March 20, 1928. 1,663,199

W. F. HIRSCHMAN

ROTARY VENTILATOR

Filed Jan. 3, 1925 5 Sheets-Sheet 1

Fig. 1.

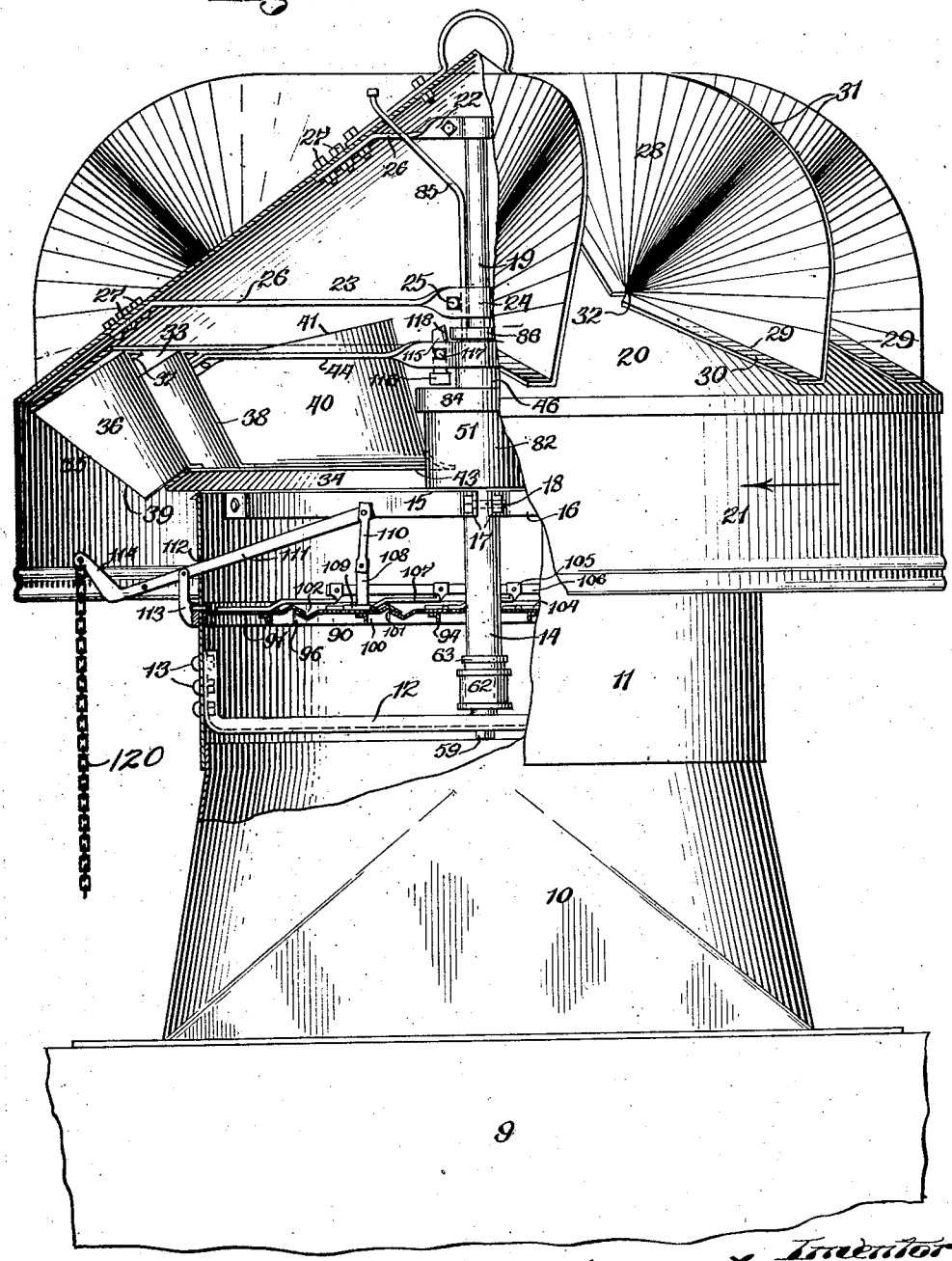

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Fig. 2.

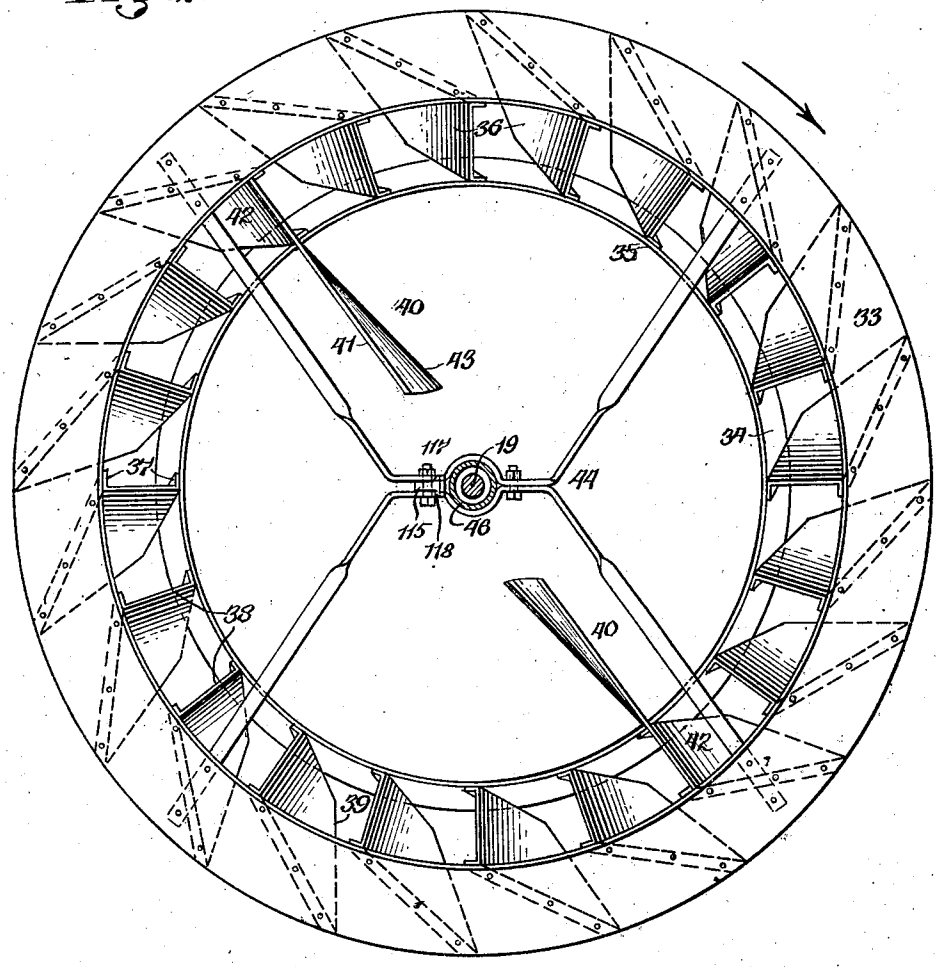

Fig. 3.

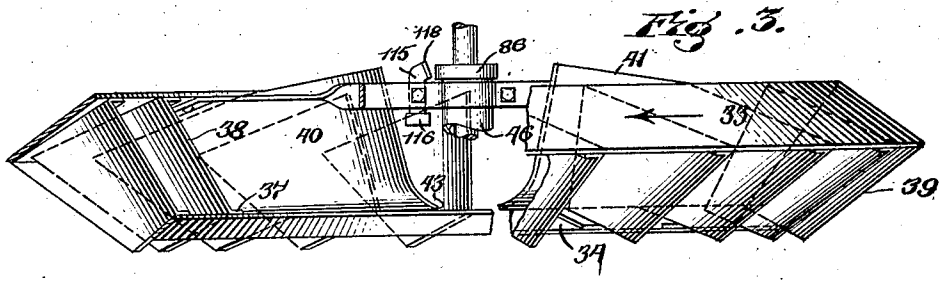

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Fig. 4.

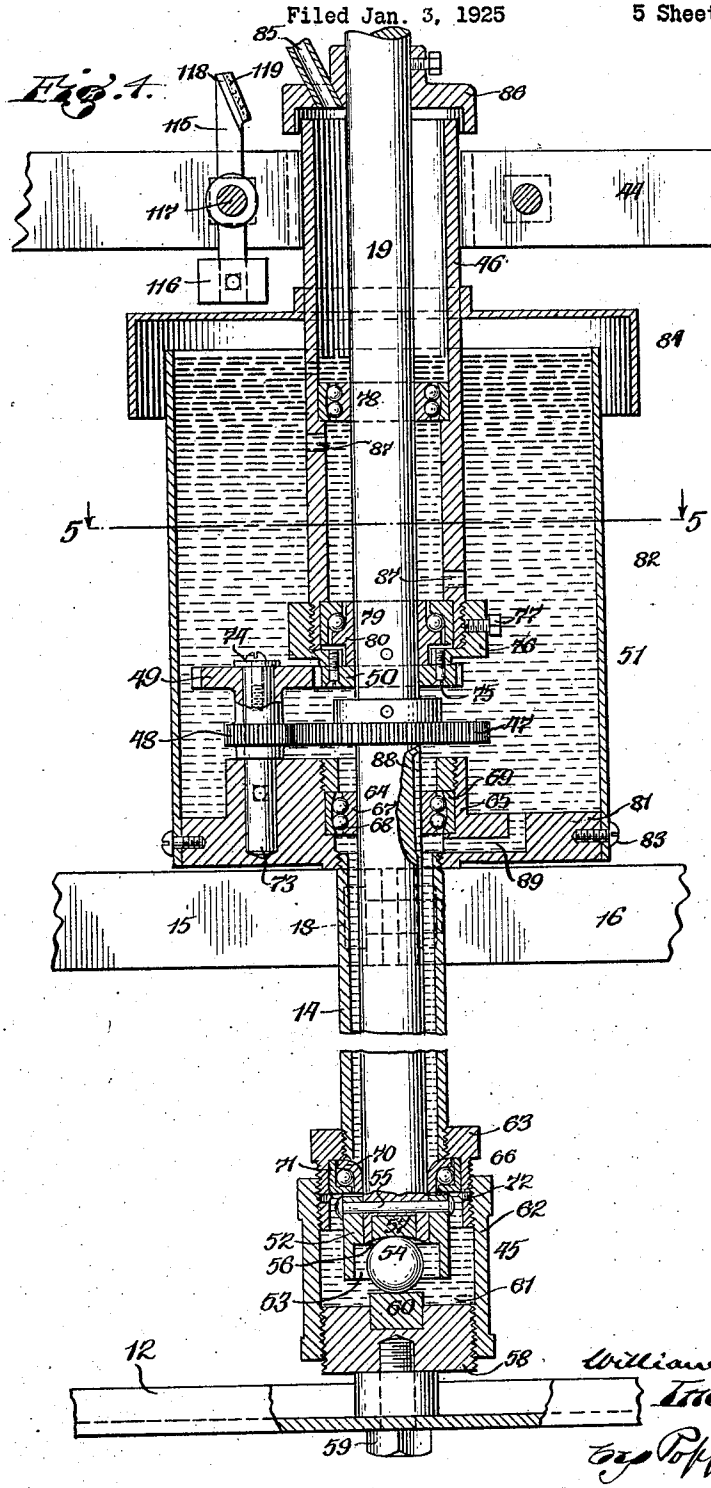

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Fig. 5.

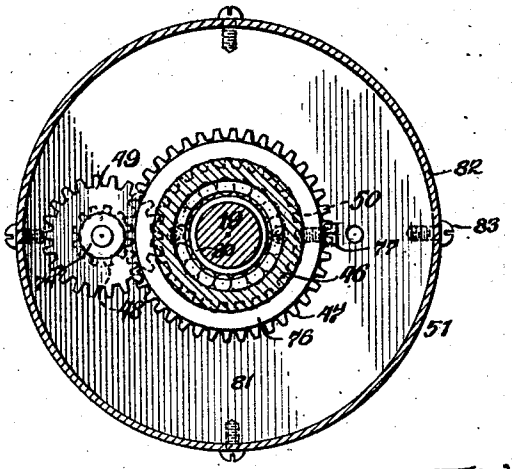

Fig. 6.

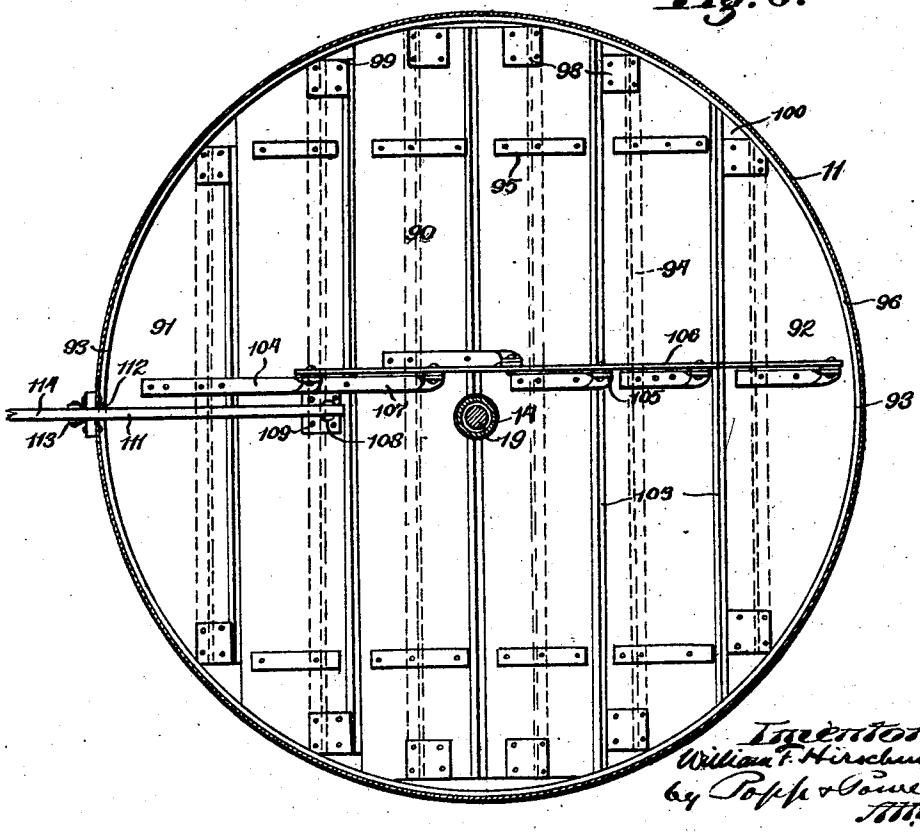

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Fig. 7.

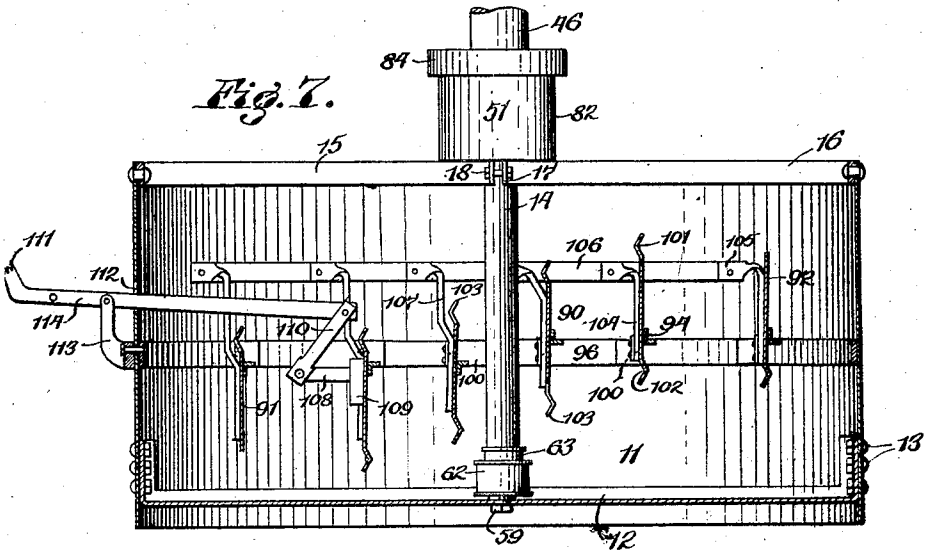
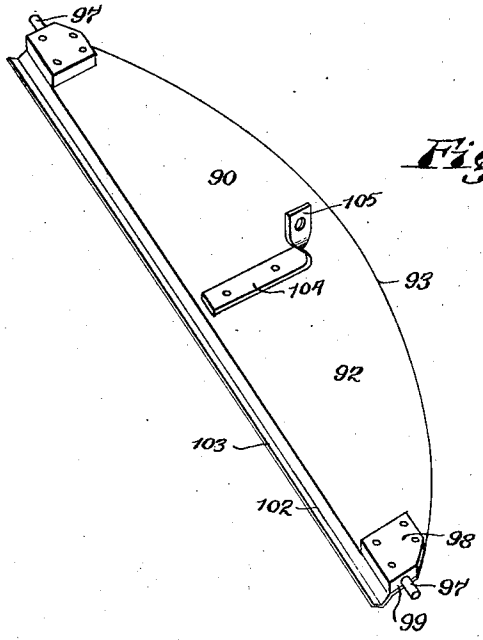


Fig. 8.



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Patented Mar. 20, 1928. 1,663,199

UNITED STATES PATENT OFFICE.

WILLIAM F. HIRSCHMAN, OF BUFFALO, NEW YORK.

ROTARY VENTILATOR.

Application filed January 3, 1925. Serial No. 348.

This invention relates to a rotary roof ventilator which is adapted to utilize the pressure of the wind or air currents to draw out or suck objectionable gases and foul air from the building on which it is installed and discharge the same into the outer atmosphere, this ventilator being an improvement on the one for which Letters Patent were granted to me May 16, 1922, bearing the Number 1,416,295.

One of the objects of this invention is to provide a ventilator which will operate at very low wind pressures and obtain the maximum pneumatic-dynamic efficiency.

Another object is to provide a louver or damper in the stack by which the flow of air through the ventilator can be controlled or regulated to suit the varying conditions.

Further objects are to simplify the construction and arrangement of the gearing and bearings, to reduce the wear upon these parts, and to prevent dirt, iron scale, etc., from interfering with the free operations of the same.

In the accompanying drawings:

Figure 1 is a side elevation of my improved ventilator showing part of the stack, dome and suction fan in section, and the louvers in their closed position.

Figure 2 is a top plan view of the suction fan showing the supporting post in section.

Figure 3 is a fragmentary side elevation of the fan and supporting post.

Figure 4 is a framentary sectional view of the fan driving mechanism and associated parts.

Figure 5 is a horizontal section, the same being taken on line 5—5, Fig. 4.

Figure 6 is a horizontal fragmentary sectional view of the stack showing the louvers in their closed position.

Figure 7 is a fragmentary sectional view of the same showing the louvers in an open position.

Figure 8 is a perspective view of one of the outer louvers or shutters.

Similar reference numerals indicate similar parts in each of the several views.

The ventilator is adapted to be placed on an exposed part of the roof 9 of the house or building being ventilated and is mounted on an upwardly extending vent pipe 10 of the ventilating system, (not shown), through which the foul air or objectionable gas is drawn out of the building and exhausted into the outside air.

In its general organization the ventilator comprises a stack on which is rotatably mounted a vaned dome or turret, a fan arranged within the turret and geared thereto so as to be rotated by the same, and a system of louvers or shutters arranged in the stack so that the suction of the fan can be regulated.

The stack 11 is made in the form of a cylindrical sheet metal body and is adapted to fit over the vent pipe 10 and be secured thereto in any approved manner. The stack is braced at its lower end by a transverse channeled bar 12 which is secured to the diametrically opposite sides of the stack by bolts or rivets 13 passing therethrough. This bar also serves to support the post 14 upon which the turret and ventilating fan are supported. In the upper part of the stack are arranged cross braces 15, 16 secured at their outer ends to the stack and the inner ends of which are provided with flanges 17 which flanges of both braces are adapted to be secured together by bolts 18 and to clamp the post 14 therebetween.

Within the post is arranged the vertical driving shaft 19 on the upper end of which the turret 20 is secured. The diameter of this turret is greater than the diameter of the stack 11 and vent pipe and is provided on its peripheral edge with a depending vertical flange or apron 21 the lower edge of which is lower than the upper edge of the stack 11, thereby preventing the entrance of rain and snow into the body of the ventilator. The means for securing the turret to the vertical driving shaft comprise an upper spider 22 and a lower spider 23 secured to each of these members and adapted to retain them in coaxial relation. Each of these spiders is composed of two sections the central parts 24 of which are formed to receive the driving shaft and are bolted together by bolts 25. The ends of each section are bent at an angle to the central part and form arms 26 which are adapted to be secured at their ends to the underside of the turret by bolts 27 or otherwise.

The rotation of the turret is accomplished by securing a number of spaced propeller buckets or blades 28 to the upper inclined face of the conical rotary turret. For sub-

stantially one half of the rotation of the turret these propeller blades are traveling with the wind, of course, and the remaining half rotation against the wind. The construction of the blades when traveling with the wind obviously presents no difficulty, but to travel against the wind the blades must be designed so as to offer the minimum resistance to the air current. For this purpose each of the propeller blades has its forward or leading edge 29 disposed flush with the upper surface of the turret and is secured thereto by suitable forwardly extending flanges 30 while the main body of each blade extends rearwardly and upwardly from said leading edge and terminates in a trailing edge 31. The central or body portion of each blade is pointed forming a forwardly and downwardly tapering bucket, the apex 32 of the same being arranged adjacent the upper surface of the turret. Since all of the blades or buckets are arranged in the same relation to the turret, the blades on one side of the turret present their concave sides to the wind while the blades on the other side present their convex sides. The turret, obviously, is rotated in the direction opposite to that direction in which the bucket shaped blades open, i. e., in the direction of the arrow, as shown in Figure 1, by reason of the greater resistance offered by the blades when arranged in that position than when arranged in the position the blades assume on the side of the turret going against the wind, i. e., when the buckets open in the direction of the wind current. This arrangement of the blades effectively rotates the turret even when the air current is of slight velocity, the action of the same being in accordance with accepted pneumatic-dynamic practice, the air current curling over the trailing edge 31 when the buckets travel against the wind and effectively killing the vacuum tending to form thereunder.

The ventilating fan is arranged within the turret coaxially therewith immediately above the upper edge of the stack or throat 11. The means for supporting the blades of the fan comprise two annular plates or rings of frustal form, the upper ring 33 being arranged adjacent the inner surface of the turret and conforming therewith, and the lower ring 34 being arranged immediately above the stack 11. The lower ring 34 is narrower and of smaller diameter than the upper ring 33. Between these supporting rings the blades of the fan are arranged. As shown in Figures 1, 2 and 3, two sets of blades are provided. The outer set, indicated generally at 35, comprises a plurality of vanes 36 disposed at an angle to the vertical and provided with transverse flanges 37 at their upper and lower edges by which they are riveted to the adjacent surfaces of the upper and lower supporting rings 33 and 34 respectively. Each of these blades are disposed at an angle to the radius of the fan, the advancing edge 38 of each blade being arranged adjacent the inner edges of the rings, and the trailing edges 39 being arranged adjacent the peripheries thereof. By this arrangement the foul air is forced outwardly by centrifugal force as the fan is rotated, the fan acting in the same manner as an ordinary propeller blade, the foul air being sucked from the interior of the turret and throat of the ventilator and expelled downwardly underneath the weather apron 21 into the outer atmosphere.

To increase the efficiency of the fan in expelling the foul air, blades 40 are provided which extend inwardly from the supporting rings 33 and 34, the upper or trailing edge 41 of the same being substantially radial of the fan. These inner blades are preferably only two in number as a large number of blades in the center of the fan would impede the flow of air and reduce the efficiency of the fan. The outer part 42 of the blades are similar in construction to the vanes 36, the blades being extended inwardly to form these inner blades. The lower part of each of these inner blades is curved forwardly forming a lower advancing edge 43. It is obvious that these blades act as scoops, throwing the foul air upwardly and outwardly where it is finally expelled by the other blades of the fan. By this means a greater exhausting effect is obtained.

The fan is supported from the supporting post by a spider 44 of the same form as the spiders 22 and 23 which support the turret, the same description applying.

In order to increase the exhausting effect of the ventilator, the fan is rotated at a greater speed than the turret by a driving mechanism which is preferably constructed as follows:

As shown in Figures 4 and 5, the driving means consist generally of the driving shaft 19 extending downwardly through the supporting post 14 and provided at its lower end with a thrust bearing 45, a hollow driven shaft 46 surrounding said driving shaft and supporting the fan at its upper end, a train of gears 47, 48, 49 and 50 connecting said driving and driven shafts, and a gear housing 51 surrounding the gears and shafts and forming the upper part of the oil well in which the driving mechanism runs.

The driving shaft 19 is provided at its lower end with a retaining collar 52 which is provided on its under side with a recess 53 in which the thrust ball 54 is arranged. This collar may be secured to the shaft in any suitable and well known manner, but preferably by a transverse rivet 55 passing through the shaft and the adjacent sides of

the collar. The lower end of the shaft is provided with an upwardly dished recess 56 for a purpose which will presently appear, and a hardened block 57 is arranged centrally within this recess and conforms therewith forming a hardened surface against which the thrust ball 54 bears. An externally threaded plug 58 is provided which is secured to the channeled brace 12 by a bolt 59, a separating washer being interposed and arranged in the channel of the brace. This plug is provided centrally with a hardened steel block 60 which extends above the upper end of the plug and forms a lower bearing surface for the thrust ball. By extending the hardened block upward from the supporting plug, an annular channel or well 61 is formed around the same which receives any iron scale or rust which may settle and accumulate at the thrust bearing, preventing this grit from interfering with and rapidly wearing the thrust ball.

Surrounding the thrust bearing at the lower end of the post 14 is an enclosing housing adapted to prevent leakage of the oil bath in which the driving mechanism is run. This housing comprises a coupling sleeve or union 62 secured at its lower end to the externally threaded supporting plug 58, and a collar 63 having an internally threaded portion which receives the supporting post and an externally threaded reduced portion engaged by the upper end of the union.

The driving shaft is supported laterally by an upper self-aligning ball bearing 64 interposed between this shaft and the adjacent part 65 of the gear housing, and a lower ball bearing 66 interposed the shaft and the collar 63. Each of these ball bearings may be of any suitable and well known construction, the upper self-aligning bearing 64 being shown as having an inner aligning ball race 67, ball bearings 68, and an outer race 69 having a concave inner face which is adapted to permit a limited aligning movement of the inner race and the balls, and the lower bearing preferably having an outwardly flanged inner race 70 and an inwardly flanged outer race 71 forming an annular groove therebetween which is adapted to receive the ball bearings. Adjustment of this lower bearing is effected by adjusting screws 72 provided in the collar 63 which screws are pointed at their inner ends and are adapted to force the outer race 71 upwardly against the balls when said screws are moved inwardly.

Inasmuch as a slight play in these bearings is necessary to their efficient operation, the driving shaft does not run perfectly true at its lower end but moves slightly in a circular path. It is therefore obvious that by using a single large thrust ball, a slow rotation of the same is effected which results in a slower and more even wear of the same than if it were rotated on one axis. Moreover a longer life is given to the hardened blocks between which it is interposed since the ball describes a slight circular path on these blocks and hence does not wear constantly on a single point of the surfaces thereof. By providing the upwardly dished recess 56 on the lower side of the upper bearing block and shaft, the thrust ball is retained in a position substantially coaxial with the driving shaft thereby rendering the thrust bearing self-aligning. The outer retaining collar 52 is, however, necessary when the ventilator is being shipped or installed, or possibly when a very severe gust of wind lifts the turret and shaft so as to free the thrust ball from the recess. Moreover this collar also serves to prevent such an undue upward movement of the shaft by the engagement of its upper face with the under side of the outer race of the lower ball bearing.

The gearing by which the hollow fan shaft and fan mounted thereon is driven at a greater speed than the driving shaft and turret comprises a large gear wheel 47 mounted on said driving shaft and meshing with a small pinion 48, and a pinion 49 made integrally with said pinion 48 and meshing with a gear wheel 50 of substantially the same size mounted on the driven shaft. The counter pinions are mounted on a vertical pintle 73 extending upwardly from the lower part of the gearing housing and are retained thereon by a retaining screw and washer 74. The gear wheel 50 is secured to the driven shaft by screws 75 which engage a collar 76, said collar being screwed over the lower end of said driven shaft, and retained in place by a transverse screw 77.

The hollow driven shaft 46 is mounted and supported on the driving shaft 19 by an upper self aligning bearing 78 which supports the driven shaft laterally, and a lower thrust ball bearing indicated at 79 which supports the driven shaft 46 vertically, and receives the downward thrust of the same. The upper bearing 78 which laterally supports the driven shaft is similar to the upper ball bearing 64 supporting the driving shaft, the same having inner and outer races secured respectively to the driving and driven shafts, and balls interposed therebetween. The lower or thrust bearing 79 is arranged at the lower end of the driven shaft 46, and is similar to the lower bearing 66 supporting the driving shaft, the outer race of the same being L-shaped in cross section and secured to the driven shaft, and the inner race 80 of the same being made integral with the gear wheel 50. The driven shaft 46 is therefore supported on, and the thrust thereof received by the gear wheel 50, which is

pinned or otherwise suitably secured to the driving shaft 19. By interposing the roller bearings between these shafts and thereby supporting the driven shaft on the driving shaft, the wear on the bearings is reduced since both of these shafts rotate in the same direction and the wear on these bearings results from the difference in the speed of these shafts.

The gearing housing comprises a circular base 81 mounted on the upper end of the supporting post 14, which base supports the driving shaft and counter pinions, and a circular wall 82 secured to the periphery of said base by screws 83 and rising therefrom. This housing is adapted to contain oil and is provided with a dust cap 84 which is secured to the driven shaft and extends over the open upper end of the housing.

Oil is supplied to the driving mechanism by a conduit 85 which extends through the turret to the upper side thereof, the lower end of the conduit extending through a dust cap 86 which is secured to the driving shaft and arranged over the upper end of the driven shaft, said conduit supplying oil between these shafts. Free intercommunication of the oil in the driving mechanism is established by providing transverse ports 87 in the driven shaft, a longitudinal oil groove 88 in the driving shaft leading around the upper ball bearing, and an oil passage 89 in the base of the gearing housing leading to the interior of the supporting post.

In order to control the flow of air through the stack and thereby regulate the ventilation of the building, a valve or closure consisting of a plurality of louvers or shutters is provided in the stack which are adapted to be swung into a horizontal position in which they overlap and engage each other and cut off the flow of air, or into a vertical position in which they permit a free suction through the system, or into any intermediate regulating position.

Each of the louvers 90 are of substantially the same width and jointly form a circular closure, the end sections 91 and 92 having curved sides 93 conforming to the circular stack and the intermediate sections having similarly curved ends. Each shutter is provided with a longitudinal stiffening angle iron 94 on its under side, and the intermediate sections are provided with transverse reinforcing strips 95 on their upper sides.

The shutters are supported on an annular supporting ring or band 96 the shutters being pivotally mounted thereon so as to swing on their longitudinal axes. The pivotal bearings may be of any suitable construction but preferably consist of pins 97 projecting from the ends of each shutter, each pin being supported in a block 98 arranged on the top of said shutter. In order to permit the louver to be swung into a vertical position the ends 99 of the same are squared at right angles to the axis of the shutter adjacent the bearing so that when the shutter is swung vertically the inner corners of the same do not come in contact with the inner side of the stack which would occur if the shutters were not squared. Filling blocks 100 are provided on the supporting ring 96 which extend inwardly therefrom adjacent the ends of the shutters and fill the space between the squared ends of the shutters and the ring, and also form bearing blocks for the pivot pins of the shutters. It is to be understood however that the louver is not intended to act as an air tight closure and a considerable clearance is allowed between the louvers and the supporting ring and filling blocks.

To form a more perfect closure when the louver is fully closed and also to reinforce the edges of the shutters each is formed so as to provide a groove 101 on its under side on one longitudinal edge, and at its opposite longitudinal edge with a groove or channel 102 on its upper side, the corresponding grooved edges of the shutters being adapted to register with each other, the outer part 103 of each groove engaging the groove of the adjacent shutter when the louver is closed as best shown in Figure 1. The curved edges of the outer louvers 91 and 92 are not, of course, provided with such grooves.

It will be observed that the individual shutters are not balanced or hung centrally on the pivots, but that in each case the pivots are arranged at a point considerably inward from the longitudinal center line of the shutter, that is to say on that side of the shutter remote from the periphery of the stack. By this arrangement shutters of larger area, and a larger opening are obtained since the shutters require a relatively small squared end to properly swing to a vertical position and hence the size of the filling blocks 100 can be correspondingly reduced. It will also be observed that the balance of the louver system as a whole is not affected since those shutters on the side on which the greater part of the same is swung upwardly is counterbalanced by the shutters on the other side in which the greater part of each shutter is swung downwardly as best shown in Figure 7.

Each of the shutters is provided with a transverse arm 104 which is riveted to the upper side of the shutter. Each of these arms extend in the same direction and are provided at their outer ends with ears 105 which are adapted to pivotally engage a transverse connecting bar or link 106 on which all of the arms are mounted. This bar is at all time disposed horizontally and the length of the arms 104 is therefore de-

termined by the distance between each shutter and the bar when the shutters are in an open position, the arms of the depending shutters having outwardly extending portions in the form of arms 107 for this purpose as shown in Figure 7. It is obvious that by this construction the shutters move in unison and the operation of any shutter will operate the others.

To operate the louver system one of the shutters is provided with a lever arm 108 which extends perpendicularly from the upper side of said louver and is secured thereto by its base 109. At its outer end this lever arm is pivotally connected to a link 110 which link is connected at its upper end to the inner end of the operating lever 111. This operating lever may be mounted in any suitable manner but preferably extends through a vertical slot 112 in the stack and is pivotally mounted on a bracket 113 which is arranged outside of the stack. Any suitable manual or automatic means indicated conventionally by a chain 120 may be used to operate the lever, the same being connected to the outer short arm 114 of this lever. It is apparent that by lowering the outer end of this lever, the link 110 is raised, raising the lever arm 108 and rotating the louver to a closed position as shown in Figure 1. In a similar manner the shutters are opened by raising the operating lever.

By providing a louver system of this character, the ventilator and louver can be installed as a unit and the necessity for an individual damper in each duct of the ventilating system is eliminated.

A governor is provided to prevent too rapid rotation of the turret which comprises a swinging arm 115 having a lower weighted end 116 which arm is pivoted by a transverse pin 117 to one of the arms of the spider supporting the ventilating fan. An inclined head 118 is provided on the upper end of this swinging arm, the inner side of which is faced with asbestos 119, said head being adapted to swing inwardly and engage the periphery of the dust cap 86 covering the hollow driven shaft when the speed of the fan throws the lower weighted end of the same outward. Since the driving shaft 19 to which the dust cap 86 is secured travels at a different speed from the fan, an effective braking action is secured by this governor.

This ventilator is relatively compact and simple in construction and the internal parts offer little resistance to the free flow of air through the same. It is also efficient in operation and is not liable to wear rapidly or get out of order notwithstanding the severe and constant usage to which this type of ventilator is subjected.

I claim as my invention:—

1. In a ventilator, a circular stack through which the foul air is exhausted; a plurality of parallel louvers each of which is pivotally mounted at its ends in said stack and said louvers being adapted to be moved into a position in which they are arranged transversely of said stack and form a closure therein or into a position parallel with the stack in which a flow of air through the stack is permitted; a transverse bar pivotally connected to the corresponding sides of each of said louvers so as to cause all the louvers to move in unison to an open, closed or intermediate position; and means for moving one of said louvers to an open, closed, or intermediate position comprising a lever arm secured to one of said louvers and extending transversely outward relative thereto; a transverse operating lever pivotally mounted on said stack; a link pivotally connecting one arm of said operating lever and said lever arm; and operating means associated with the other arm of said lever.

2. In a ventilator, a circular stack through which the foul air is exhausted; a plurality of parallel louvers each of which is pivotally mounted at its ends in said stack and said louvers being adapted to be moved into a position in which they are arranged transversely of said stack and form a closure therein or into a position parallel with the stack in which a flow of air through the stack is permitted; a transverse bar pivotally connected to the corresponding sides of each of said louvers so as to cause all the louvers to move in unison to an open, closed or intermediate position and means for moving one of said louvers to an open, closed or intermediate position comprising a lever arm secured to one of said louvers and extending transversely outward relative thereto; a transverse operating lever pivotally mounted on said stack; a link pivotally connecting one arm of said operating lever and said lever arm; and operating means associated with the other arm of said lever and said last mentioned arm being arranged without said stack.

3. In a ventilator, a circular vent stack, a plurality of parallel louvers arranged transversely in said stack and conforming at their ends to the shape of said stack, means for pivotally supporting each end of each of said louvers on said stack to swing about a longitudinal axis, the axes of at least two of said louvers being disposed between the longitudinal center line of said louver and the longitudinal inner edge thereof, said louvers being adapted to engage each other and form a closure and to be disengaged and permit air to pass through the stack, and means for swinging said louvers into open, closed or intermediate positions.

4. In a ventilator, a circular vent stack, a plurality of parallel louvers arranged transversely in said stack, means for pivotally supporting each end of each of said louvers

on said stack to swing about a longitudinal axis, the axis of each of said louvers being offset relative to the longitudinal center line of the louver to form a portion of greater extent on one side of said louver, and said louvers being adapted to engage each other and form a closure, and means for simultaneously actuating said louvers, the axes of said louvers being disposed in such manner that the greater portions of substantially half of said louvers swing downwardly, the greater portions of the other louvers swinging upwardly.

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