

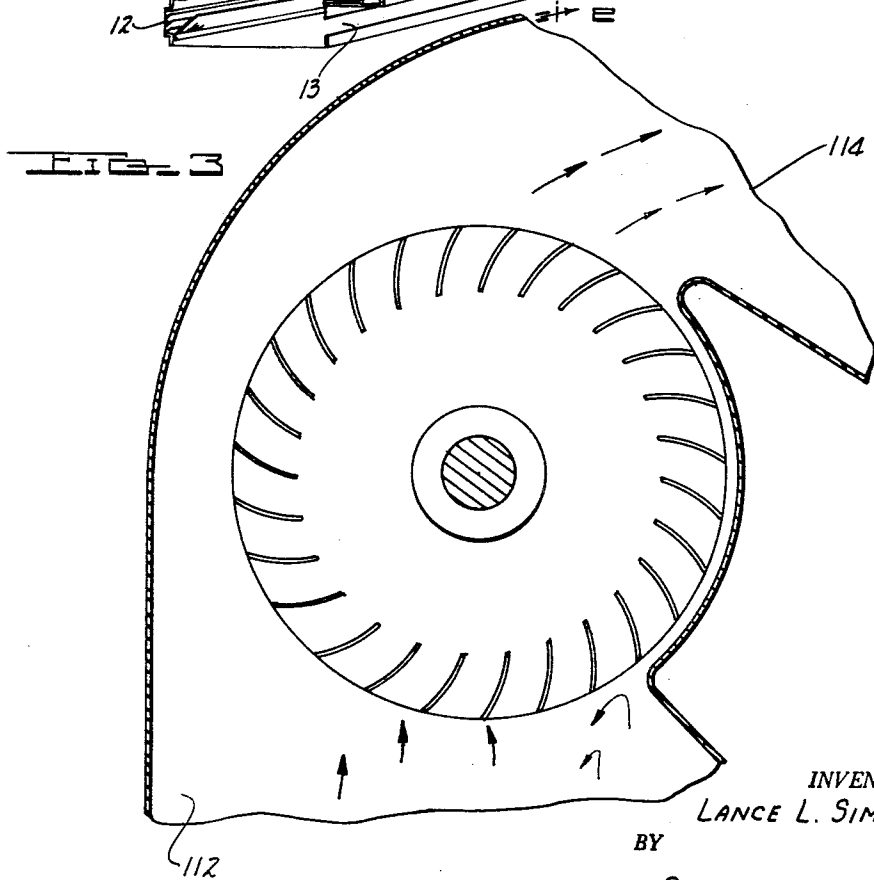
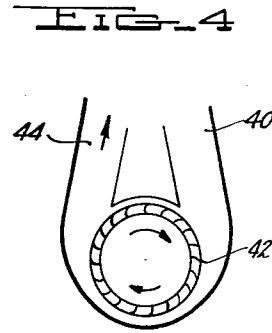
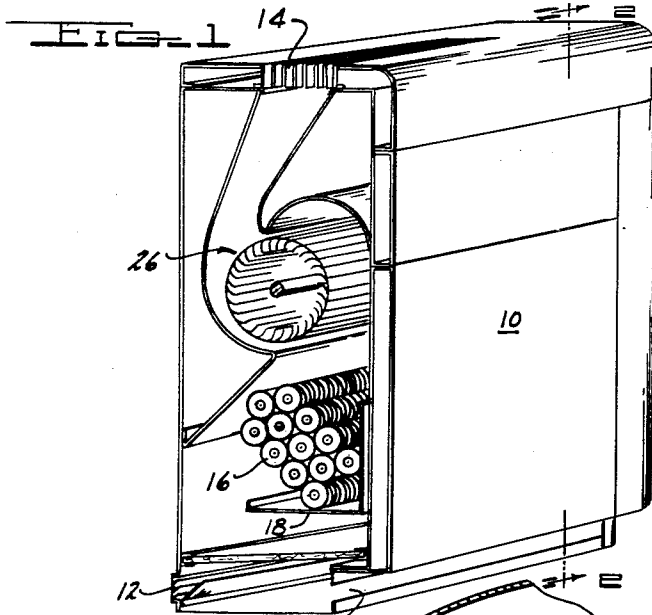
May 22, 1962

L. L. SIMMONS
AIR MOVING UNIT

3,035,760

Filed Nov. 1, 1954

2 Sheets-Sheet 1



INVENTOR.
LANCE L. SIMMONS
BY
SMITH, OLSEN & KOTTS
ATTORNEYS

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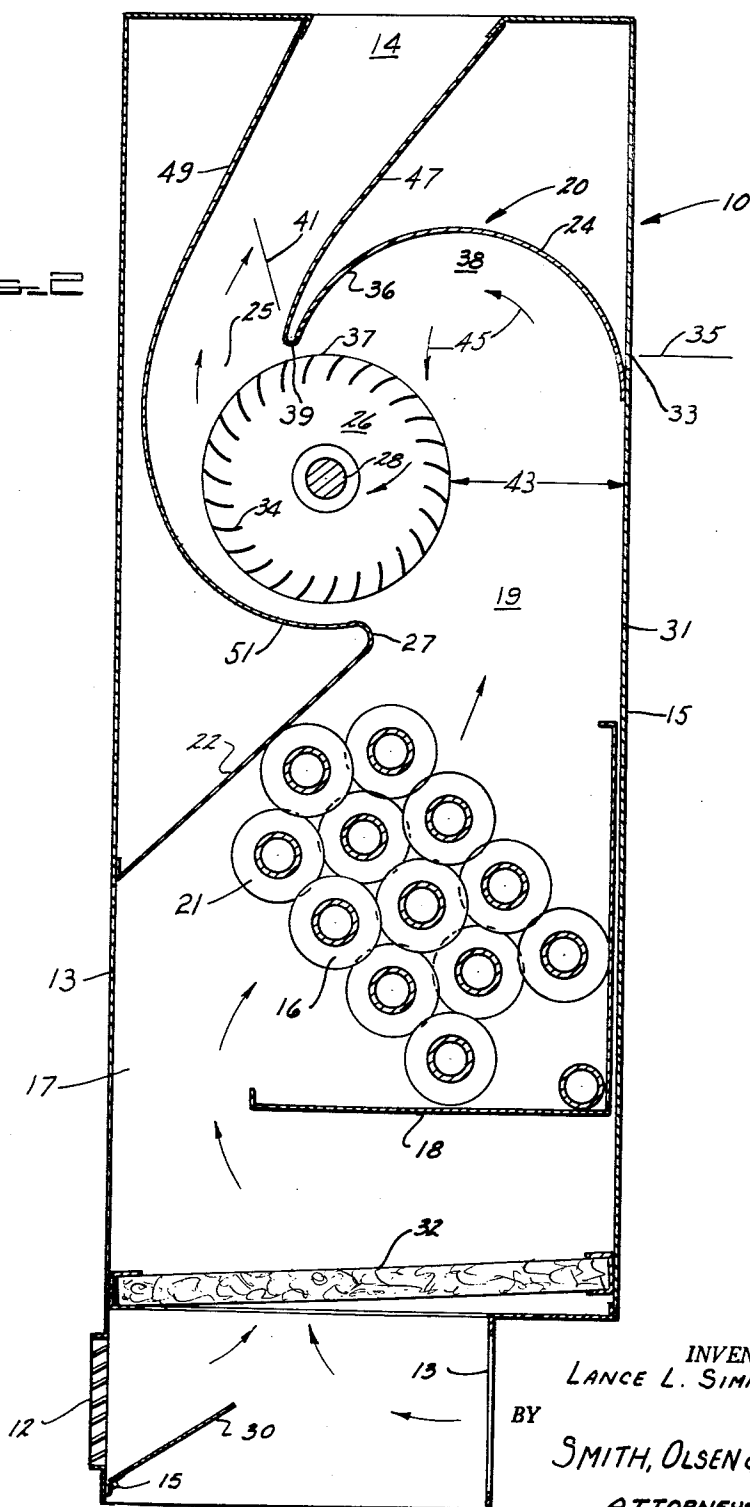
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2 Sheets-Sheet 2

FIG. 2



INVENTOR.
LANCE L. SIMMONS
BY
SMITH, OLSEN & KOTTS
ATTORNEYS

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AIR MOVING UNIT

Lance Lovejoy Simmons, Detroit, Mich., assignor, by mesne assignments, to American Radiator & Standard Sanitary Corporation, New York, N.Y., a corporation of Delaware

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1 Claim. (Cl. 230—125)

The present invention relates to an air moving unit, and in particular to such a unit which includes a peripheral line flow fan of the centrifugal type, said unit being particularly but not exclusively adapted for use in an air conditioner.

Peripheral line flow fans are well known in the art. Such fans are centrifugal fans of the type wherein air is drawn in along the periphery and also discharged along the periphery. Such a fan is shown in Patent No. 1,838,169, dated Dec. 29, 1931, issued to Edward L. Anderson.

All fans generate in the fan wheel velocity pressure and static pressure in varying ratios. When a forwardly curved fan blade is utilized, the ratio of velocity pressure to static pressure has in the past been relatively high, and means must be provided for effectively converting velocity pressure to static pressure. When a backward curved blade is utilized, the ratio between velocity pressure and static pressure is quite low, and conversion of velocity pressure to static pressure is not as critical. The blade designs between these two extremes provide ratios of velocity pressure to static pressure which vary accordingly.

In many applications of a line flow fan, particularly one with a forwardly curved blade design, the overall construction such as shown in the Anderson patent has not produced optimum results. This is particularly true in high pressure systems. The air moving device of the present invention provides a fan chamber and duct which permits the use of a forwardly curved fan blade while still effectively converting velocity pressure to static pressure to produce a suitable ratio.

It is an object of the present invention to provide an air moving unit with a centrifugal fan of the above-mentioned type which is capable of moving more air per unit of power input than has heretofore been considered possible.

It is another object of the present invention to provide a fan chamber for an air moving unit which is so constructed and arranged as to aid in obtaining maximum efficiency of the fan operation.

It is a further object of the present invention to provide an air moving unit including a chamber which efficiently handles air movement with a minimum misalignment of the inlet and outlet of said chamber.

Other objects of this invention will appear in the following description and appended claim, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

FIGURE 1 is a perspective view of a heat exchange unit embodying the present invention with the side cover removed.

FIGURE 2 is a mid-section taken on the line 2—2 in the direction of the arrows, FIGURE 1, but with certain external casing panels removed from the operative components.

FIGURE 3 is a fragmentary sectional view of a conventional prior art fan and chamber.

FIGURE 4 is a schematic view of a theoretical fan chamber design which would provide optimum air flow conditions.

Before explaining the present invention in detail, it

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is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring to the drawings and particularly FIGS. 1 and 2, there is shown an air moving unit of the present invention comprising a housing 10 having an outside air opening 12, a room air opening 13, and a discharge opening 14. The operative components of the unit are shown in FIG. 2, and include a back wall 13, and a front wall 15 extending parallel thereto. Extending between walls 13 and 15 adjacent opposite ends thereof are two end walls, one of which is visible in FIG. 2, as at 17. The other end wall is not visible in the drawing; however it will be appreciated that it extends parallel with wall 17 but adjacent the opposite end portions of walls 13 and 15. The end walls are of course spaced inwardly from the external end panel sections of the heat exchange device for accommodation of such structures as the fan-driving motor and the return bend portions of the heat exchange coils 16.

The fan of the FIG. 1 unit comprises a cylindrical fan rotor 26 having a shaft 28 suitably connected with the fan-driving motor to cause the fan to rotate in the arrow 29 direction. The fan comprises a series of forwardly curved blades 34 extending through substantially the entire distance between end wall 17 and the other end wall (not shown), the arrangement being such that the fluid is taken into the rotor along one portion of its periphery and discharged from another portion of its periphery.

In operation of the FIG. 2 structure, the air is introduced into the unit through room air opening 13 and (if hinged damper 30 is open) through outside air opening 12. The incoming air is directed through a filter 32 which preferably extends the entire distance between end wall 17 and the opposite end wall. The air then passes from filter 32 upwardly around the drip pan 18 and through heat exchange coils 16, said coils having the usual fins 21 thereon for improved heat transfer, and the coils and drip pan extending through the entire space between end wall 17 and the opposite end wall. The air is directed through the coils 16 by a wall 22 which angles from wall 13 toward wall 15 to a termination point 27 located adjacent the rotor periphery. The space between termination point 27 and point 31 on wall 15 defines an entrance throat or opening 19 for the air as it is directed toward the rotor, the arrangement of walls 13, 15 and 22 cooperating with the end wall 17 and the opposite end wall to define a relatively large inlet for the blower unit.

Wall 15 extends upwardly from point 31 to a point 33, where it is connected with an arcuate wall portion 24. It will be noted that the spacing between points 31 and 33 corresponds approximately with the diameter of fan rotor 26. Arcuate wall 24 thus forms a pocket 38 which is located beyond the rotor 26 for causing the air to approach the rotor in a proper direction. In this connection it will be seen that connection point 33 is located in an imaginary plane 35 which extends normal to wall 15 and tangent to the rotor periphery at point 37. The wall portion 24 bulges from point 33 in a substantial arc away from the entrance opening 25 and thence back toward the rotor periphery at 36 to a termination point 39. It will be noted that termination point 39 extends in an imaginary plane 41 extending through point 27 and the axis of rotor 26. By this arrangement an entire one-half of the rotor periphery is exposed to the incoming fluid. It will also be noted that wall 15 is

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spaced from the periphery of rotor 26 by the distance 43, which is somewhat greater than the radius of the rotor. This arrangement cooperates with the disposition of arcuate wall portion 24 and entrance opening 19 to properly direct the incoming fluid into the rotor. Thus, as the fluid passes from coils 16 a substantial portion thereof moves along wall 15 and then into the portion of pocket 38 adjacent wall portion 24. The air is then permitted to turn in the pocket as indicated by arrows 45 so as to approach the rotor in the direction of rotor rotation. A certain percentage of the air of course flows along wall 22 and thence into the rotor adjacent termination point 27. However, a substantial portion of the incoming air flows along walls 15 and 24 as indicated above so as to be properly received into the rotor. The large spacing at 43 is of course instrumental in permitting the air to be received into the pocket 38 and be turned around prior to its entry into the rotor.

The fluid is discharged from the rotor via an exit throat 25 defined by the two laterally spaced outlet walls 47 and 49, end wall 17 and the opposite end wall (not shown). Wall 49 is connected with the inlet wall 22 through a curved wall portion 51 which extends around a portion of the rotor periphery from termination point 27, the arrangement being such that less than one-half of the rotor periphery is exposed to the exit throat.

The fan 26 produces a high ratio of velocity pressure to static pressure. This is particularly true since the blades 34 are the forwardly curved type. The inlet adjacent the fan 26 is substantially larger than the outlet 25 to reduce inlet losses. In addition the pocket 38 formed by wall 24 permits a large portion of the air to approach the fan 26 in a direction tangent to the rim of blades 34 as indicated by the arrows in FIG. 2. It has been found that this is the best direction in which to introduce the air, and under no circumstances should any appreciable portion of the air be introduced at an angle greater than a perpendicular to the tangent.

Theoretically, the most efficient handling of the air would be accomplished with the design shown in FIG. 4 wherein air is introduced through inlet 40 in the direction of travel of the fan 42 and is expelled through outlet 44. Such a design is completely impractical for commercial units such as air conditioners. The design of the present invention approaches the efficiency of the theoretical design while maintaining the other characteristics necessary in a commercial unit.

Referring to a typical prior art fan and chamber construction as shown in FIG. 3, the air is taken in through inlet 112 and is expelled through outlet 114. It will be noted by the arrow indications at the lower right in FIG. 3 that air entering the inlet 112 substantially opposite to the fan blade rotation is given an impact in nearly

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a reverse direction to the direction of final flow. This causes severe energy losses and impairs the efficient creation of proper static pressure.

From the foregoing description, it can be seen that I have devised an air moving unit which has an unusual pressure development and efficiency. There is good stability over all utilizable pressure ranges. This improved structure has transformed a commercially abandoned line flow fan design into a device of substantial application.

Having thus described my invention, I claim:

The combination comprising a casing having first and second parallel walls; a fan rotor located between said parallel walls and having a rotational axis parallel thereto; a third wall angling from one of the parallel walls toward but terminating in spaced relation to the other parallel wall to define a restricted throat at the rotor; a fourth wall extending from the terminus of the third wall around a portion of the rotor periphery and away therefrom to form one wall of an exit throat; said rotor having its periphery spaced a substantial distance from the other parallel wall to cooperate therewith in forming a passage from the restricted throat; a fifth arcuate wall starting from a point on said other parallel wall located on an imaginary plane normal to said other wall and tangent to the rotor periphery at a second point concealed from the first point, and extending in an arc bulging away from said restricted throat and then back toward said imaginary plane to a third point closely adjacent the second point whereby to form an axially extending pocket; a sixth wall angling from said third point toward said other wall and away from the rotor to form another side of the aforementioned exit throat; said rotor being turnable in a direction from the aforementioned second point toward said other wall and being bladed to draw fluid in the direction of its rotation, the arrangement of said fifth wall and the spacing between the rotor and said other wall cooperating whereby entering fluid is caused to travel along said other wall and fifth wall so as to turn and approach the periphery of the rotor in the direction of rotor rotation.

References Cited in the file of this patent

UNITED STATES PATENTS

507,445	Mortier	Oct. 24, 1893
1,823,579	Anderson	Sept. 15, 1931
2,033,273	Buck	Mar. 10, 1936
2,580,535	Feinberg	Jan. 1, 1952

FOREIGN PATENTS

242,076	Germany	Dec. 22, 1911
288,312	Germany	Oct. 27, 1915
807,978	Germany	July 9, 1951