May 1, 1951 J. P. JOHNSON 2,551,004

VENTILATOR

Filed Nov. 6, 1947 2 Sheets-Sheet 1

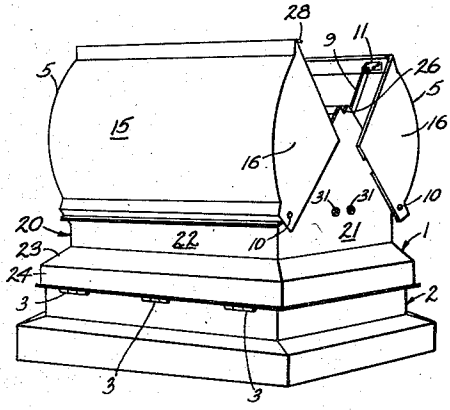

FIG. 1

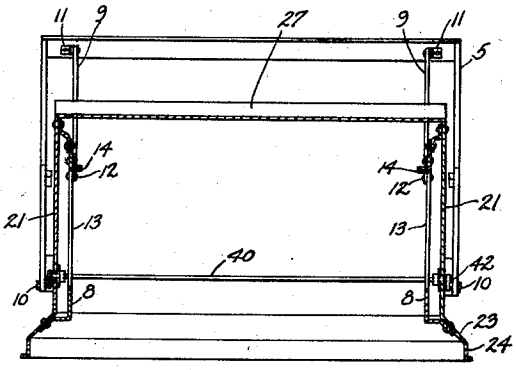

FIG. 2

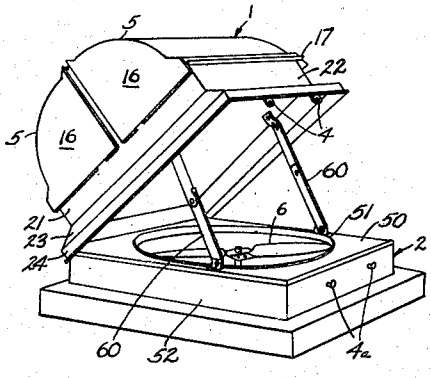

FIG. 3

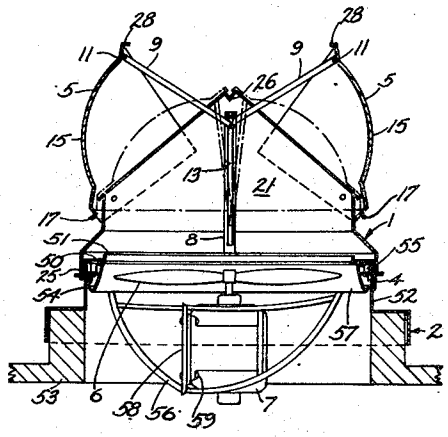

FIG. 4

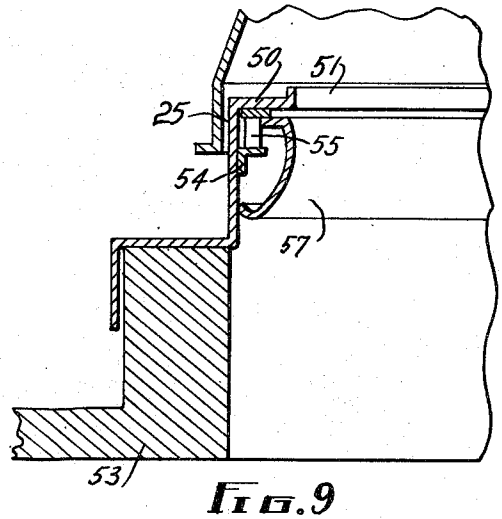

FIG. 9

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VENTILATOR

Filed Nov. 6, 1947 2 Sheets-Sheet 2

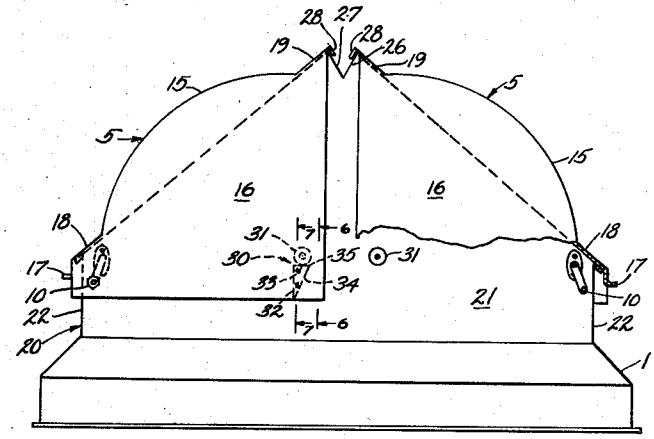

FIG. 5

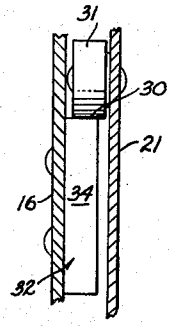

FIG. 6

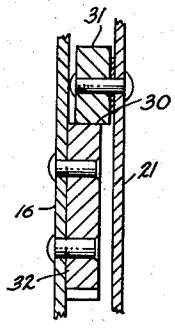

FIG. 7

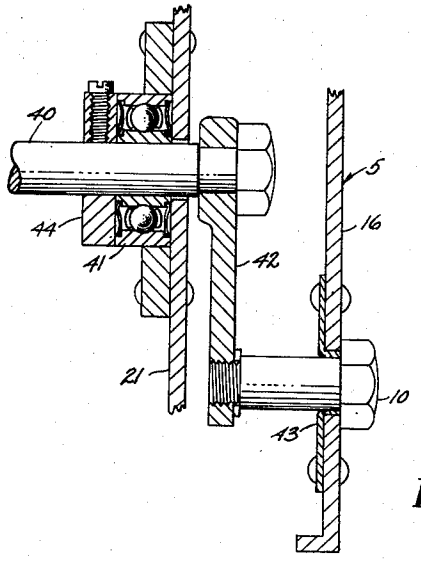

FIG. 8

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UNITED STATES PATENT OFFICE

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VENTILATOR

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Application November 6, 1947, Serial No. 784,416

11 Claims. (Cl. 98—43)

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This invention relates to roof ventilators and more particularly to an automatically opening and closing ventilator responsive to the action of a power driven exhaust fan housed therein.

It is among the objects of my invention to provide a positive acting exhaust ventilator of the straight-through type for positively and forcefully removing contaminated air and gases from a building through the roof thereof and at the same time to provide a weather-tight closure for such a ventilator wherewith to prevent ingress of the elements through the roof when the ventilator is in its closed position. Another object of my invention is to provide a ventilator that is capable of moving a large volume of air, fumes and gases at a high rate of speed for such needs as use over vats, furnaces, foundry pouring floors and other industrial and commercial applications where the need for removal of fumes and gases may be more or less intermittent. Another object of my invention is to provide a weather-proof ventilator which automatically opens and closes depending upon the forcible movement of air or gases therethrough, the air blast preventing admission of rain, snow and the like while the ventilator is open and the automatic self-closing feature insuring the weather-tightness of the ventilator when it is closed.

Another object of my invention is to provide a ventilator of relatively large capacity for its size, that can be easily mounted on roofs of different shapes and configurations, and that is easily controlled as by the mere opening and closing of a switch for starting and stopping the fan or propeller thereof. Another object is to provide a power driven fan ventilator with a high measure of accessibility to the working parts thereof from the roof side of the ventilator, eliminating the awkwardness and hazard of using ladders or scaffolding to reach the working parts for repair and maintenance from within the building. Another and more specific object is to provide a hinged mounting for movement of the upper or weather excluding portion of the ventilator relative to the lower base and fan housing parts thereof.

A further object is to provide an automatically opening and closing ventilator which is automatically self-locking in its closed weather-sealing position in the absence of a fan induced blast and which is responsive only to the fan blast as an automatic unlocking influence, external air movement being ineffective in inducing an undesirable opening of the ventilator.

Other objects include the provision of a ventilator that is efficient and automatic in operation,

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that is easily installed, operated and repaired, and that is economical of manufacture and rugged and enduring in construction.

Other objects and advantages will appear from the following description of a preferred form and embodiment of my invention, reference being had to the accompanying drawings in which Figure 1 is a perspective view of my ventilator with the top closure elements in open position; Figure 2 is a median longitudinal section of the upper portion thereof; Figure 3 is a perspective view of my ventilator in its hinged open or inspection position; Figure 4 is a transverse section of the whole ventilator including the base portion and curb structure shown in Figure 1; Figure 5 is an end elevation of the upper portion of my ventilator with part of one of the cover elements broken away to show the cover locking and supporting mechanism; Figures 6 and 7 are enlarged sections showing details of the cover locking mechanism taken in the planes of the lines 6—6 and 7—7 respectively of Figure 5 and Figure 8 is a greatly enlarged section taken in a plane through the pivotal support of Figure 5 and showing details of the swinging pivotal support for the cover elements; and Figure 9 is an enlarged section of a portion of Figure 4 showing the construction of the base portion and adjacent parts.

In the preferred form of my invention herein specifically illustrated and described my ventilator comprises a top part 1 and base part 2 hingedly connected together as at 3 for relative movement as shown in Figure 3, when it is desired to inspect, assemble or repair the parts in situ, but normally being arranged so that the top part rests squarely upon the base or bottom part as shown in Figures 1 and 4 particularly, for normal ventilating operation. The top part 1 is characterized by a pair of pivotally swingable preferably identical closure elements 5 which in the closed position, as shown especially in Figure 5, provide a weather-tight covering for the ventilator, excluding rain, wind, snow and sleet from the room or building on which the ventilator is mounted and which in the open position, Figs. 1, 2 and 4, afford a wide, free and clear opening for the forceful exhaust of air and gases upwardly therethrough as induced by the fan 6; the latter being carried in the base part 2 and driven by an electric motor 7. Each of the closure members 5 is pivotally supported for both pivotal and swinging movement, to be more fully described below, about a longitudinally extending axis 10 whereby to be swingable from the closed position to the wide open position in response to

pressure developed within the upper portion of the ventilator by the operation of the fan 6. The closure members 5 in their wide open position are disposed in a manner whereby gravity will induce their closing whenever the fan 6 ceases to deliver the air blast and/or pressure which otherwise holds them open.

The upper portion of the ventilator also comprises a generally rectangular structure 20 having vertically disposed, somewhat triangular shaped, end walls 21, see Figs. 1, 2 and 5, which end walls carry the axes 10, see Fig. 8, upon which the closure elements are supported and also carry portions of the locking mechanisms 30, see also Figs. 6 and 7, by means of which the closure elements are releasably secured in closed position. The structure or body 20 of the upper portion of the ventilator also comprises vertical side walls 22 of limited height, see Figure 4. The vertical side and end walls of the body structure 20 preferably rise from a lower truncated pyramidal skirt portion 23 sloping outwardly and downwardly from the vertical walls 21 and 22 and terminating in a lowermost rectangular vertical skirt or band 24. Along one of the lower longitudinal edges of the band are connected the hinges 3 about which the whole of the upper portion may be swung from its normal operating position to the position shown in Figure 3 when it is desired to gain access to the interior of the ventilator. The lower wall or skirt 24 on the longitudinal portion opposite the hinges 3 preferably also carries brackets 4 which are adapted to coact with studs 4a and nuts or wing nuts, not shown, in order to secure and support this edge of the skirt 24 to the bottom portion 2 of the ventilator in its operative position; both the hinges 3 on the one hand and the studs and brackets on the other hand serve to space the skirt portion 24 and the sloping wall 23 from the adjacent upper portions of the base portion 2 to facilitate the free drainage of rain or other fluid therebetween as at 25, see Figure 4.

The upstanding portions of the end walls 21 take a generally triangular form and are preferably inturned a little along their sloping upper edges for the sake of stiffness. The apexes of the end walls are both notched as at 26 to receive a small V-shaped drain trough 27, the ends of which extend to and if desirable slightly beyond the exterior surfaces of the end walls 21 whereby to spill rain outwardly over the end walls 21 and prevent its entry into the interior of the ventilator. It will also be noted that the top longitudinally extending edges of the closure members 5 each have angled flanges 28 which in the closed position of the closure members, see Figure 5, overlie and seat upon the upper edges of the trough 27 throughout the length of the trough and closure members. A continuous support is thus provided for the upper edges of the closure members from end to end of the ventilator and a fluid tight and freely draining and weather-proof connection for the topmost part of the ventilator is provided as well.

Interiorly of the end walls 21 and carried by each of them approximately in the vertical median plane of the ventilator there are provided slotted vertically extending guides 8, Figs. 2 and 4. These guides are spaced away a little from the end walls 21 respectively and are preferably secured directly to the end walls at the top below the trough 27 and may be conveniently secured to the sloping skirt portion 23 at their lower ends. A pair of links 9 is provided at each end of the device, the upper ends of which are pivotally connected to the upper portions of the closure members 5 as at 11 and the lower ends of which are pivotally connected together on pins 12 which are free to slide in the vertically extending slots 13 in the guides 8. In this manner the movements of both of the closure members 5 are correlated so that their opening and closing movements will be substantially identical as will be their positions relative to the median vertical plane of the ventilator. Preferably rubber bottom stop members 14 are also provided to be adjustably secured to the upper portions of the guides 8 wherewith to cushion the stopping of the upward movement of the pins 12 and the lower ends of the links 9 as the closure members swing to their fully open position as shown in Figure 4. The stops 14 may be adjustably raised or lowered on the guides 8 to limit the movement of the links 9 and thus to control the open position of the closure members 5. As will be described later it is desirable that the closure members in their wide open positions have a tendency to close by their own weight whenever the fan is turned off. The stops 14 must be adjusted to retain this characteristic and yet maintain a wide free opening for the fan blast when the fan is on and the ventilator is open.

Each of the closure members, see particularly Figs. 1, 3 and 4, comprises a main central longitudinally extending arcuate portion 15 and integrally joined or connected quadrant like ends 16. When the parts are in their closed position the vertical edges of the end 16 lie substantially parallel and closely adjacent each other, see Figures 3 and 5, and their lower edges lie in a horizontal plane. Upwardly beyond the arcuate portions 15 the closure members comprise plane portions joining the arcuate portions and the flanged upper edges 28. The lower and outward parts of the sides of the closure members preferably comprise inclined planar parts which terminate in vertical and flared skirts 17; the skirts being spaced outwardly from the adjacent and parallel side walls 22 of the body 20 sufficiently to permit the swinging movement of the closure members to take place without bringing the lowermost edges of the skirts 17 into contact with the side walls 22. This spacing also permits moisture to drain downwardly from the insides of the closure members and to pass freely between the closure members and the side walls 22 of the body structure 20 and downwardly over the exterior of the walls 22 and the skirt of the body 23–24. The lower edge of the skirt 17 preferably lies in the same horizontal plane as the lower edges of the ends 16. The closure members are preferably formed of sheet metal such as galvanized sheet steel and each of the closures has its side and end parts appropriately joined in water tight or weather-proof engagemen whereby each closure acts as an integral piece of metal which in its configuration and structure is self-reenforcing and is strong enough to easily withstand the forces to which it is subjected in operation.

As will now be described and especially with reference to Figures 2, 5 and 8, the closure members are supported in a manner which provides for a compound swinging movement having especial coaction with a locking mechanism 30 yet to be described. This movement may be most easily described with reference to the closing movement in which the major portion of the

movement is a pivotal movement about the axis 10. As the members near closed position, however, the locking mechanism causes the axis 10 first temporarily to swing outwardly and slightly upwardly and then swing back while at the same time the major pivoting movement continues.

As shown also in Figure 2 longitudinal rods or axes 40 extend longitudinally of the ventilator adjacent the side walls 22 of the body 20 and are preferably pivotally supported in ball bearings 41, Figure 8, carried by the end walls 21 and each of the shafts or axes 40 has depending from each of its ends a link or crank 42 which cranks in turn carry or comprise the swinging and closure supporting axes 10 above mentioned. The axes 10 are pivotally supported in bearings or bushings 43 carried respectively by the end walls 16 of the closure members 5 at their lower and outer corners. Appropriate nuts and lock washers secure the parts in the desired position. Collars 44 locate the shafts 40 longitudinally. When the closure members are in their closed position, as shown in Figure 5, the links 42 take an inclined position so that the axes 10 at each end of the ventilator are somewhat more widely spaced apart than the shafts 40. As a result gravity tends to swing the lower portions of the closures 5 toward each other; the movement of the closure members however being restrained by contact with the upper edges of the lower sloping portions of the end walls as at 18 a little above and outwardly of the location of the axis 40. By the same token the effect of gravity on the closure members resists in desirable and limited degree the bodily outward movement of the lower portions thereof.

As mentioned above I provide the locking mechanism 30 to hold the closure members 5 in closed position against inadvertent opening and the tendency to open, rattle, or shake around under the influence of external forces such as wind or roof drafts. To this end, as shown more particularly in Figures 5, 6 and 7, each of the end walls 21 carry a pair of pivotally supported rollers 31 which are disposed to lie near the lower portions of the vertical edges of the ends 16 of the closure members when the latter are in their closed position. Juxtaposed to each of the rollers 31 there is carried by each of the closure ends 16 a cam or locking block 32 which has sufficient thickness to underlie and have bearing contact with a juxtaposed roller 31. Each of the blocks 32 has a substantially horizontal upper surface 33 and has an inclined forward face 34. These faces intersect at a corner 35. The result is that when the closure members swing downwardly to their closed positions the lower portions of the faces 34 of the blocks 32 contact the upper and outward portions of the rollers 31 and cause the axes 10 and the lower portions of the cover members to swing outwardly and slightly upwardly, as viewed in Figure 5, as they are permitted to do by the swinging of the cranks 42 about the axes 40. As the closure members continue to swing downwardly toward their closed position the inclined faces 34 of the blocks 32 cause the axes 10 and the lower portions of the closing members to swing increasingly outwardly, spreading the axes 10 farther and farther apart. When the corners 35 of the blocks 33 roll below the centers of rotation of the rollers 31 then as gravity induces further downward movement of the closure members the axes 10 and the lower portions of the closure members will start to swing

back toward each other and this return movement continues as the corners 35 roll downwardly and inwardly around the rollers 31 until they and the upper flat surfaces 33 of the blocks 32 pass under the rollers 31, to assume the position shown in Figure 5. The return swinging of the axes 10 and the lower portions of the closures thereupon is limited as mentioned above by contact of the closure members with the end walls at about the points 18, the blocks 32 at this time coming to rest with the corners 35 inwardly of the axis of rotation of the rollers 31. Opening of the closure members requires as a prerequisite the spreading and lifting of the axes 10 and the lower portions of the closure members away from each other far enough to allow the corners 35 of the blocks 32 to pass around the rollers 31. After the corners 35 have cleared the rollers, the inclined faces 35 move upwardly and allow the axes 10 to return inwardly. The remaining major portion of the opening movement consists primarily in pivotal movement about the axes 10 although perhaps lateral and upward thrust upon the closure members may result in some swinging of the cranks 42. This latter mode of operation of the locking mechanism is achieved automatically by the building up of air pressure within the upper portion of the ventilator by the operation of the fan 6, but in the absence of the magnitude of air pressure that is developed by the fan the closures are held in their snug downward position with the blocks 32 underlying the rollers 31 and with the closures bearing on the end walls at about the point 18 near their lower outer edges and bearing on the end walls in their upper inner portions at the points 19 and having the flanges 28 overlying, reaching in and having contact with the trough 27 at the extreme top. In this closed and locked position the closures are snugly held and securely positioned with respect to the body 20 of the ventilator so that they are restrained against rattling and/or inadvertent opening by the influence of external air movements and influences.

The bottom part of the ventilator hingedly supporting as it does the upper part by the hinges 3 and the studs 4a and also supporting the fan 6 and motor 7 comprises an upper sheet or deck 50 having a central circular opening coaxial of the fan's axis with an upstanding annular flange 51, see Figs. 3 and 4, defining an opening of diameter preferably slightly greater than the diametrical length of the fan blade. The deck or shell 50 is preferably substantially horizontal and has its outer rectangular edge overlying and preferably integrally connected with the upper edge of the rectangular wall 52 of the base or bottom part 2 of the ventilator. It will be recalled that the lower skirt portion 23—24 of the top portion overlies and is spaced from the upper part of the base part of the ventilator as at 25 with the result that any moisture that is either thrown from the fan or the fan blast or that otherwise enters the ventilator and tends to collect on the deck 50 will, since it is restrained from draining inwardly toward the fan opening by the annular flange 51, drain outwardly from the ventilator through the space 25. Likewise moisture which wets the interior walls of the body 20 will also drain out through the opening 25.

Preferably the wall 52 rises from an integrally formed enlarged and stepped or shouldered lower part or base portion which is adapted to rest upon the flash over the curbing or foundation 53 on which the ventilator as a whole is mounted.

Interiorly the wall 52 at or near the upper portion thereof preferably carries a mounting flange which may take the form of an inturned angle iron 54 with its vertical leg appropriately bolted or riveted to the wall 52 and with its horizontal flange lying inwardly and spaced below the deck 50. Preferably rubber-like or vibration dampening mountings 55 are carried by the horizontal flange of the supporting member 54 which in turn by suitable means of attachment, not shown, carry the motor supporting frame 56 and the fan cowling 57. Preferably the frame 56 supports and affords a vertical mounting plate 58 to which the motor is removably secured by mounting bolts 59 so that the fan and motor may be raised bodily upwardly through the central opening in the deck 50 by detaching the motor from its vertical mounting plate 58. Similarly when the ventilator is in its position open for repair, as shown in Figure 3, with folding struts 60 holding it in that position the fan and motor may be detached one from the other and/or other repairs or replacements made from without the ventilator with much convenience and facility and without the hazard of operating from the interior of the room or building with the necessary ladders, scaffolding and the like required for such purpose. The struts 60, as shown in Figure 3, are connected to and pivotally supported with respect to the deck 50 at their lower ends and the interior of the body 20 of the upper portion of the device and act to hold the parts in the position shown in Figure 3 in a familiar fashion while permitting the lowering of the upper portion down to its normal operating position by bending the struts at their middle pivot points.

When the ventilator is in its operative and closed position with the upper and lower parts secured together in their working relation and with the closure members 5 in their closed and locked position, then energization of the motor 7 and the rotation of the fan 6 builds up air pressure in the upper portion of the device to effect the unlocking and opening of the closure members 5 in the manner above described. It may be noted in passing that the end walls 16 of the closure members rather closely overlie the end walls 21 of the upper portion of the ventilator and that the lower inclined parallel portions of the closure members adjacent the points 18 lie close to or snugly upon the upper edges of the side walls 22 of the upper body portion of the ventilator and that the extreme upper edges of the closure members have a close fit with the trough 27 so that egress of air from the interior of the ventilator when the same is in its closed position is much restricted in comparison with the capaciy of the fan to move air thereinto whereby an appreciable pressure will be developed interiorly of the closure members to bring about the release of the lock to initiate the opening thereof. The arcuate shape of the closure members appears to facilitate the pocketing of air therein when the same are in the closed position and appear to develop the desirable horizontal components of force incident to the unlocking of the closure members. After the aerodynamic unlocking of the closure members the air blast taken with the configuration of the closure members and especially the arcuate portions thereof maintains the closure members in their wide open position against the tendency of gravity and the influences of external drafts and air movements which might otherwise tend to close them. The links 9 coacting with the guides 8 perform the functions above mentioned and also perform an equalizing function or rather an equalizing and balancing function. For example, an external force such as a roof air current which bears on one of the closure members and tends to close it will in more or less corresponding degree act on the other closure member so as to tend to open it. However the members cannot have independently opening and closing movements by reason of their connection with the links 9 and guides 8. These tendencies are thus balanced out and neutralized. It is therefore only from the inside of the ventilator that effective forces can be exerted and consequently the air blast from the fan tends to have exclusive control over the closure members.

It will also be noted that my ventilator as a whole lends itself to economical sheet metal construction for the major portions thereof, exceptions being recognized as to the shafts, guides, links, axis, frame, motor, fan and the like.

While I have illustrated and described a preferred form and embodiment of my invention, changes, modifications and improvements therein will occur to those skilled in the art who come to understand the fundamental principles and advantages thereof and I do not care to be limited in the scope of my patent to the form herein specifically illustrated and described other than by the claims appended hereto.

I claim:

1. In a ventilator having a base member with an opening, pneumatically actuable closure members having their outer and lower portions pivotally supported on spaced axes and having their upper and inner edges proximate in closed position and movable to positions above said axes in open position, parts of said closure members lying at approximately the level of said axes and spaced therefrom, and locking mechanism associated with said parts comprising elements carried by said parts and movable therewith and coacting elements mounted on said base, said elements being superposed and in contact when said members are closed and coacting to resist opening movement of said members about said axes, said elements being disengageable upon movement of said parts toward said axes, said closure members in their closed position being movable in response to interior pneumatic pressure to move said parts toward said axes.

2. A power actuated ventilator comprising a base, a fan, closure members movable to open position in response to the pneumatic influence of said fan, means supporting said members for swinging and pivotal movements including an axis fixed on said base and an axis movable with respect to said fixed axis secured to each of said members, and a locking mechanism comprising coacting latching parts mounted on said members and on said base requiring an initial bodily movement of said closure members relative to said fixed axis to unlatch said parts before permitting an opening movement of the members primarily about said movable axis.

3. A ventilator according to claim 2 in which said initial movement comprises pivoting about the movable edges of said members.

4. A ventilator comprising the combination of a base member, a fan mounted on said base member, a closure member pivotally mounted on a swinging axis supported by said base mem-

ber and movable in response to the pneumatic pressure developed by said fan, and locking mechanism for said member comprising one element movable with said member and another element mounted on said base and fixed in relation to said axis in a plane approximately tangent to the arc of operative movement of said swinging axis, said elements engaging each other transversely of said tangent when said member is in its closed position and preventing direct opening movement thereof, said member, axis and said one element being pneumatically movable in approximately the direction of said tangent to effect disengagement of said elements.

5. The combination of claim 4 in which said swinging axis is disposed to rise against gravity during the disengagement of said elements.

6. The combination of claim 5 in which one of said elements comprises a roller and the other a block having acutely angled surfaces successively engageable with said roller.

7. In a ventilator the combination of a stationary body with spaced end walls having edges inclined from the vertical, a shaft journalled in said walls near the lower ends of said edges, links depending from said shaft adjacent said walls, axes carried by said links swingable with respect to said shaft, movable closure members overlying the said edges of said walls and having end portions parallel to said walls disposed exteriorly thereof and pivotally supported on said axes, and locking mechanism comprising parts carried by said walls and portions between which relative locking and unlocking movement is effected with the swinging of said axis relative to said shaft.

8. In a ventilator a body member having side walls of limited height and end walls having inclined converging upper edges rising from approximately the top edges of the side walls, a drain trough overlying and supported by the uppermost parts of said end walls and disposed to spill fluid over the exterior of said end walls, movable closure members supported for pivotal movement on axes parallel to said side walls and transversely of said end walls, means for pivotally supporting said closure members on said axes, said closure members overlying the upper edges of said end and side walls at least in closed position and having end portions overlapping said end walls and supported by said pivotal supporting means, the upper edges of said closure members being inturned and lying within said trough in the closed position of said closure members.

9. In a ventilator a body member having side walls of limited height and end walls having inclined converging upper edges rising from approximately the top edges of the side walls, a drain trough overlying and supported by the uppermost parts of said end walls and disposed to spill fluid over the exterior of said end walls, movable closure members supported for pivotal movement on axes parallel to and adjacent said side walls, means for pivotally supporting said closure members on said axis near the upper edges of said side walls, said closure members overlying the upper edges of said end and side walls at least in closed position and having end portions overlapping at least the upper parts of said end walls and supported by said pivotal supporting means, the upper edges of said closure members being inturned and lying within said trough in the closed position of said closure members and the lower edges of said closure members overlapping and spaced from said side walls.

10. A ventilator comprising a base part supporting a housing, an exhaust fan, a top part attached to said base having walls partially overlapping the walls of said base part and spaced therefrom, closure members hinged adjacent their outer edges to the walls of said top part, said closure members having end walls and side walls which partially overlap the walls of said top and are spaced therefrom and having flanged top edges and a longitudinally extending drain trough in which the top flanged edges of said closure members are adapted to lie when the closure members are in closed position, said trough being adapted to conduct liquid exteriorly of said top part.

11. The ventilator of claim 10 in which said base part has a deck with an upwardly flanged opening through which the blast from said fan passes, said deck lying flush with the top of said base part and draining away from said flanged opening and under the said overlapping walls of the top part.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
544,390	Shannon	Aug. 13, 1895
951,508	Millman	Mar. 8, 1910
1,040,360	Lee	Oct. 8, 1912
1,222,394	Grimes	Apr. 10, 1917
1,291,184	Schulz	Jan. 14, 1919
1,503,915	Posner	Aug. 5, 1924
1,532,635	Osbun	Apr. 7, 1925
1,695,502	Parsons	Dec. 18, 1928
1,831,800	Bales et al.	Nov. 17, 1931
2,141,923	McMahan	Dec. 27, 1938
2,295,451	Davis, Jr., et al.	Sept. 8, 1942
2,439,271	Shaver	Apr. 6, 1948

FOREIGN PATENTS

Number	Country	Date
93,817	Austria	Aug. 10, 1923
56,536	Switzerland	Feb. 28, 1911