

Jan. 15, 1957

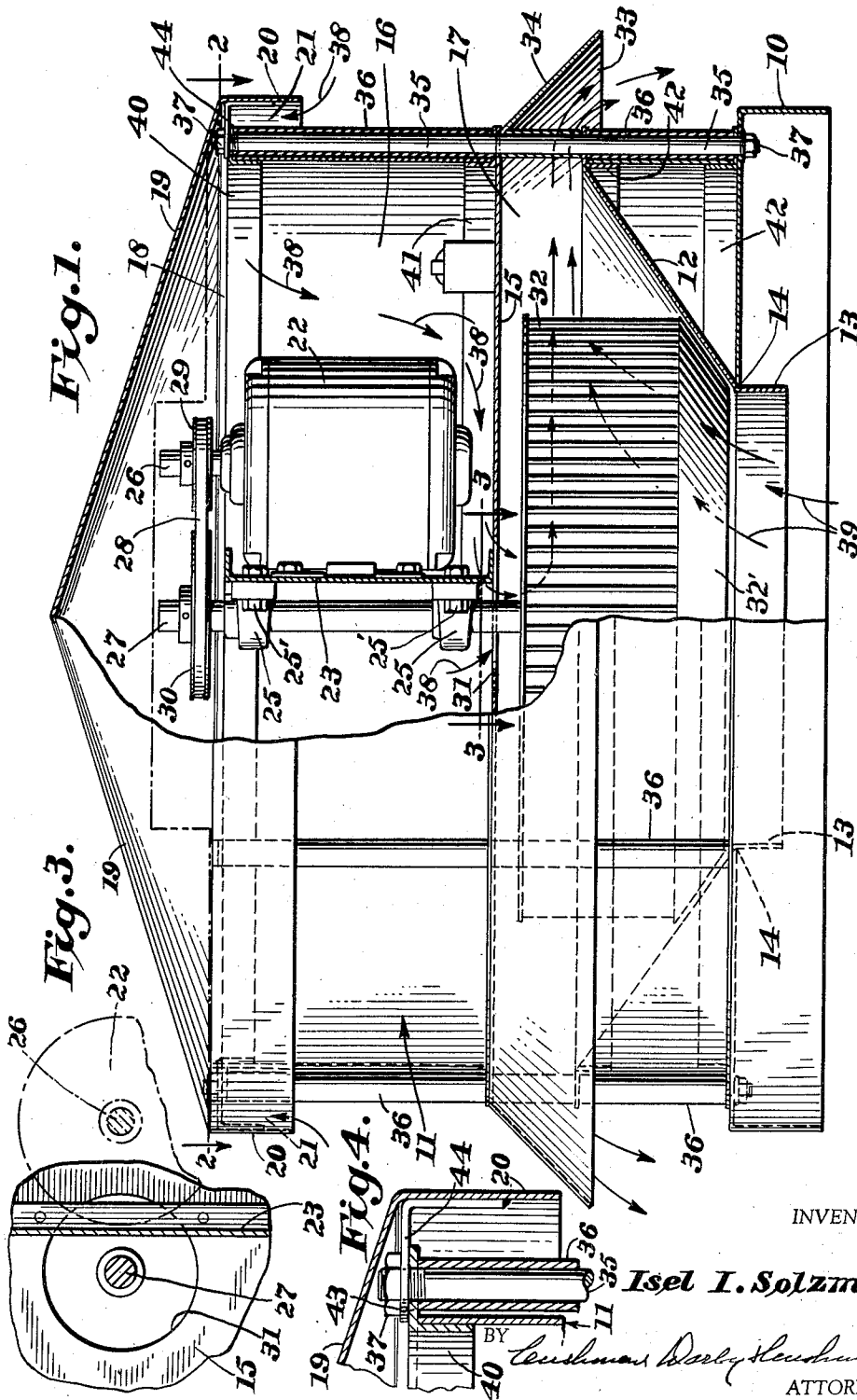
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2,777,382

AIR EXHAUSTER

Filed April 10, 1953

2 Sheets-Sheet 1



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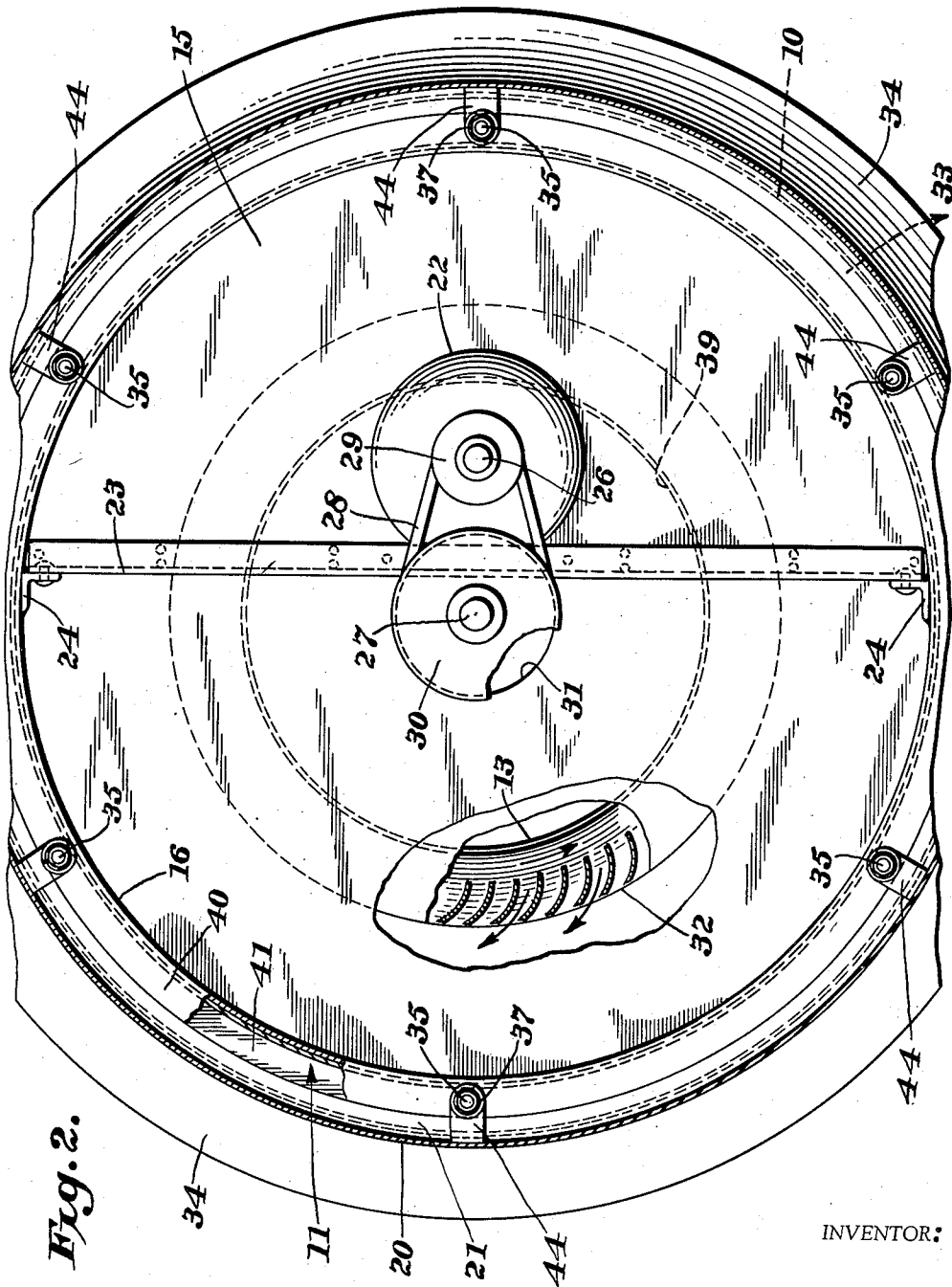


Fig. 2.

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AIR EXHAUSTER

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Application April 10, 1953, Serial No. 347,949

2 Claims. (Cl. 98—43)

The present invention relates to an improved power operated ventilator or air exhauster.

An important object is to provide an air exhauster with separate motor and fan compartments, and in which means are provided for introducing fresh air into the motor compartment for cooling the same. In order to prevent contaminated air from entering the motor compartment or housing, the motor operating shaft connected to the fan extends through a metered opening in a separating plate and means are provided for withdrawing the contaminated air and the fresh air from the fan compartment in such a manner as to prevent any of the contaminated air from entering the motor housings when the exhauster is in operation.

A further object consists in positioning between the outer housing of the air exhauster and the centrifugal fan, a frusto-conical inner housing, which achieves the double purpose of loading the entire fan wheel so that it will do its maximum work in imparting energy to the air, and will also convert to static pressure a portion of the high velocity pressure at the discharge of the fan blades.

Other objects and advantages of the invention will become apparent from the following description when taken in conjunction with the accompanying claims and drawings.

Referring to the drawings in which is shown a preferred embodiment the invention may assume:

Figure 1 is a side elevation with parts in section of a ventilator constructed in accordance with the present invention.

Figure 2 is a sectional view taken substantially along the line 2—2 of Figure 1.

Figure 3 is a detail sectional plan view of the central portion of one of the separating plates, and

Figure 4 is a detail enlarged sectional view of a part of the exhauster.

Referring to the drawing, the ventilator or air exhauster may be of any suitable size and shape, and as shown, includes a metal base or support 10 on which is mounted a cylindrical metal casing generally indicated by the numeral 11 which comprises a lower substantially frusto-conical shaped housing 12 (Fig. 1) having a depending annular portion 13 which extends through a central opening 14 in the base 10. Above the housing 12 a transverse closure plate 15 separates the casing 11 into what will be referred to as an upper motor chamber or compartment 16 and a lower fan chamber or compartment 17. The casing 11 has an open upper end 18 which is covered by a cap or dome 19 having an annular depending skirt portion 20 circumferentially spaced from the adjacent wall of the casing to provide a fresh air inlet passage 21 that communicates with the motor chamber 16. An electric motor or the like 22 is mounted within chamber 16 on a transverse channel bar or plate 23 connected at its opposite ends as at 24 to the inside of the casing 11 (Fig. 1). The plate 23 also carries the vertically spaced bearing blocks 25 secured thereto by the

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bolts 25'. The motor shaft 26 may be connected to the operating shaft 27 in any suitable manner such as by the endless belt 28 that passes over the pulleys 29 and 30 keyed to the shafts 26 and 27, respectively.

The lower end of the operating shaft 27 extends through a centrally disposed metered opening 31 (Fig. 3) in the plate 15 and into the lower chamber 17, so as to be connected to any suitable type of centrifugal fan 32 which is rotatably mounted in the frusto-conical housing 12. The opening 31 may be varied in size to maintain a predetermined ratio between the contaminated air being handled by the exhauster and the fresh ventilation air which is drawn in from above and over the motor into the fan housing. The fan housing 12 is spaced from the transverse supporting plate 15 (Fig. 1) to provide a peripherally disposed discharge outlet 33 which may be provided with an annular hood 34 for deflecting the air downwardly as it discharges from the chamber 17. The casing 11 and the fan housing 12 together with their associated parts are maintained in a fixed position on the base 10 preferably by the retaining threaded bolts 35, which are circumferentially spaced around the ventilator and extend through vertical spacer sleeves 36 so as to be firmly secured to the ventilator at opposite ends by the nuts 37 in order to insure the parts being firmly maintained in a fixed position when assembled. The frusto-conical housing 12 is positioned between the outer housing or casing and the centrifugal fan 32 so as to provide a secondary enclosure for the fan wheel which, as shown, preferably has a diameter of 24" and is larger than the fan wheel disclosed in my Patent 2,526,290. The lower end portion 32' of the fan 32 is tapered, so as to converge downwardly and be spaced from and substantially parallel to the adjacent inclined wall of the housing 12 (Fig. 1), so as to provide a restricted passage therebetween. The tapered portion 32' is positioned directly above the depending annular portion 13 of the housing 12, so as to facilitate or assist the entrance of the air into the housing.

Thus, it will be seen that when the motor 22 is in operation, fresh air is drawn in through the circumferential opening 21 so as to follow the path indicated by the arrows 38 (Fig. 1) and pass through the metered opening 31 around the shaft 27 so as to maintain the motor chamber 16 under negative pressure, due to the rotation of the fan forcing the metered fresh air out of the fan housing into the fan chamber 17. At the same time, contaminated air from the room or building passes upwardly through the inlet 13 of the fan housing 12 in the direction of the arrows 39 (Fig. 1), so that the fresh air from the chamber 16 which has been utilized to cool the motor 22 now mixes with the contaminated air in the chamber 17 and discharges therewith through the discharge outlet 33. Thus, it will be seen that as long as the ventilator or exhauster is in operation, there is no possibility for contaminated air in the room or building entering the motor housing 16, since the speed of rotation of the fan 32 prevents any flow of the contaminated air into the chamber 16 and causes this air to be discharged through the outlet 33 in the manner as previously described. The size of the opening 31 is such as to constitute a metered or restricted orifice in order to provide an air curtain around the shaft 27 so as to effectively seal off the chamber 16 from the contaminated air passing through the chamber 17. The metered opening 31 is of such a diameter or size as to control the total capacity of the air drawn from the motor chamber 16 downwardly therethrough and around the shaft 27 into the fan chamber 17. Thus, it will be seen that by varying the size or diameter of the opening 31, means are provided for regulating the proportion of the total fan capacity of fresh air which is drawn downwardly into the fan chamber 17 as compared to

the contaminated air which is drawn upwardly through the inlet 13 that mixes with the air from the chamber 16 prior to the discharge through the exhaust 33. By reason of this proper control of the amount of clean air being drawn through the motor chamber 16 into the fan chamber 17, means are provided for handling high temperature air by the exhauster without this high temperature air entering the motor chamber 16. Thus, it will be seen that if the size of the metered opening 31 is increased, so as to draw more clean, cool air around the motor 22 and into the fan chamber 17, air at higher temperatures can be handled without danger of damaging the motor 22 or the drive shaft 27 by this heated air being brought into contact therewith. Further, by reason of this novel arrangement of parts, contaminated air carrying acid fumes or similar contaminants, can be treated by the exhauster, and where the concentration of the contaminated air is heavy, the size or diameter of the metered opening 31 can be increased so as to obtain the desired proportion of fresh air to pass through the chamber 16 into the chamber 17 in order to insure proper protection for the motor 22, shaft 27 and the bearing members 25.

The cone-shaped housing 12 is associated with the centrifugal fan 32 so as to obtain the desired scroll effect. In other words, the housing 12 provides means for converting a portion of the high velocity air as it issues or is discharged from the fan 32, to static pressure. In this connection, it might be mentioned that without this scroll effect a centrifugal fan is incapable of developing static pressure. Accordingly, in the conventional housed centrifugal fan, this result is obtained by logarithmic housing. Substantially, the same results are obtained by reason of the cone-shaped housing 12. Consequently, the shape of the housing 12 is primarily for the purpose of developing static pressure for insuring the efficient operation of the exhauster. Thus, it will be seen that simple, efficient and economical means are provided for cooling the motor and preventing contaminated air from entering the same, and which also eliminates the need for special winding or explosion-proof motors.

The upper and lower ends of the motor chamber 16 are connected to angularly spaced rings 40 and 42 while the upper and lower ends of the fan chamber 17 are similarly connected to spaced angulated rings 42. The upper ring 40 has a horizontal flange 43 provided with an opening for receiving the bolts 35 (Fig. 4). The other rings have similarly formed openings for receiving the bolts when the parts are assembled. Circumferentially spaced angle brackets 44 have their vertical arms suitably connected such as by welding to the inner side of the skirt 20, and their horizontal arms provided with openings through which the bolts 35 extend so as to detachably connect the cap 19 to the housing 11 when the nuts 37 are applied to the bolts. The frusto-conical shaped housing 12 for the fan 32 is so shaped as to approximate the static pressure curve of the fan 32 so as to allow the same to develop considerable static pressure by converting the high velocity air being discharged from the tip of the fan blades into static pressure. The energy thus developed allows the unit to operate against considerable static pressure. The ventilator is composed of a minimum number of parts which are readily detachable and may be assembled at a minimum expenditure of time, labor and cost.

It will be understood that the form of the invention shown is merely illustrative of a preferred embodiment, and that such changes may be made as come within the scope of the following claims.

I claim:

1. An air exhauster of the class described including an outer casing having an open upper end, said casing being separated by a transverse plate into an upper chamber and a lower chamber, said plate having a central restricted, metered opening communicating said chambers with each other, an operating shaft revolvably mounted in said upper chamber and extending through said central opening into said lower chamber, a centrifugal fan in said lower chamber and connected to said shaft, a motor in said upper chamber, means for connecting the motor to said operating shaft, a cover closing the upper end of the casing and spaced therefrom to provide an opening for introducing fresh air into the upper chamber to cool the motor, said fan having a cylindrically and inwardly tapered lower end portion, a substantially frusto-conical shaped inner housing mounted in the lower chamber and enclosing said fan, said housing having an upwardly diverging portion spaced from said transverse plate and coacting therewith to provide a mixing passage, said inner housing having a depending circular lower end portion positioned beneath said fan, the converging inclined portion of said fan being spaced from the adjacent inclined side of the housing and disposed substantially parallel therewith to form a restricted angular passage therebetween, and said lower chamber having a circumferentially disposed outlet communicating with said mixing chamber, said frusto-conical housing coacting with the fan to load the entire fan wheel so that it will do its maximum work in imparting energy to the air, said inner housing also converting a portion of the high velocity pressure at the discharge of the fan to static pressure.

2. An air exhauster of the class described including a casing having an opened upper end, said casing being separated by a transverse plate into an upper chamber and a lower chamber, said plate having a central, restricted, metered opening communicating said chambers with each other, a centrifugal fan in said lower chamber, a motor in said upper chamber, means extending through said opening for operatively connecting the motor to said fan, a substantially frusto-conical shaped inner housing in the lower chamber and encircling said fan, said inner housing having a depending parallel lower end portion positioned beneath the fan, the upper end portion of said inner housing being spaced from said transverse plate and coacting therewith to provide a mixing passage, said lower chamber having a circumferentially disposed discharge opening extending around the outer periphery thereof, said opening communicating with said passage for withdrawing the air therefrom, said frusto-conical housing coacting with said fan to convert a portion of the high velocity pressure at the discharge opening of said fan to static pressure and said fan having an inwardly tapered lower end portion spaced from and substantially parallel with the adjacent inclined wall of the inner housing for facilitating the passage of the air upwardly through the exhauster.

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