6 by the circulating fan 11 and when steam is supplied to the heating element 16 the latter will heat the air flowing through the conditioning chamber.

In accordance with the present invention the circulating fan 11 may be mounted in the conditioning chamber 6 to deliver air in the direction desired for the particular installation. As illustrated in the drawing the circulating fan 11 is of the centrifugal type comprising a scroll casing 23 having parallel side walls 24 and 25 and a curved peripheral wall 26. Circular air inlet openings 27 are provided in the side walls 24 and 25 of the casing 23 and the walls of the casing form the rectangular outlet 12 which projects through the opening 8 of the conditioning chamber 6. A wheel 28 having blades 29 on its periphery is mounted fast on a rotatable shaft 30 having its axis in alignment with the center of the circular inlet openings 27. The shaft 30 is journaled in bearings 31 mounted on the side walls 32 of the conditioning chamber 6, see Fig. 3, and the shaft is driven by a motor 33 and belt 34 in T-shaped casing 5 cooperating with pulleys 35 and 36 on the motor and wheel shaft, respectively. In the preferred embodiment illustrated, the top wall 37 and end wall 38 of the conditioning chamber 6 extend beyond the side walls 32 with removable panels 39 attached thereto to enclose the bearings 31. The bearings 31 are located on the side walls 32 of the conditioning chamber 6 to position the wheel shaft 30 equal distances from the top and end walls 37 and 38 so that the shaft will be located on a 45° diagonal line A—A through the corner of the conditioning chamber.

The opening 8 in the conditioning chamber 6 is located in its top and end walls 37 and 38 midway between the side walls 32 and extends an equal distance on either side of the diagonal line A—A. The opening 8 is of such dimensions as to adapt the circulating fan 11 to be moved bodily into and removed bodily from the conditioning chamber 6. A cover plate 40 fastened to the sides of the scroll casing 23, as by welding or the like, is shaped to conform to and overlie the top and end walls 37 and 38 of the conditioning chamber 6 adjacent the opening 8 and the fan is mounted on the walls of the chamber by means of screws 41 extending through the cover plate and into

the walls of the chamber. When the fan 11 is mounted in the position illustrated in Fig. 1 the curved peripheral wall 26 is located closely adjacent the lower edge of the opening 8 in the conditioning chamber 6. A short depending flange 40a of the cover plate 40 overlies the end wall 38 of the conditioning chamber and a longer flange 40b of the cover plate overlies the opening 8 in the top wall 37 between the fan and the edge of the opening.

The direction of air delivery from the fan 11 may be changed from the vertical direction illustrated in Fig. 1 to a horizontal direction illustrated in Fig. 2 by merely turning the fan bodily 180° on an axis coincident with the diagonal line A—A through the center of the fan. Due to the shape of the fan casing 23 and the opening 8 it is necessary to remove the fan 11 bodily from the conditioning chamber 6, turn it to the position illustrated in Fig. 2 and then reinsert the fan into the conditioning chamber through the opening 8. Because of the asymmetrical shape of the scroll casing 23 the peripheral wall 26 will be positioned closely adjacent the edge of the opening 8 in the top wall 37. The cover plate 40 fixedly connected to the fan casing 23 will cooperate with the top and end walls 37 and 38 to mount the fan on the conditioning chamber 6, but the cover plate will be reversed from the position illustrated in Fig. 1 so that the short flange 40a will be positioned to overlie the top wall and the longer flange 40b will be positioned to overlie the opening in the end wall. Thus the cover plate 40 will cooperate with the conditioning chamber 6 at the sides of the opening 8 to mount the fan 11 for either vertical or horizontal air delivery.

The fan 11 may be arranged to deliver air in other directions at equal angles to the diagonal line A—A by rearranging the position of the cover plate 40 on fan casing 23. However, as the air is delivered to either vertically or horizontally arranged ducts in practically all installations, the arrangement illustrated in Figs. 1 and 2 for vertical and horizontal air delivery is preferred. One form of the invention having now been described in detail the manner of changing the air conditioner for either horizontal or vertical air delivery is explained as follows.

The air conditioner is shipped to the place of installation in a plurality of sections adapted to be quickly assembled into a complete unit with the fan 11 mounted in the conditioning chamber 6 in either one or the other of its two positions. At the place of installation it is determined from the particular conditions, such as the relative location of the conditioner and ducts, as to whether the fan 11 should be mounted for horizontal or vertical air delivery. If the conditioner unit is shipped with the fan positioned for vertical air delivery as illustrated in Fig. 1 and it is necessary to change the position of the fan for horizontal air delivery as illustrated in Fig. 2, the screws 41 are removed from the cover plate 40 and the wheel shaft 30 withdrawn from the wheel 28. To this end the panels 39 are removed, the wheel 28 loosened on the shaft 30 and the shaft withdrawn longitudinally through one of the bearings 31.

The fan 11 is removed bodily from the conditioning chamber 6 through the opening 8 and rotated 180° about the axis A—A from the position shown in Fig. 1 to that shown in Fig. 2 and then reinserted into the conditioning chamber through the opening. The flanges 40a and 40b of the cover plate 40 will overlie the top and side walls 37 and 38 of the conditioning chamber 6, respec-

tively, and the fan is rigidly mounted in position by inserting the screws 41 through the same holes in the cover plate and screwing them into tapped holes in the conditioning chamber. Outlet 12 of the circulating fan 11 will be positioned to deliver air horizontally as illustrated in Fig. 2 and the wheel shaft 30 is reinserted through the wheel 28 and the shaft and wheel connected together for rotation as a unit. The direction of rotation of the wheel 28 must be reversed, preferably by changing the wiring of the electric motor 33 to reverse its direction of rotation.

The duct 9 is connected to the inlet opening 7 of the conditioning chamber 6 and the duct 13 is connected to the outlet 12 of the fan 11. When it is desired to cool the enclosure 10 a cooling medium is supplied to the cooling element 15 and the motor 33 is energized to rotate the fan wheel 28. The fan 11 draws air from the enclosure 10 through the duct 9 and filter 14 into the conditioning chamber 6 and over the cooling element 15 where the air is cooled and dehumidified. The cool air is drawn into the fan casing 23 through the inlet openings 27 and is delivered by the fan wheel 28 to the outlet 12 and delivered through the duct 13 to the enclosure 10. When it is desired to heat the enclosure 10 a heating medium is supplied to the heating element 16. Air is drawn through the duct 9 into the conditioning chamber 6 through the filter 14 and passes over the tubes 20 of the heating element 16 where it is heated. The heated air enters the circulating fan 11 in the manner previously described and is delivered through the duct 13 to the enclosure 10.

It will now be observed that the present invention provides a novel construction and arrangement of elements to adapt the circulating fan to be mounted in the conditioning chamber 6 for either horizontal or vertical delivery of air. It will also be observed that the present invention provides a common means for mounting the circulating fan in a plurality of positions in the conditioning chamber. It will still further be observed that the present invention provides for changing the direction of air delivery by merely removing fan from the conditioning chamber and rotating it bodily about a diagonal axis in the plane of the fan casing and remounting it on the conditioning chamber.

While only a single embodiment of the invention is illustrated and described, it will be understood that modifications may be made in the construction and arrangement of the elements without departing from the spirit or scope of the invention. Therefore, without limiting myself in this respect, the invention is defined by the following claims.

I claim:

1. In an air conditioner, a conditioning chamber having an opening therein, an air directing casing in the conditioning chamber having an outlet duct projecting through the opening and a laterally extending cover plate overlying the conditioning chamber at the sides of the opening, said conditioning chamber and cover plate being so constructed and arranged as to mount said air directing casing in a plurality of positions in the conditioning chamber so that its outlet duct may project through the opening in different directions, common means for attaching the cover plate to the conditioning chamber in any of its plurality of positions, and means to deliver air from said conditioning chamber through said air directing casing.

2. In an air conditioner, a casing forming a conditioning chamber having an opening therein, a centrifugal fan comprising a scroll casing having an outlet duct projecting through the opening in the conditioning chamber, said scroll casing being rotatable bodily about an axis in the plane of its casing to adapt the outlet duct to project through the opening in different directions, and a cover plate on the scroll casing overlying the conditioning chamber at the sides of the opening for mounting the fan casing in the conditioning chamber in either position.

3. In an air conditioner, a casing forming a conditioning chamber having an opening therein, a centrifugal fan having a casing movable into and removable from the conditioning chamber through the opening therein, said casing forming an air outlet projecting through the opening in the conditioning chamber, a cover plate attached to the sides of the fan casing and overlying the conditioning chamber at the sides of the opening, said conditioning chamber and fan casing being so constructed and arranged as to adapt the fan for either horizontal or vertical air delivery by rotating it bodily about an axis in the plane of the casing, and said cover plate cooperating with the conditioning chamber to mount the fan in either position on the conditioning chamber.

4. In an air conditioner, a casing forming a generally rectangular conditioning chamber, an air inlet opening at one end of the chamber, an opening in a corner at the opposite end of the conditioning chamber extending an equal distance on opposite sides of a diagonal line bisecting the corner angle of the chamber, a centrifugal fan having a scroll casing movable into and removable from the conditioning chamber through the opening therein, said scroll casing forming an outlet projecting through the opening and said outlet being adapted for either horizontal or vertical air delivery by rotating the scroll casing about an axis coincident with the diagonal line through the corner of the casing, and a cover plate attached to the sides of the scroll casing and cooperating with the conditioning chamber adjacent the sides of the opening for mounting the scroll casing in either of its two positions.

5. In an air conditioner, a casing forming a generally rectangular conditioning chamber having an air inlet opening at one end and an opening in the top end and walls at the opposite end, a centrifugal fan having a scroll casing and a blade wheel movable into and removable from the conditioning chamber through the opening, said scroll casing forming an air outlet, and a cover plate attached to the sides of the scroll casing and cooperating with the conditioning chamber at the sides of the opening to mount the fan in the chamber with its outlet extending through the opening and the axis of rotation of its wheel positioned equally distant from the top and end walls of the chamber whereby to adapt the fan for either horizontal or vertical air delivery by rotating the fan with respect to the chamber about a diagonal axis normal to the axis of rotation of the wheel.

6. In an air conditioner, a casing forming a generally rectangular conditioning chamber having an air inlet opening at one end and an outlet opening in a corner at the opposite end, said outlet opening being arranged symmetrically on opposite sides of a diagonal line bisecting the corner angle of the chamber, a centrifugal fan having a scroll casing and blade wheel movable

into and removable from the conditioning chamber through the opening, said blade wheel being mounted for rotation on an axis normal to said bisecting line and said scroll casing being asymmetrical with respect to the axis of rotation of the wheel and forming an outlet projecting through the opening in the conditioning chamber, said scroll casing being adapted for either horizontal or vertical air delivery by bodily rotating the scroll casing on an axis coincident with the diagonal line through the corner of the chamber before the casing is inserted into the chamber, and a cover plate projecting from the sides of the scroll casing and cooperating with the conditioning chamber adjacent the sides of the opening to mount the casing for either

horizontal or vertical air delivery and cover the opening at the sides of the fan outlet.

WALTER M. SIMPSON.

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