May 1, 1934. J. M. FRANK 1,956,829

AIR VOLUME REGULATOR

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Fig. 1.

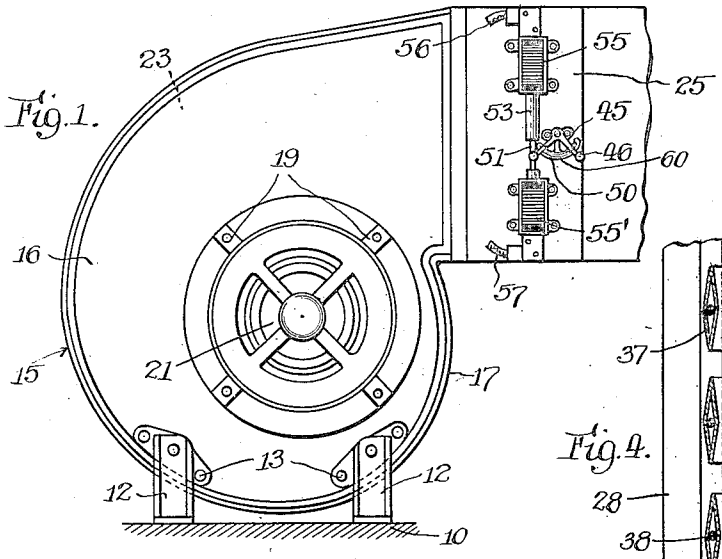


Fig. 4.

Fig. 3.

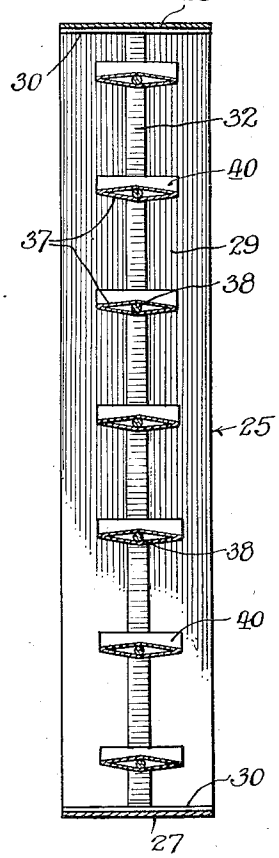
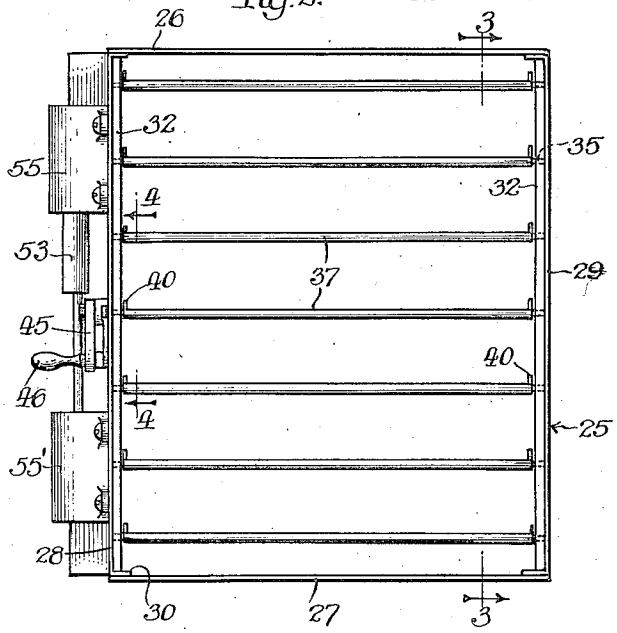


Fig. 2.



Inventor:
John M. Frank,
By Fisher, Clapp, Soames & Ford, Attys.

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Fig. 5.

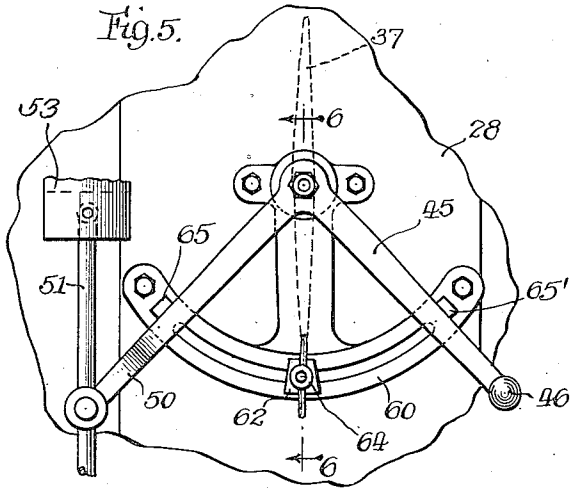


Fig. 6.

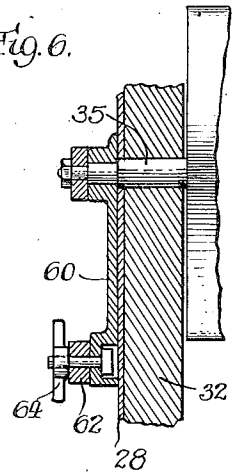
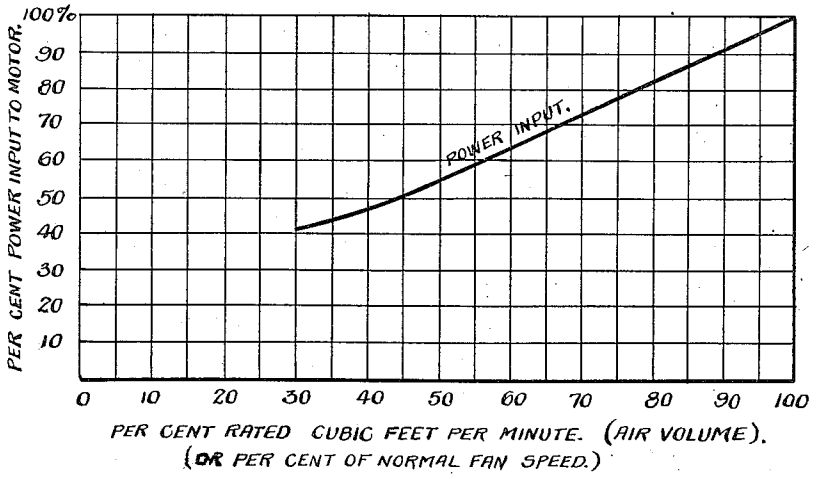


Fig. 7.



Inventor:
John M. Frank,
By Fisher, Clapp, Soans & Pond, Attys.

Patented May 1, 1934 1,956,829

UNITED STATES PATENT OFFICE

1,956,829

AIR VOLUME REGULATOR

John M. Frank, Winnetka, Ill., assignor to Ilg Electric Ventilating Company, Chicago, Ill., a corporation of Louisiana

Application July 24, 1929, Serial No. 380,475

2 Claims. (Cl. 230—114)

My invention relates broadly to ventilating devices and has to do more particularly with means for regulating the air volume output of blowers when directing a current of air into an enclosure.

Ventilating devices, as ordinarily used in commercial establishments, such as restaurants and the like, are frequently required for service only at special "rush" hours which may be definitely fixed. Between these hours there is usually a lull in patronage and, hence, the requirement for the ventilating apparatus ceases. As usually installed, the ventilators must be turned on and off by manual operation of a switch or the like, and, in the event that the person whose duty it is to operate the ventilator forgets to turn it off at the end of a rush period, the result is an unusually high amount of wear on the equipment as well as a power loss.

An object of my invention, therefore, is to provide a ventilating device of the type referred to, in combination with means for automatically controlling the air output thereof at predetermined fixed hours.

Ventilating devices of the type referred to are subjected to a diversity of requirements with regard to air output, depending upon weather conditions, the number of occupants within the enclosure to be ventilated, etc. As ordinarily installed, blowers are provided with variable speed motors, which are usually arranged for belt drive. However, the cost of such equipment is high, and it is, therefore, a further object of my invention to provide a blower which may be operated by a constant speed motor of any suitable type and to vary the air output of such blower by means independent of the motor.

Still another object is to provide such a device whereby the air output may be controlled by means which will create a back pressure within the blower, which pressure will effect a decrease in the load of the motor and a consequent saving of power.

Another object is to provide new and improved means for securing very high over all efficiencies in a ventilating device operating at less than normal capacity.

Still another object is to provide such a device which will be incapable of fully shutting off the air output, so that as long as the motor is operating, a degree of ventilation will result.

A further object is to provide in a device of the type referred to efficient stream-line blades to reduce eddy currents of air to a minimum.

Various other objects and advantages will be apparent to those skilled in the art as the description proceeds.

Referring now to the drawings forming part of the specification and illustrating a preferred embodiment of my invention;—

Fig. 1 represents a side elevational view of a blower embodying my invention.

Fig. 2 is a front elevational view of the means for controlling the air output of the device shown in Fig. 1;

Fig. 3 is a sectional view taken substantially on the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary sectional view taken substantially on the line 4—4 of Fig. 2, with the shutters in closed position;

Fig. 5 is a detailed view on a large scale of a modified arrangement of the shutter controlling means.

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 5, and

Fig. 7 is a curve showing the relation between power input and volume of air.

Referring first to Figure 1, the blower here illustrated may be supported from a floor 10 or other suitable support by means of legs 12 which may be secured by means of bolts 13, or other suitable means, to a casing indicated at 15. This casing comprises a pair of side walls 16 and a more or less spirally-shaped wall 17. Arranged on the casing 15 and supported thereon by means of brackets 19 or the like is a motor indicated at 21, which may be of any suitable type, preferably electrical, which actuates a fan wheel (not shown). The motor 21 is preferably of a constant speed type, inasmuch as this type is less expensive than one of variable speed and also results in better operating characteristics at reduced loads, and is especially adapted for devices embodying my invention.

The casing 15 thus defines a substantially spiral air passage or channel indicated at 23 in Figure 1. Secured to the casing 15 at the outer end of this spiral passage 23 is a tubular frame 25 substantially in the shape of a rectangular parallelepiped, comprising a top plate 26, a bottom plate 27, and side plates 28 and 29. The side plates are preferably flanged over as at 30, which flanges may be secured to the top and bottom plates by means of solder, welding, rivets, or other suitable means. Secured to the inside of the side plates 28 and 29 by any suitable means are bars 32. These bars are apertured at spaced intervals to receive pintles 35 which serve to rotatably mount a plurality of vanes or shutters 37.

The blades or shutters 37, as shown best in Figures 3 and 4, are preferably of hollow construction and are preferably of stream line contour in order to reduce the friction of air passing over them, as well as the losses due to the eddying of the air as it passes the blades, and are mounted on rods 38 which terminate in the pintles 35. The shutters 37 have at their extremities angular flanges 40 which are adapted to seat snugly against the bar 32 when the shutters are arranged in their extreme closed position, as shown in Figure 4.

At one side of the frame 25, say on the side adjacent the plate 28, a bar 42 extends longitudinally of the side plate and has a plurality of laterally extending ears 43 pivotally secured to the flanges 40 of the shutters. Attached to the pintle 35 of one of the shutters is a crank 45 having a handle 46. Preferably integral with the crank 45, as in the form of a bell crank or the like, is a crank or lever 50 preferably connected to a connecting rod 51, which is secured to an armature 53 of a solenoid 55. This solenoid is connected with an electrical conduit 56 which may lead from a time switch of any type well known in the art or from a thermostatic switch or other suitable device. The crank 50 is also pivotally connected to a solenoid 55', which is connected by means of an electrical conduit 57 to a source of current.

In the operation of the device described above, the motor 21 is connected to any suitable source of energy (not shown) and is started when ventilation is desired. The motor sets up a current of air through the spiral passage 16, which, when the vanes 37 are open as shown in Figures 2 and 3, is directed out into the enclosure with a minimum of friction and eddying because of the stream-line design of the vanes.

When it is desired to reduce the amount of air issuing from the blower to a desired minimum, one of the solenoids, say the solenoid 55, is actuated by means of a suitable electric switch. The solenoid will move the crank 50 about its pivot which results in simultaneous movement of all the shutters by means of their pivotal connection to the bar 42. The time switch (not shown) meanwhile is set to close the shutters at a definite time, and, when the switch is actuated, the solenoid 55' controlled thereby operates to rotate the crank 50 and close the shutters. Similarly, the time switch may be set to open the shutters at a predetermined time or times. Furthermore, the shutters may be operated, if desired, by pneumatic means or by a motor geared to the shutters.

It will be noted that the shutters 37, when in their extreme closed position, as shown in Figure 4, do not entirely cut off the flow of air out of the blower. In my preferred embodiment, the shutters in their extreme closed position cut off only about fifty per cent of the total flow. The purpose of this construction is not only to permit a degree of ventilation in the position of minimum displacement of the blades, but also to eliminate noise. It has also been found that when the blades completely close the discharge opening, air at high velocity escapes through minute cracks and openings and sets up whistling and other obnoxious noises.

Figures 5 and 6 show an embodiment which is substantially similar to that described above, except that in this embodiment means is provided for adjustably limiting the extreme open or closed positions of the shutters. Secured to the frame 25 is a slotted arcuate plate 60, in the slot of which is arranged a boss 62 adjustably secured to the plate 60 by means of a bolt and wing nut 64. Fixed bosses 65 and 65' may be provided adjacent the extremities of the arc. It will be readily apparent that if the blades 37 are in the position indicated in dotted lines in Figure 5 in their extreme closed position, they may be prevented from opening further than a predetermined amount by adjustment of the boss 62 in the slot. It will be apparent that a second similar boss may be provided for limiting the extreme closed position of the blades if desired.

Furthermore, the blades may be arranged for manual control by means of the crank 45 and handle 46 merely by providing a wing nut adjustably secured in the slot in the arcuate member 60.

It will be seen that the air volume is controlled according to my invention by means independent of the motor, and, as a matter of fact, an actual saving in power output is accomplished as the air output is decreased, as shown by the curve in Figure 7. This curve shows actual experimental results with devices embodying my invention. This is explained by reason of the fact that as the pressure is raised within the blower, this results in a decrease in the air volume output, which effects a proportional decrease in the load on the motor.

Obviously, many variations of my invention will readily appear to those skilled in the art, and I do not wish to be limited to the specific forms disclosed or uses mentioned except as set forth in the appended claims.

I claim as my invention:

1. In a device of the class described, a rotary blower, means for conducting air from said blower along a channel, means for controlling the volumetric air output of said blower and for simultaneously varying the load on said blower, said means comprising a plurality of shutters interposed in said channel, said shutters being pivoted adjacent their medial axes, the width of each of said shutters being less than the distance between said axes, and means independent of said blower for operating said shutters as a unit.

2. In a device of the class described, a rotary blower, means for conducting air from said blower along a channel, means for controlling the volumetric air output of said blower and for simultaneously varying the load on said blower, said means comprising a plurality of stream-line shutters interposed in said channel, said shutters having symmetrical V-shaped longitudinal edges and being pivoted adjacent their medial axes, the width of each of said shutters being less than the distance between said axes, and means independent of said blower for operating said shutters as a unit.

JOHN M. FRANK.