

Nov. 3, 1942.

E. T. WARD

2,300,475

VENTILATING DEVICE

Filed April 24, 1939

2 Sheets-Sheet 1

Fig. 1.

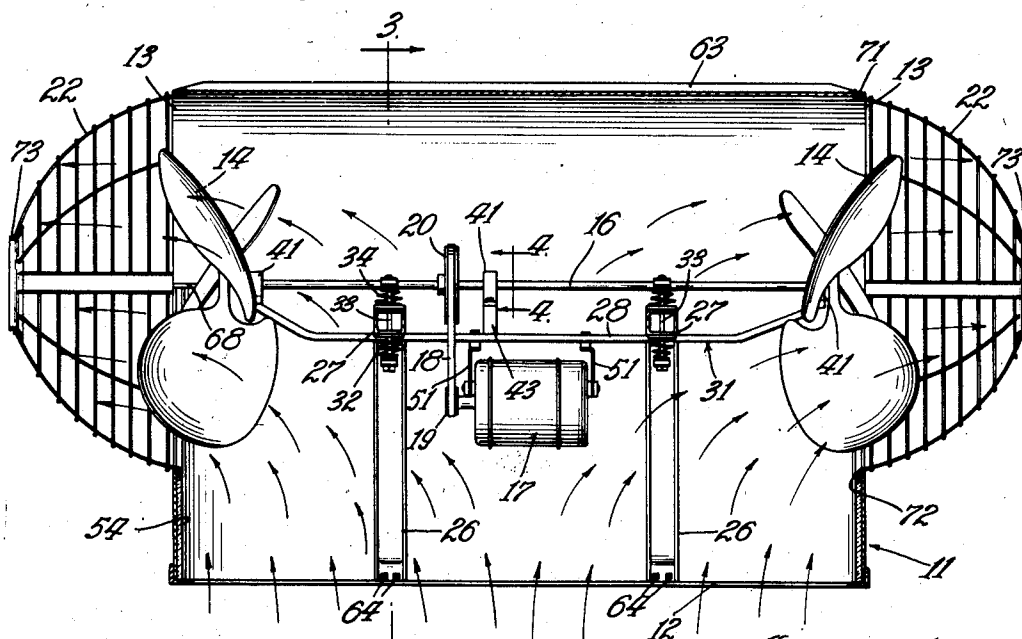
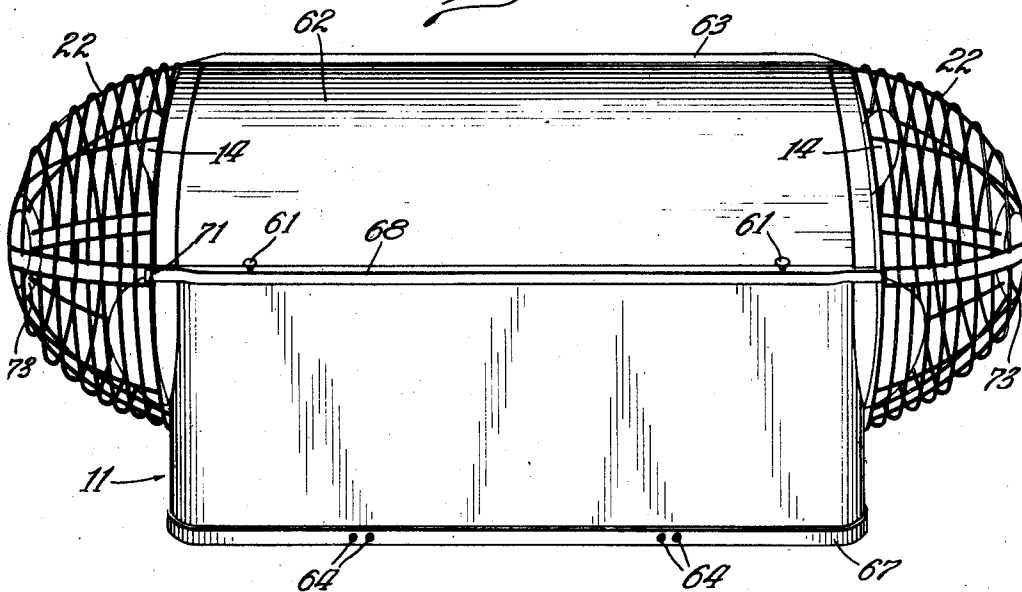


Fig. 2.

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Fig. 3.

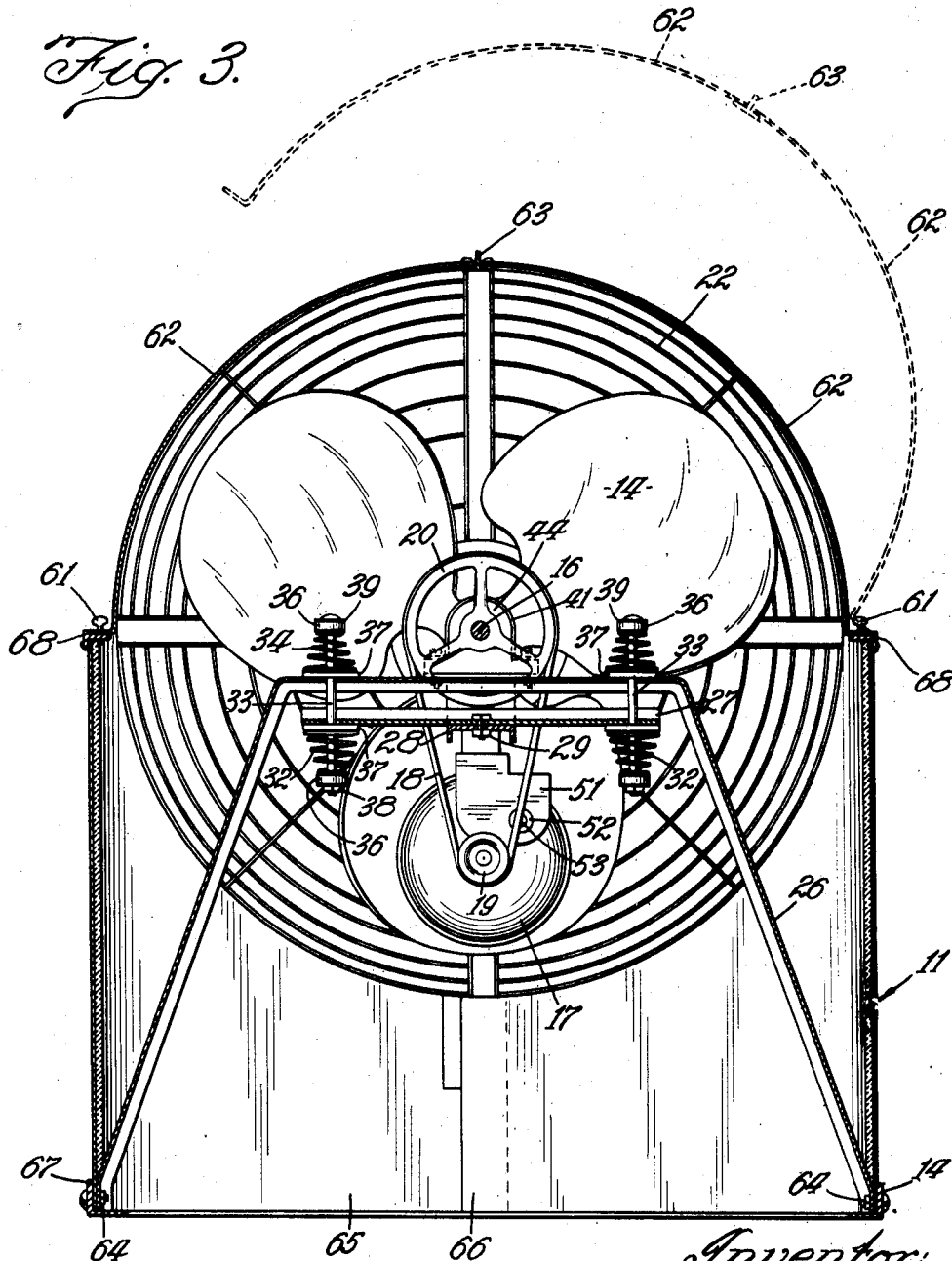
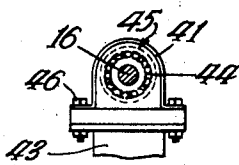


Fig. 4.



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UNITED STATES PATENT OFFICE

2,300,475

VENTILATING DEVICE

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12 Claims. (Cl. 98—43)

My invention relates generally to ventilating units, but more in particular to ventilating units adapted to draw a large volume of air out of a room or building.

Some aspects of the invention relate especially to central ventilating units that are adapted to be installed in houses or buildings that have already been erected. It has been found to be most satisfactory to place such units near the top of a house so as to draw out the hottest air in hot weather and also to lessen the difficulty of forcing the air against its normal upward direction of movement. By placing a ventilating unit in an attic window, air is apt to be drawn through possible openings under the cornices thereby reducing the quantity of air drawn up from the lower floors of the house. It has therefore been found most satisfactory to install the ventilating unit over a passage or cut-out portion through the top ceiling of the house, which in the ordinary home is the ceiling for the second floor. However, units of this type prior to my present invention have been similar to portable ventilating fans, and it has been necessary to construct a plenum chamber connecting said cut-out portion and the fan itself so that the air may be drawn more efficiently through a limited passage. This obviously entails further bother and expense to the owner.

A central ventilating unit of the type referred to above must of necessity have a great drawing power in order to accomplish its purpose in effectively drawing air up from the lower floors of the house in which it is installed. When only one propeller is used in such a unit, it has to be of relatively enormous proportions to draw the desired quantity of air. A propeller of this size requires a great deal of space, and in order to prevent undesirable noise and vibration the single propeller is rotated at a relatively slow speed.

An object of my invention is to provide an improved ventilating unit.

Another object of my invention is to provide a relatively compact ventilating unit which will move a large volume of air and yet operate substantially without objectionable noise or vibration.

A further object of my invention is to provide a ventilating unit which will have a greater drawing power than similar units heretofore employed.

A still further object of my invention is to provide a self-contained, portable, ventilating unit which may be easily dismantled, which may be passed through an ordinary trap door and which

may be used even where the available space is low.

One of the features of my invention is to provide a pair of oppositely facing propellers mounted on a shaft common to both, thus eliminating end thrust and obtaining a reduction of dimensions and increase in efficiency that would not be possible otherwise.

A further feature of my invention is to provide a ventilating unit having an inexpensive yieldable mounting for its moving parts to arrest possible objectionable vibration transmission.

Further objects and features of my invention will be apparent from the following detailed description taken with the drawings, in which:

Fig. 1 is a perspective side view of my invention.

Fig. 2 is a longitudinal vertical sectional view of the structure shown in Fig. 1.

Fig. 3 is an end transverse sectional view taken approximately on the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary sectional view showing one of the driven shaft mountings and taken approximately on the line 4—4 of Fig. 2.

In practicing my invention, I provide a self-contained ventilating unit which is generally adapted for home use, although it is understood that my unit may be employed for any suitable purpose pertaining to forced-draft ventilation.

The illustrated form of the ventilator includes a housing 11 having a large and generally rectangularly shaped inlet 12 at the bottom thereof and a pair of outlets 13, one at each end of the housing. In or adjacent each of the outlets 13 is a fan 14, the two fans 14 being mounted on one shaft 16 which is driven by a motor 17 through belt 18 and pulleys 19 and 20. The ventilator has also been shown provided with grill-like guards 22, although these may be dispensed with when the ventilator is so located that guards are not necessary.

Inasmuch as the ventilator is adapted for use in homes where it will be in operation close to people who are sleeping, extreme quietness is very important. For this reason, high speed fans which move a large volume of air with a single relatively small blade are not satisfactory and it has been the practice heretofore to use a large fan rotating at relatively low speed. According to the present invention an equal or even greater volume of air is moved with a smaller and more economical ventilator by the use of two fans mounted on a single shaft and blowing the air from opposite ends of the ventilator. The use of two fans on a single shaft not only provides an

efficient arrangement for utilizing one motor for two fans, but it has various other advantages as well, chiefly in connection with mounting and sound-deadening simplifications.

As seen best in Figs. 2 and 3, the entire fan assembly is supported by two spaced channel irons 26 which are generally of an inverted U-shape and are secured at their bottom ends to the housing 11. Below the top portion of each of the channel irons 26 is supported a channel-shaped crossbar 27 to which is secured an elongated and specially shaped channel bar 28 which may be rigidly secured to each of the crossbars 27 as by means of a nut and bolt 29, as seen in Fig. 3. The structure comprising the crossbars 27 and the channel bar 28 together make up a frame which may be designated in its entirety by the numeral 31. The frame 31 is suspended from the channel irons 26 by a spring mounting construction, as seen best in Fig. 3. Each of the crossbars 27 rests on a pair of springs 32, one at each end of the crossbar 27, and each of the springs 32 is supported by a bolt 33 which in turn rests on an upper spring 34 resting on the channel iron 26. Rubber washers 36 separate the bolts 33 from the springs 32 and 34, and rubber washers 37 separate the springs 32 and 34 from the crossbars 27 and the channel irons 26 respectively. Thus, as seen in Fig. 3, the bolt 33 passes through a washer 36, spring 34, an oversize hole in channel iron 26, an oversize hole in crossbar 27, through the second washer 37, through spring 32, the lower washer 36 and into the nut 38 which is screwed thereon. Of course, metal facing washers 39 may be provided between the washers 36 and the nut 38 or the head of bolt 33. The springs 32 and 34 absorb any large amplitude vibration of the frame 31 so that this vibration is not transmitted to the channel irons 26. Likewise, the rubber washers 36 and 37 absorb any sound vibrations which would be transmitted by the springs 32 and 34. The springs 34 are preferably slightly heavier than the springs 32. Any suitable means may be provided for keeping the bolts 33 approximately centered within the holes through which they pass, as, for example, by providing the various rubber washers with pre-formed collars extending into these holes.

As seen best in Fig. 2, the longitudinal member 28 extends upwardly at its ends, at each of which is secured a bearing block 41, through which the shaft 16 rotates. The fans 14 are secured at the ends of the shaft outside of the bearing blocks 41. The pulley 20 is secured on a mid-point of the shaft and near it is positioned a third bearing block 41. This bearing block 41 is secured to a pedestal 43 which in turn is rigidly secured to the longitudinal channel bar 28. Each of the bearing blocks 41 comprises a rubber housing or pillow 44 secured in place by bolts 46. Within the rubber housing or pillow 44 is an oilless ball bearing assembly 45 to permit the shaft 16 to rotate with a minimum of friction. The pedestal 43 is of such height that the three bearing blocks 41 will be accurately aligned when the apparatus is in operation, but it should be noted that one of the advantages of the use of the rubber pillows 44 is in their self-aligning characteristic. Because of resiliency of the rubber, the bearings will accommodate themselves to correct that slight imperfection of alinement which is substantially inevitable and which in rigid bearings can only be approximately avoided by very accurate machining.

The motor 17 is secured by two brackets 51 which in turn are secured to the longitudinal channel bar 28, either rigidly or with rubber spacers for sound deadening. The mounting of the motor 17 on the brackets 51 is best seen in Fig. 3. A rubber grommet 52 is inserted in a hole in each bracket 51, and a pin 53 pivots within the grommet, being screwed or otherwise secured to the housing of motor 17 at an eccentric position thereon. As viewed in Fig. 3 the rotation of the motor is in a counter-clockwise direction. On initial starting of the motor the pulley 19 tends to climb that portion of the belt to the left of the pin 53, as also viewed in Fig. 3, to in turn pivot the motor 17 upwardly about the pin 53. This cooperating action of the belt and pulley, when the motor is initially started, reduces the tension in the belt 18 and also the starting torque on the motor. After the initial starting torque has been overcome the weight of the motor 17 tends to swing the motor downwardly about the pin 53 as an axis, thus tending to tighten the belt 18 to its position shown in Fig. 3. The weight of the motor automatically keeps a satisfactory tension on the belt 18 so that no adjustment for tightening the belt is necessary.

From the foregoing it is seen that sound is deadened close to each of the sources of sound, namely the bearings and motor, and that any sound which passes the initial deadening means, namely the grommets 52 and the rubber pillows 44, or any sound which is created by a vibration of the carriage 31 as a whole, will be deadened between the carriage 31 and the channel irons 26 because of the use of springs 32 and 34 and the rubber washers 36 and 37. Of course, it is important to use a quiet type of fan such as the wide-bladed fans illustrated, and in order to have a large flow of air at a low speed of rotation these fans are of a steep pitch. Furthermore, the housing 11 is lined with sound-insulating and deadening material 54 which not only tends to absorb sound striking it but also tends to deaden any vibration of the metal housing 11. As a further means of reducing sound, the rotating parts are very carefully balanced. To this end, for example, the pulleys 19 and 20 are not the ordinary pressed steel pulleys but instead are cast-iron pulleys which are carefully balanced by drilling holes in the heavy side thereof. In addition, the entire ventilator unit may be mounted on rubber which may be in the form of strips of rubber surrounding the hole above which the unit is placed.

Although the illustrated ventilators make a complete and very compact unit, it will sometimes, if not usually, be desirable to assemble them at the point of use. Sometimes, in fact, they will have to be passed through an opening which is just barely large enough for a man to pass through and it is therefore desirable that the ventilator be such that it can be shipped in small parts and readily assembled into the complete unit. To this end the major portions are separable by bolts. Thus, the upper half of the housing 11 is in the nature of a cover which may be removed simply by unscrewing the thumb screws 61, and in addition this cover is made of two portions 62 secured to a T-bar 63 from which at least one of the portions may be easily released. The fans may be removed from the shaft 16 by loosening set screws, not shown, and the shaft 16 with its bearings and pulley 20 may be removed by loosening the bolts 46 which secure the bearing blocks 41 in place. The lon-

gitudinal channel bar 28 may be removed by unscrewing the nuts and bolts 29, and the spring mounting assemblies each comprising a channel iron 26 and a crossbar 27 may be removed simply by unscrewing nuts and bolts 64 which secure the channel irons 26 to the housing 11. As a matter of fact, it will not ordinarily be necessary to separate the shaft 16 from the longitudinal channel bar 28 since merely by loosening the bolts 64 and 29 the spring mounting assemblies can be separated from the longitudinal bar 28 and shaft 16, making three units each of which is of a nature to pass through any opening that a man can pass through. The main portion of the housing 11 may in turn be taken apart since it is formed of two portions 65 which telescope at 66 and which are secured together by suitable bolts, not shown, near the telescoping joint. Each of these main portions of the housing is preferably reinforced along its bottom edge by an angle iron 67 and along its top edge by another angle iron or T-iron 68 on which the cover sections 62 rest. The lower flange or angle iron 67 may be drilled with holes for screwing the ventilator unit to the ceiling or floor structure on which it rests.

It should be noted that if guards 22 are provided they are preferably removable by springing the bent ends 71 out of the holes in T-irons 63 and 68 and flanges 72 into which they are sprung to secure the guards 22 in place. Each of these guards is preferably separable into two or four sections. The sections may be bolted together or all bolted to rings 73.

By a reverse of the procedure outlined, the parts may be assembled together in the complete unit.

From the foregoing it is seen that a ventilator is provided which, although readily disassembled and assembled for passage through small openings, forms a complete unit for placing over a suitable ventilating opening, as in an upper ceiling of a home. Furthermore, the unit is extremely simple, inexpensive, compact and quiet, this combination of desirable qualities being obtained largely through the use of two oppositely disposed fans on a single shaft driven by a single motor with the entire moving structure spring-mounted and with sound-deadening in conjunction with the spring mounting and adjacent the various rotating parts.

The disclosures of this application are illustrative and the invention is not to be limited by them. In fact, if modifications or improvements are not at once obvious, they may be devised in the course of time to make additional use of the broad ideas taught and covered by this application. The claims are intended to point out novel features and not to limit the invention except as may be required by prior art.

I claim:

1. A substantially silent ventilating unit adapted to be secured over an opening in the ceiling of a building for drawing large quantities of air from the portion of the building below the ceiling, including a housing having an opening adapted to fit over a ceiling opening, a frame carried within the housing, a rotatable shaft, bearings carried by the frame for rotatably supporting said shaft, a pair of oppositely pitched propellers carried by the shaft and positioned adjacent additional openings in the housing, a motor carried by the frame and connected to drive the shaft, and sound-deadening means in-

cluding rubber mountings for the bearings, rubber support means for the motor, spring support means for permitting the frame to vibrate without vibrating the housing, sound-insulating means in association with the springs to prevent the transmission of sound through the springs, and a sound-deadening lining on the housing.

2. Compact ventilating apparatus for moving large volumes of air through a ceiling opening, including a housing readily separable into small parts to permit its passage through a small opening, and when assembled, having an opening substantially over the entire base thereof adapted to fit over the ceiling opening and a pair of spaced end openings, and air-moving apparatus movably secured within the housing including transverse frame members separable from the housing, a longitudinally extending frame assembly separable from the transverse members, means including yieldable members supporting said frame assembly on said transverse members and acting to absorb vibration in said frame assembly, a horizontal shaft mounted on said assembly, a motor for driving said shaft carried on said longitudinally extending frame assembly, and a pair of oppositely pitched propellers on the shaft at separated points thereon adjacent said openings, said motor being disposed over said housing opening intermediate said end openings, the two propellers providing for a flow of air through said opening, and about said motor for a suitable cooling thereof, whereby to condition said motor for moving a relatively large volume of air.

3. Substantially silent ventilating apparatus adapted to be secured over an opening in the ceiling of a building for drawing large quantities of air from the portion of the building below the ceiling, including a housing having an opening adapted to fit over a ceiling opening, a frame carried within the housing, a shaft rotatably carried by the frame, a pair of oppositely pitched propellers carried by the shaft and positioned adjacent openings in the housing, a motor carried by the frame and connected to drive the shaft, and sound-deadening means including rubber mountings for the bearings of the shaft, rubber support means for the motor, spring support means for permitting the frame to vibrate without vibrating the housing, sound-insulating means in association with the springs to prevent the transmission of sound through the springs, and a sound-deadening lining on the housing, said propellers being substantially similar except for the opposed pitch whereby their thrusts balance one another rendering said shaft free from noise attributable to end-thrust and said spring support means free from the strain which would be attributable to end-thrust of the shaft.

4. A ventilating unit including a housing having a first opening and having twin openings at opposite ends of the housing, an elongated shaft within the housing and having spaced oppositely-pitched propellers secured thereon near each end thereof and positioned approximately in the twin openings, and a motor for driving said shaft and said propeller, a frame resiliently supported from the housing for supporting jointly said shaft, propellers and motor, to permit vibration of the frame without the transmission of sound to the housing.

5. A ventilating unit including a housing having a first opening and having twin openings at opposite ends of the housing, an elongated shaft

within the housing and having spaced oppositely-pitched propellers secured thereon near each end thereof and positioned approximately in the twin openings, and a motor for driving said shaft and said propeller, a frame resiliently supported from the housing for supporting jointly said shaft, propellers and motor, to permit vibration of the frame without the transmission of sound to the housing, and sound-deadening means on the frame for carrying each said motor and said shaft tending to prevent the transmission of sound to the frame.

6. Air-moving apparatus including a housing having an inlet opening adapted to be fitted over an air duct opening and having spaced outlet openings, a shaft within the housing, means for driving the shaft, a pair of spaced-apart air movers rigidly mounted on the shaft each adjacent an outlet and adapted to expel air through said outlet upon rotation of the shaft, a skeleton frame for supporting both the driving means and the shaft with its air movers, and resilient supporting means for supporting the frame from the housing and for preventing the transmission of sound from the frame to the housing.

7. Ventilating apparatus including a housing having an opening adapted to fit over an opening in an air duct, a frame resiliently carried within the housing, a shaft rotatably carried in bearings carried by the frame but separated therefrom by sound-deadening means, a pair of oppositely pitched propellers carried by the shaft and positioned adjacent additional openings in the housing, and a motor connected by a belt and pulleys to drive the shaft and supported from the frame by pivotal means eccentric of the motor axis and mounted in rubber whereby transmission of sound from the motor to the frame is diminished and the weight of the motor serves to tighten the belt.

8. A ventilating unit having a single compartment and including a housing therefor with a bottom portion and having outlets at opposite ends thereof and an inlet intermediate said outlets and disposed substantially over the entire bottom portion of said housing, a horizontal shaft in said compartment having a propeller secured thereon near each end thereof and positioned approximately in the outlets, a motor for driving said shaft disposed over said inlet in said compartment, said propellers being adapted to effect an air flow over the complete cross section of said inlet, whereby to cool said motor and to provide for an efficient movement of air through said housing and frame means within said housing supporting said shaft, propellers, and motor in an assembly above said inlet and spaced therefrom so as not to impede air flow into said housing over the entire inlet cross section, said frame means including relatively thin frame members extending away laterally and downwardly from said assembly to the bottom portion of said housing at the sides of said inlet so as not to obstruct said inlet.

9. Air moving apparatus including a housing having an inlet opening at one side thereof extending substantially over the entire side thereof, and an outlet opening in a side thereof substantially at right angles to said one side, an air mover within said housing at said outlet opening

and displaced from said inlet opening, means for driving said air mover, first frame means supporting said air mover and driving means, second frame means supported on said housing substantially rigid with respect thereto and including a portion extending substantially transversely of the housing, and means yieldably supporting said first frame means from said second frame means including spring means above said transverse portion in axial alignment with spring means below said transverse portion with both of said spring means being under compression and equally stressed by said first frame means.

10. Ventilating apparatus including a housing having an opening adapted to fit over an opening in an air duct, a frame carried within the housing, a horizontally extending shaft rotatably supported on said frame, a pair of propellers carried by said shaft and positioned adjacent additional openings in the housing, a motor having a shaft in vertical co-planar relation with said propeller shaft and substantially parallel thereto, means including belt means operatively connecting said two shafts, with said belt means having straight portions thereof on opposite sides of said vertical plane, and means pivotally supporting said motor downwardly from said frame including axis means arranged in substantially parallel relation with said two shafts and to one side of said vertical plane, with said axis means being above said motor shaft, and the weight of the motor acting to tension said belt means, said motor shaft being rotated in a direction such that on starting of said motor the motor shaft travels upwardly on the portion of said belt means to the other side of said vertical plane to in turn pivotally move said motor upwardly about said axis means to initially reduce the tension in said belt means and the starting torque on said motor.

11. A ventilating unit including a housing having an opening at each end thereof, frame means within said housing including transverse frame members, a frame member extending longitudinally of said housing, means resiliently supporting said longitudinal frame member on said transverse frame members, a horizontal shaft having a propeller secured thereon near each end thereof, with each propeller being positioned at a corresponding one of said openings, means including resilient means rotatably supporting said shaft on said longitudinal frame member, a motor for driving said shaft carried by said longitudinal frame member, and means including a flexible belt connection for operatively connecting said shaft and motor.

12. A ventilating unit including a housing having an inlet opening in one side thereof and an outlet opening at each end thereof, a horizontal shaft within said housing having a propeller mounted near each end thereof for positioning within a corresponding one of said outlet openings, a frame supported within said housing, yieldable means carried by said frame for rotatably supporting said shaft, a motor within said housing for driving said shaft, resilient means yieldably supporting said motor on said frame, and means including a flexible driving connection operatively connecting said shaft and motor.

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