

July 6, 1954

K. J. WAHLBORG
ELECTRICALLY DRIVEN FAN

2,682,826

Filed June 25, 1945

4 Sheets-Sheet 1

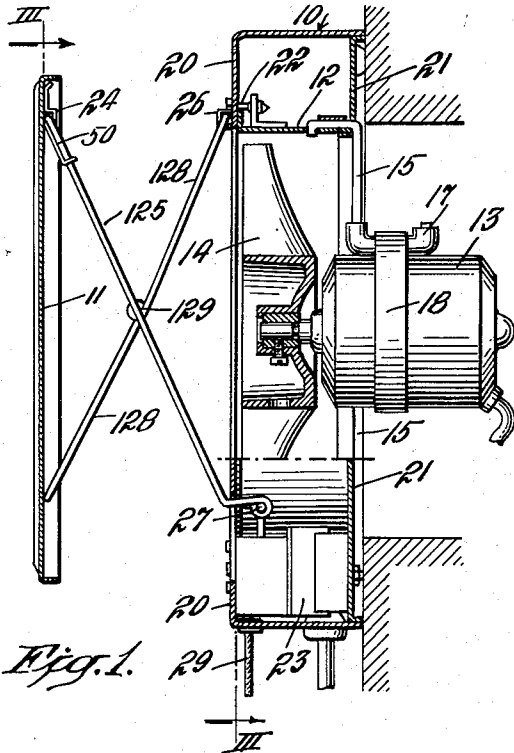


Fig. 1.

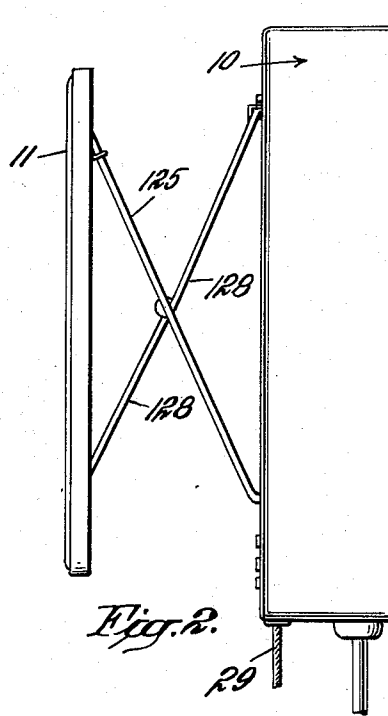


Fig. 2.

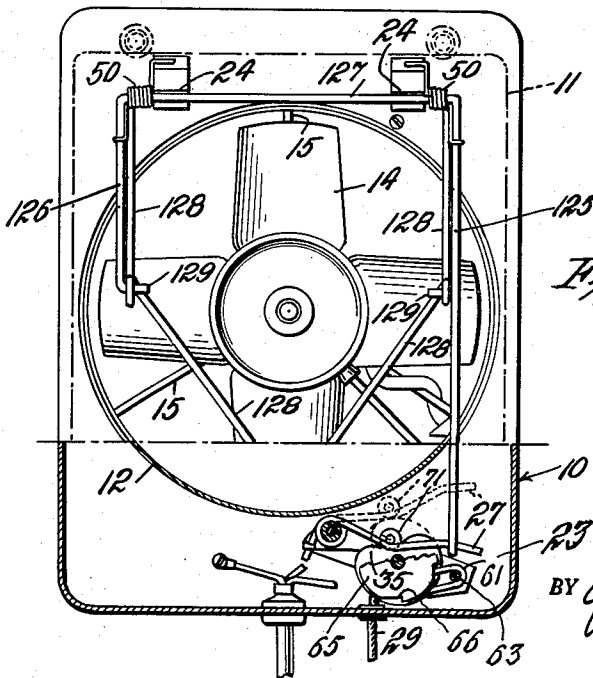


Fig. 3.

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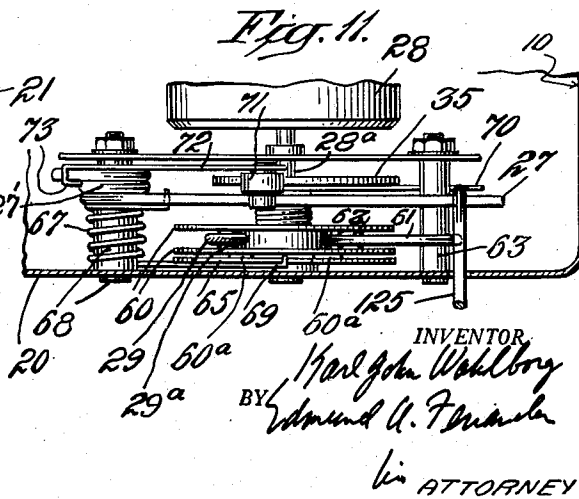
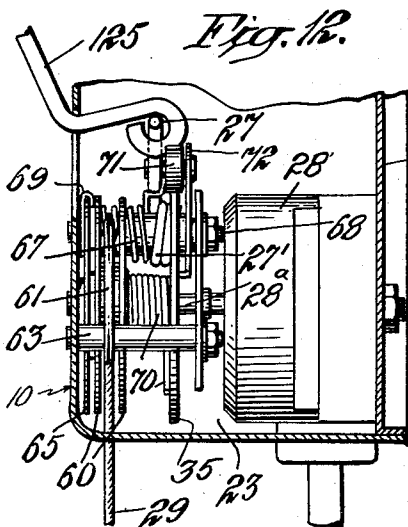
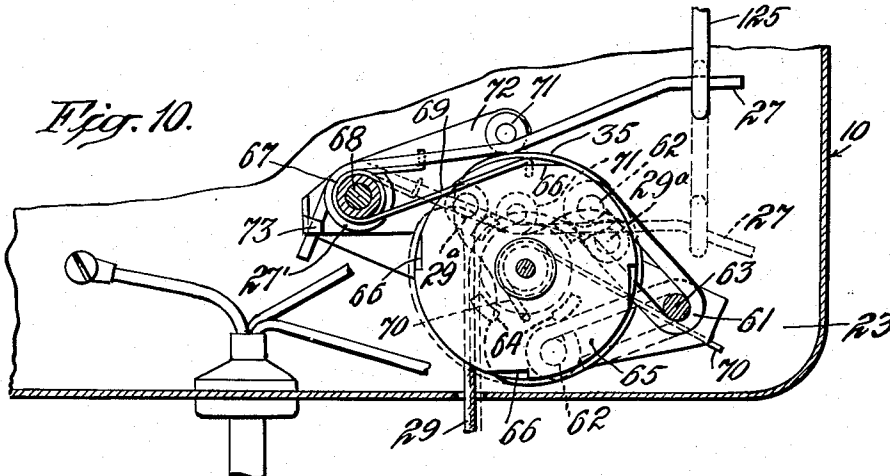
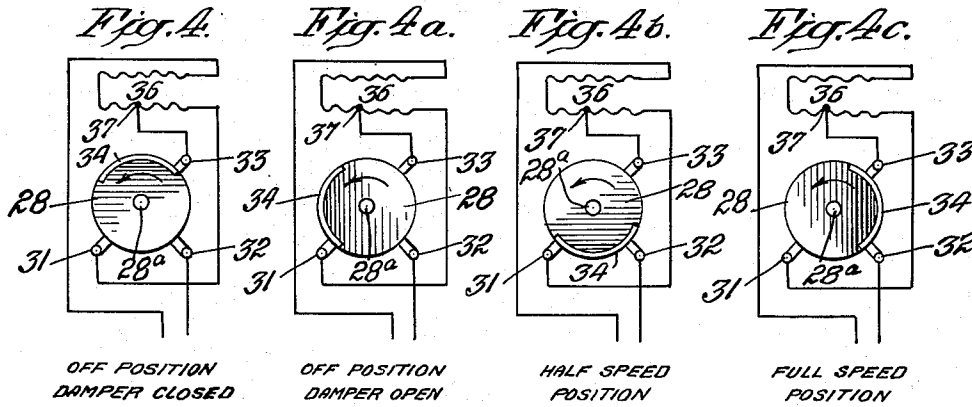
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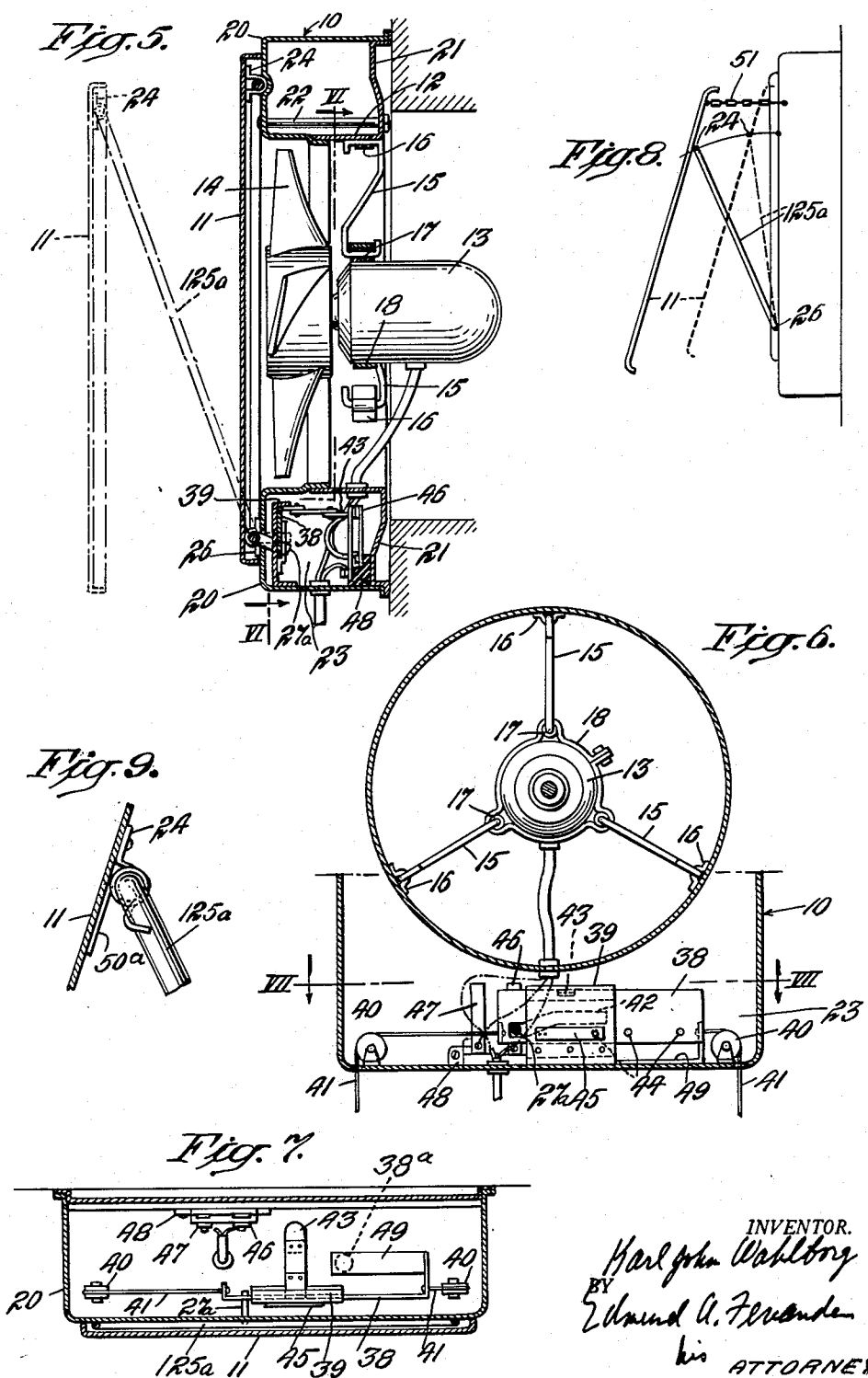
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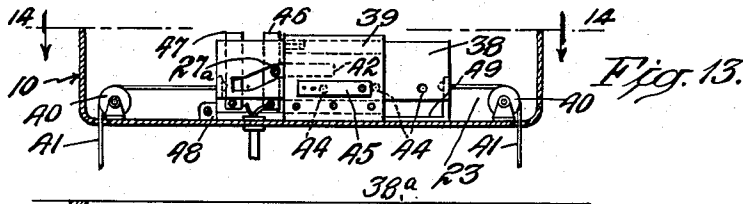


Fig. 13.

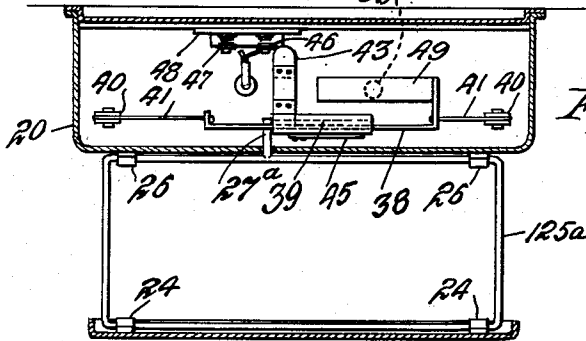


Fig. 14.

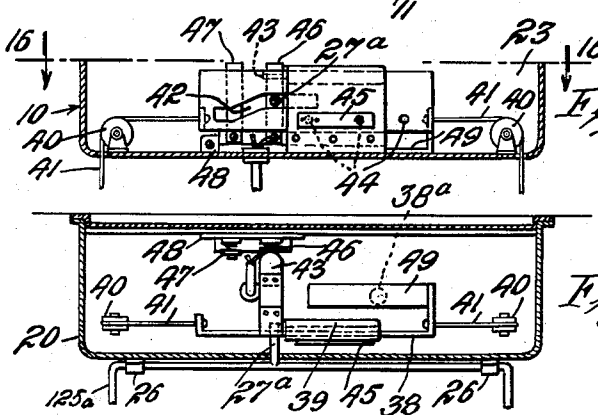


Fig. 15.

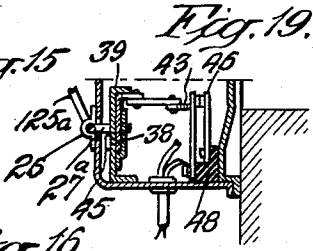


Fig. 19.

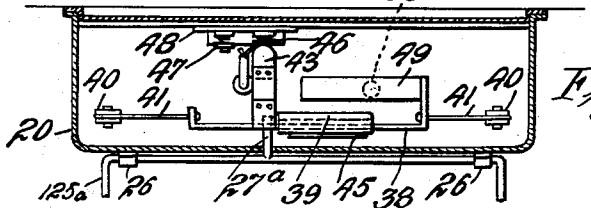


Fig. 16.

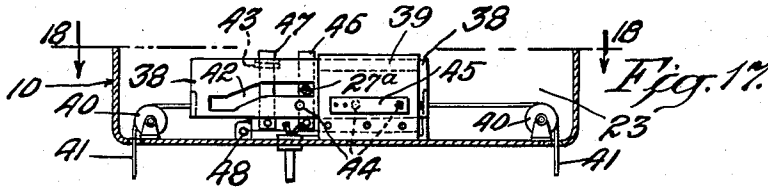


Fig. 17.

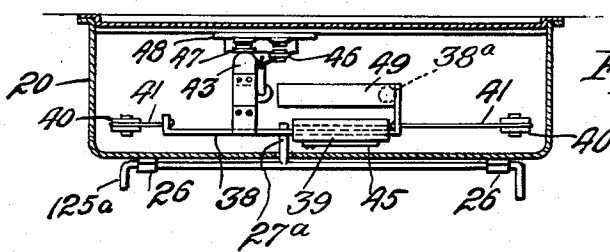


Fig. 18.

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ELECTRICALLY DRIVEN FAN

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Application June 25, 1945, Serial No. 601,444

Claims priority, application Sweden July 12, 1944

8 Claims. (Cl. 98—116)

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This invention relates to a ventilator unit of a type which is employed to circulate air through a duct or opening in a building wall of an enclosure.

The object of this invention is to provide an improved ventilator unit of this type which can be conveniently employed to circulate air through an existing duct in a building wall, the construction being such that the unit occupies a minimum amount of space at the inner face of the wall and a part thereof telescopically fits into the duct itself.

According to the present invention, the ventilator unit embodies a box-like casing having a rear wall adapted to be mounted on the building wall or the like so as to cover the existing air duct and an air passageway extending there-through, and a motor-fan unit carried by the casing, the fan being disposed in the air passageway and the motor projecting exteriorly of the casing from the rear wall thereof so that the duct will constitute a housing for the motor when the box-like casing is mounted at or immediately adjacent to the inner surface of the building wall. With such an arrangement it is very easy to mount the ventilator unit on a wall of an existing air duct even when the size of the duct does not correspond with the diameter of the passageway in which the fan is positioned, and also when the duct may be rectangular in shape with its greater dimension in a vertical direction. By providing a ventilator unit having a box-like casing the rear wall thereof may be applied to ducts which vary considerably in size. Since the rearwardly extending motor telescopically fits into the duct, the casing when mounted on a building wall will project from the inner surface thereof into the enclosure a distance which is less than the overall axial distance taken up by the fan and motor, thereby providing a neat and compact ventilator unit which is essentially disposed in its entirety within the enclosure and readily removable for inspection and cleaning.

The invention, together with the above and other objects and advantages thereof, will be described more fully hereinafter in connection with the accompanying drawings forming a part of this specification, and in which:

Fig. 1 is a side view, partly in section, of a ventilator unit embodying the invention;

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Fig. 2 is a side elevation of the ventilator unit shown in Fig. 1;

Fig. 3 is a front view, partly broken away and in section, of the ventilator unit shown in Figs. 1 and 2, the damper being omitted to illustrate details more clearly;

Fig. 4 is a wiring diagram for the ventilator unit shown in Figs. 1 to 3;

Figs. 4a, 4b and 4c are views similar to Fig. 4 illustrating the control member in its different operating positions;

Fig. 5 is a view similar to Fig. 1 illustrating another embodiment of the invention;

Fig. 6 is a sectional view taken on line VI—VI of Fig. 5 to illustrate details more clearly;

Fig. 7 is a sectional view taken on line VII—VII of Fig. 6;

Fig. 8 is a side elevation similar to Fig. 2 illustrating a further embodiment of the invention;

Fig. 9 is an enlarged fragmentary sectional view of the embodiment shown in Fig. 8;

Fig. 10 is a front elevation of the damper and switch operating mechanism shown in Figs. 1 and 3, the front member of the casing being omitted to show details more clearly;

Fig. 11 is a top plan view of the operating mechanism illustrated in Fig. 10;

Fig. 12 is a side elevation of the operating mechanism shown in Figs. 10 and 11;

Figs. 13, 15 and 17 are fragmentary vertical views of the damper and switch operating mechanism, being similar to the details of such mechanism shown in Fig. 6 and illustrating the different operating positions thereof;

Figs. 14, 16 and 18 are horizontal sectional views similar to Fig. 7 which correspond to the operating positions of the damper and switch operating mechanism illustrated in Figs. 13, 15 and 17, respectively, Fig. 14 being taken at line 14—14 of Fig. 13, Fig. 16 at line 16—16 of Fig. 15, and Fig. 18 on line 18—18 of Fig. 17; and

Fig. 19 is a transverse sectional view of the operating mechanism illustrated in Fig. 15.

Referring to Figs. 1 to 3, 10 designates generally a box-shaped outer fan casing, preferably made of sheet metal, which is arranged to carry a rectangular-shaped shutter or damper 11, and 12 denotes the wall of a cylindrical fan wheel drum defining an air passageway in which a fan 14 is disposed. The fan 14 is driven by a motor

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13 which is resiliently suspended. The suspension device in the embodiments shown comprises three S-shaped clips 15, preferably made of spring steel, having their outer arms either, as in the embodiment shown in Figs. 1 to 3, extending through the rear wall 21 of the box-like casing 10 or, as in the embodiment shown in Figs. 5 to 7, connected to the cylindrical wall 12 by lugs 16. The inner arms of the clips, which are encased with rubber bushings 17, are secured to the motor casing by a metallic strip 18 encircling the latter.

The casing 10 is formed of two wall members, namely, a front wall member 20 and a rear wall member 21 held together by a number of screws or bolts 22. Since the fan drum 12 is of cylindrical shape and the surrounding casing 10 is essentially box-like in character in the embodiments illustrated, there is provided between these parts a space in the lower part 23 in which is housed a switch for the motor-fan unit and mechanism for actuating the shutter or damper 11.

In the embodiments shown in Figs. 1 to 3 and Figs. 5 to 7 the damper or shutter is so constructed that the damper 11 assumes a position essentially parallel to the front wall member of the casing when the damper is in its "closed" and "open" positions. As seen in Figs. 1 to 3, the damper 11 is supported by a lazy-tongs arrangement which includes arms 125 and 126 joined together by a cross piece 127 pivotally connected to the damper by hinges 24. Another pair of connected arms 128 is pivotally mounted to the upper part of the outer wall member 20 by hinges 26, the lower ends of the arms 128 being arranged to slide against the inner surface of the damper 11. As best seen in Fig. 3, the arms 125 and 126 are pivotally connected to the pair of arms 128 at the points 129. Arm 126 terminates at point 129 while arm 125 continues downwardly and is connected to an actuating member or lever 27, as best shown in Figs. 1 and 3.

In the embodiment illustrated in Figs. 1 to 4, the switch comprises a control cylinder 28 which is actuated step by step to a number of different positions by a pull cord 29, as will be described presently, the cylinder with each downward pull on the cord 29 being moved angularly through 90° in the direction indicated by the arrows in Figs. 4, 4a, 4b and 4c. In this manner the brushes 31, 32 and 33 will be successively interconnected in pairs through the contact segment 34. The sequence of operations on successive downward pulls on the cord 29, as diagrammatically indicated in Figs. 4a, 4b and 4c, is that the damper is first opened while the motor remains disconnected, as seen in Fig. 4a. In the next position seen in Fig. 4b the motor is started and runs at half speed. In the next position seen in Fig. 4c, the motor runs at full speed. Finally, when the switch has again reached the starting position illustrated in Fig. 4, the motor is disconnected and the damper is closed.

The damper 11 is actuated by mechanism including a cam element 35 which is arranged on the spindle of the switch and cooperates with the lever 27 in the manner shown in Fig. 3. The torsion springs 50 acting on the arms 125 and 126 tend to close the damper 11 and cause the arm 27 to follow the cam element 35. The rotation of the fan motor 13, either at half or full speed, is effected by a tap 37 arranged on the field winding 36 of the motor, as diagrammatically seen in Figs. 4, 4a, 4b and 4c.

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As best shown in Figs. 10, 11 and 12, the cam element 35 and lever 27 form part of a damper and switch operating mechanism including a cord wheel 60 on which the cord 29 is anchored at 29a and wound thereon in such a manner that, when the latter is pulled downward, the wheel 60 is rotated 90° in a counter-clockwise direction from the position shown in Fig. 10. Such counter-clockwise turning movement of the cord wheel 60 is stopped by a member 61 in the form of an elongated loop which is pivotally mounted at one end at 62 to the cord wheel 60. The opposite end of the member 61 is looped about a bolt or stud 63 and angularly movable about the latter.

When the cord wheel 60 is rotated in the manner just described, two pawls fixed thereto and diagrammatically shown at 60a in Fig. 11 are arranged to engage apertures 64 formed in and distributed about a step wheel 65 so that a 90° rotating movement will also be imparted to the latter each time the cord 29 is pulled downwardly. As best shown in Fig. 10, the periphery of the step wheel 65 is provided with four spaced apart notches 66. A coil spring 67 is disposed about a bolt or stud 68, one end 69 of which extends from such stud and is adapted to engage one of the notches 66 to retain the step wheel 65 in its new position each time the latter is rotated 90°.

While the step wheel 65 is retained each time in the position to which it is rotated, the cord wheel 60 returns to the dotted line position shown in Fig. 10 by the action of a spring 70 when the cord 29 is released. The cam disc 35 and control cylinder 28 of the switch are rigidly secured to the same shaft 28a upon which the step wheel 65 is mounted, while the cord wheel 60 is freely rotatable on such shaft.

A cam roller 71 is rotatably carried on an arm 72 which is pivotally supported on the stud 68. The lever 27 connected to the arm 125 of the damper operating mechanism, described above, is operatively associated with the arm 72. The lever 27 is formed from a length of resilient rod having a portion 27' wound about the hub of the arm 72, and the left-hand end shown in Fig. 10 is clamped in a hooked portion 73 of the arm 72. The arm 72, lever 27 and roller 71 form a non-separable unit during normal operation of the control mechanism being described. In the event the damper 11 is accidentally pushed to its closed position when the operating mechanism is acting to maintain the damper open, the lever 27 yields due to its resiliency so that parts of the mechanism are not subjected to excessive strain.

The cam roller 71 cooperates with the cam disc 35, and, when the latter is rotated, the unit consisting of the lever 27, arm 72 and roller 71 are raised from the dotted line position to the solid line position shown in Fig. 10. Such lifting of the lever 27 imparts upward movement to the arm 125 of the damper operating mechanism to effect opening of the damper 11. When the cam disc 35 is subsequently moved to its dotted line position in Fig. 10, the roller 71 is urged downwardly by the action of the damper closing springs 50 shown in Fig. 3. Such downward movement of the roller 71 can then take place inasmuch as the inwardly curved portion of the cam disc 35 is then directed upwardly, as best shown in Fig. 3. The advantage of the regulating mechanism above described is that only a draw cord, chain or the like is required to actuate the motor switch and shutter or damper 11.

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In the embodiment shown in Figs. 5 to 7 and 13 to 19 the common actuating member for the motor switch and damper comprises mechanism including a plate 38 which is reciprocally carried in an extension 39 which is fixed to the casing and serves as a guide. Movement of the plate 38 is effected exteriorly of the casing by two cords 41 which pass over guide rolls 40 and are connected to opposite ends of the plate, the cords passing through openings in the casing and freely hanging outside the latter. The plate 38 is formed with a curved cam groove 42 arranged to receive a lever 27a which corresponds to the lever 27 in the embodiment of Figs. 1 to 3, the lever 27a being connected to the arm 125a to guide the latter and impart vertical movement thereto.

The plate 38 is also provided with a tongue 43 which is mounted in an insulated manner thereon and adapted to cooperate with a switch, as will be described presently. To hold the plate in a number of different operating positions, it is formed with a number of openings 44 located according to such operating positions, the openings being adapted to be engaged by a ratchet spring 45 connected to the extension 39. As best seen in Fig. 7, the switching provisions comprise two pairs of laminated contact springs 46 and 47 which are mounted on a contact member 48 formed of insulating material and connected to the casing.

In operating the embodiment of Figs. 5, 6 and 7, a pull on the left-hand cord 41 in Fig. 6 will move the plate 38 from the position shown in Figs. 6 and 7 to that shown in Figs. 13 and 14 to displace the lever 27 upwards, so that the damper 11 will be opened. A further pull on the cord will move the plate 38 from the position shown in Figs. 13 and 14 to that shown in Figs. 15, 16 and 19 to cause the tongue 43 to bear against the pair of springs 46, with the result that the motor will be started up and be driven at full speed. Another pull on the same left-hand cord 41 will move the plate 38 from the position shown in Figs. 15 and 16 to that shown in Figs. 17 and 18 to cause the tongue 43 to bear against the pair of springs 47, which effects switching of the motor to half speed operation. When the right-hand cord 41 in Fig. 6 is pulled, the motor will again be switched to full speed operation and a further pull on the right-hand cord will disconnect the motor at which time the damper also will be closed.

In the control mechanism just described, it is possible to switch the motor any desired number of times between half and full speed operation simply by pulling on either the right-hand or left-hand cord without actuating the damper operating mechanism. For the purpose of quickly ascertaining the operation of the ventilator unit, the reciprocable plate 38 is provided with an indicating device 49 which is visible through an aperture 38a or window in the base of the casing, such device 49 being in the form of a tongue which may indicate, as by its color, for example, whether the fan motor is disconnected or is being operated at full speed or at half speed. An indicating device of a similar type may also be provided in the embodiment illustrated in Figs. 1 to 3.

Figs. 8 and 9 show a modified damper construction in which the damper 11 is inclined to the front side of the casing in its open position and parallel to such front side or face in its closed position. As best seen in Fig. 9, such damper operation is effected by providing a torsion spring

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50a between the arm 125a and the inside face of the damper, the spring being arranged so that it always will tend to maintain the damper in the inclined position indicated by full lines in Fig. 8. When the arms of the lazy tongs assume a folded position, the damper is automatically moved to a position which is parallel to the casing, by reason of the fact that its upper edge, as indicated by dotted lines in Fig. 8, will first be moved against the front wall of the casing.

If it is desired to cause the damper to be inclined to the vertical in its open position without employing the torsion spring 50a in the manner just described, an arrangement can be adopted which is shown in Fig. 8 in which a chain 51 or the like is connected to the upper edge of the damper and to the casing, the extent of the inclination being varied by adjusting the length of the chain. The provision of the chain 51 may also be of advantage even when the torsion spring 50a is employed because it tends to prevent rattling of the damper in its open position. In the embodiment shown in Figs. 1 to 3, the torsion springs 50 are arranged to cause the damper 11 to bear resiliently against the arms 125 and 126.

Although I have illustrated and described particular embodiments of my invention, I do not desire to be limited to the particular arrangements set forth, and I intend in the following claims to cover all modifications which do not depart from the spirit and scope of my invention.

What is claimed is:

1. In a ventilating unit for circulating air through an existing air duct in a building wall of an enclosure having spaced apart inner and outer surfaces, such unit comprising a box-like casing including spaced apart first and second wall members constituting front and rear walls, respectively, each of the wall members being formed with an opening, an air passageway forming member extending between the first and second wall members and terminating at the openings therein, another member which is spaced from the passageway forming member and connects the first and second wall members to form a substantially closed outer chamber exteriorly of the passageway, an electric motor, a fan carried by the motor and driven by the latter, the fan and motor together taking up a definite overall distance in the direction of the axes of such parts, damper means for the passageway, means for mounting the damper means on the casing for movement thereon between an open position and a shut position at the first wall member or front wall of the casing, electric switching means for controlling the motor, means for adjusting the position of the damper means, the electric switching means and damper adjusting means including parts disposed in the closed outer chamber of the casing, means for mounting the casing on the building wall with the second wall member or rear wall thereof at the inner surface of the building wall with the opening in such second wall member communicating with the duct, means for carrying the motor on the casing with the fan disposed in the air passageway between the first and second wall members and the motor projecting exteriorly of the casing from the second wall member or rear wall thereof so that the duct will constitute a housing for the motor when the casing is mounted at the inner surface of the building wall, the casing when mounted on the building wall projecting from the inner surface thereof into the enclosure a distance which is less than the overall axial distance taken up by the fan

and motor, and the damper means in its shut position closing the opening in the first wall member or front wall of the casing.

2. The combination defined in claim 1 comprising structure including the electric switching means for operating the motor at full speed or a reduced speed, the casing having a window, and indicating means in the outer closed chamber which is visible through the window to indicate the position of the switching means and determine whether the motor is stopped or being operated at full or reduced speed.

3. The combination defined in claim 1 in which the electric switching means includes a movable element for controlling the motor, and the damper adjusting means comprises mechanism including cam means and a cam follower operable responsive to movement of the element for adjusting the damper means, the cam means constituting one of the parts disposed within the casing in the closed outer chamber thereof.

4. The combination defined in claim 1 in which the damper means includes a vertically disposed plate movable to and from a shut position overlying the opening in the first wall member or front wall of the casing and the means for mounting the damper means on the casing includes spaced apart vertically extending arms pivotally connected at their upper ends to the plate at a region thereof which is located above the center of gravity of the plate, said mounting means being so constructed and arranged that the arms are essentially parallel to the first wall member or front wall of the casing when the damper means is in its shut position and the plate overlies the opening in the first wall member and the arms are at an acute angle to the first wall member when the damper means is in its open position and the plate is removed from the opening of the first wall member, and the damper adjusting means including structure operatively connected to the arms for moving the latter.

5. The combination defined in claim 1 in which the electric switching means comprises a member which is movable back and forth in a straight line and a switch unit having a movable part in the path of movement of the member which is actuated by the member in one position thereof, mechanism operatively connected to the damper means and to the member for governing the position of the damper means according to the position of the member in its straight line of movement, and manually operable means accessible exteriorly of the casing to impart movement back and forth in a straight line to the member.

6. In a ventilator unit capable of circulating air through different size air ducts in building walls of enclosures having spaced apart inner and outer surfaces, such unit comprising a box-like casing including spaced apart first and second wall members constituting front and rear walls, respectively, each of the wall members being formed with an opening, an air passageway forming member extending between the first and second wall members and terminating at the openings therein, another member which is spaced from the passageway forming member and connects the first and second wall members to form a housing exteriorly of the passageway, an electric motor, a fan carried by the motor and driven by the latter, the fan and motor together taking up a definite overall distance in the direction of the axes of such parts, a shutter for the passageway, means for mounting the shutter

on the casing for movement thereon between an open position and a shut position at the first wall member or front wall of the casing, control mechanism including manually operable means for adjusting the position of the shutter and controlling the motor, the control mechanism including parts disposed in the housing and a manually operable part accessible exteriorly of the casing, means for mounting the casing on a building wall having a duct with the second wall member or rear wall thereof at the inner surface of the building wall with the opening in such second wall member communicating with the duct, means for mounting the motor on the casing with the fan disposed in the air passageway between the first and second wall members and the motor projecting exteriorly of the casing from the second wall member or rear wall thereof so that the duct will constitute a housing for the motor when the casing is mounted at the inner surface of the building wall, the casing when mounted on the building wall projecting from the inner surface thereof into the enclosure a distance which is less than the overall axial distance taken up by the fan and motor, the shutter in its shut position closing the opening in the first wall member or front wall of the casing, and the means for mounting the motor being so constructed and arranged that, when the second wall member or rear wall of the casing overlies a duct, the ventilator unit will be operable when the motor projects into ducts of different size, the maximum size duct into which the motor can project being dependent upon the size of the casing and the ability to position the latter so that the rear wall thereof overlies the duct.

7. A ventilator unit as set forth in claim 1 in which the electric switching means comprises a member which is movable back and forth in a straight line and a switch unit having a movable part in the path of movement of the member which is actuated by the member in one position thereof, mechanism operatively connected to the damper means and to the member for governing the position of the damper means according to the position of the member in its straight line of movement, and manually operable means including pull cords accessible exteriorly of the casing to impart movement back and forth in a straight line to the member, the member and mechanism operatively connected thereto and switch unit being so constructed and arranged that, when movement is imparted to the member in one direction by one of the pull cords, the damper means initially will be opened and thereafter upon further movement of the member to the one position the movable part of the switch unit will be actuated to start the motor and the damper means will remain open.

8. A ventilator unit as set forth in claim 7 in which the electric switching means includes the first mentioned switch unit and a second switch unit also having a movable part in the path of movement of the member which is actuated by the member in another position thereof, the member and mechanism operatively connected thereto and first and second switch units being so constructed and arranged that, when movement is imparted to the member in such one direction by the one pull cord, the motor will be operated at one speed when the movable part of the first switch unit is actuated by the member and operated at a different speed when the movable part of the second switch is thereafter actu-

ated by the member and the damper means will be open at both motor speeds.

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