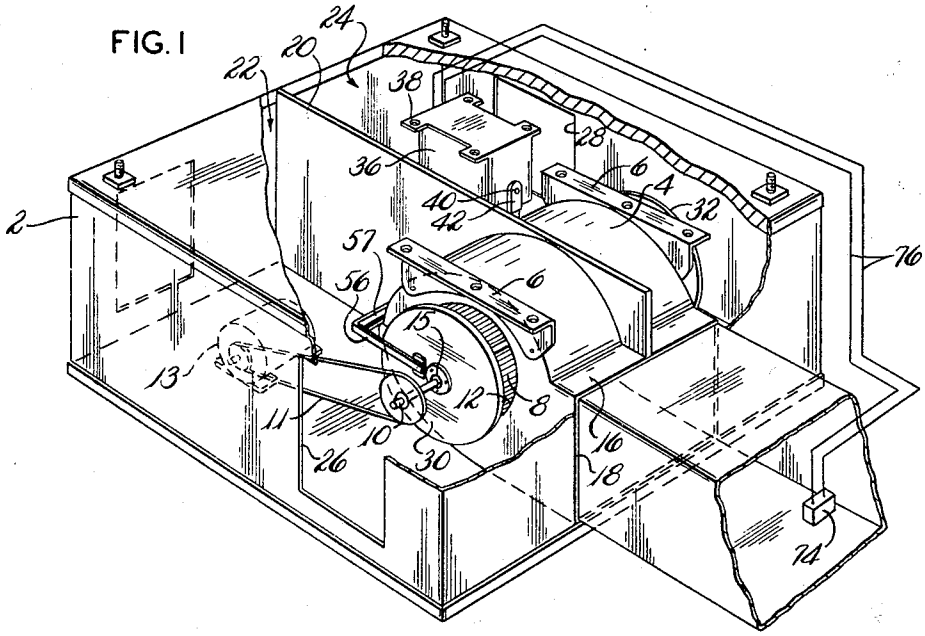
April 29, 1969 T. MORRISON 3,440,946

PROPORTIONAL CENTRIFUGAL BLOWER

Filed March 13, 1967 Sheet 1 of 2

FIG. 1



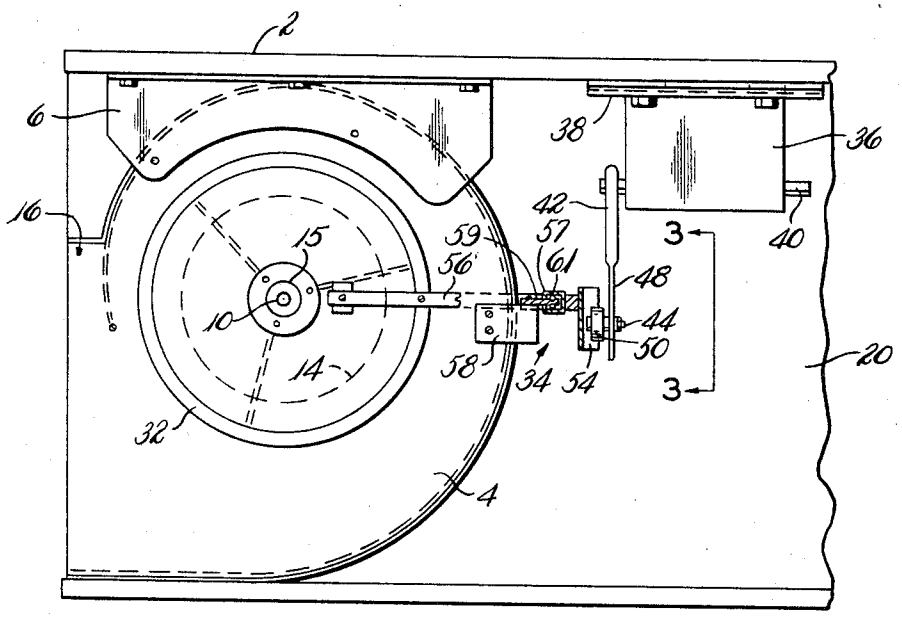


FIG. 2

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PROPORTIONAL CENTRIFUGAL BLOWER

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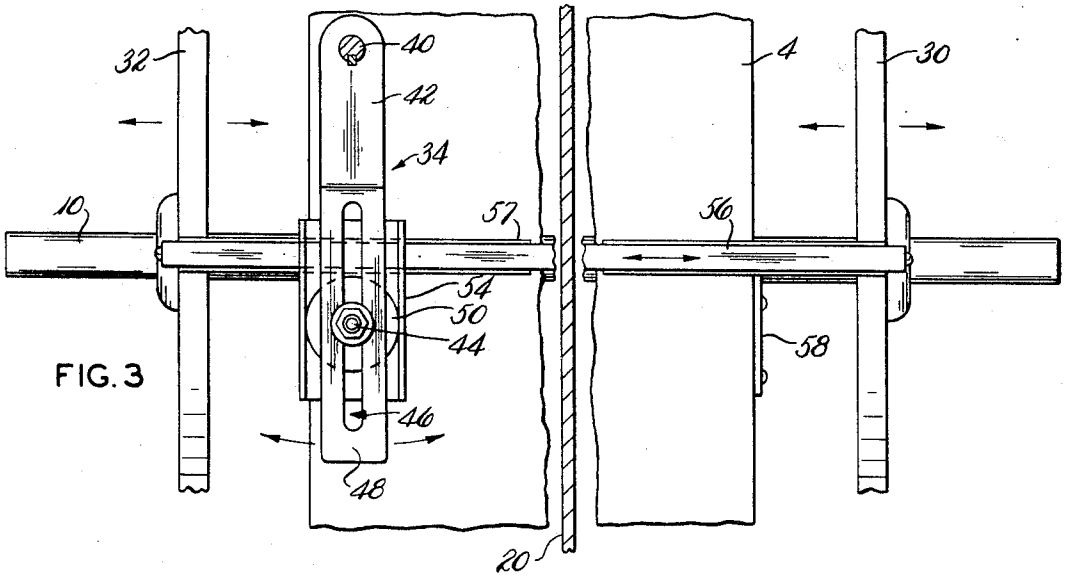


FIG. 3

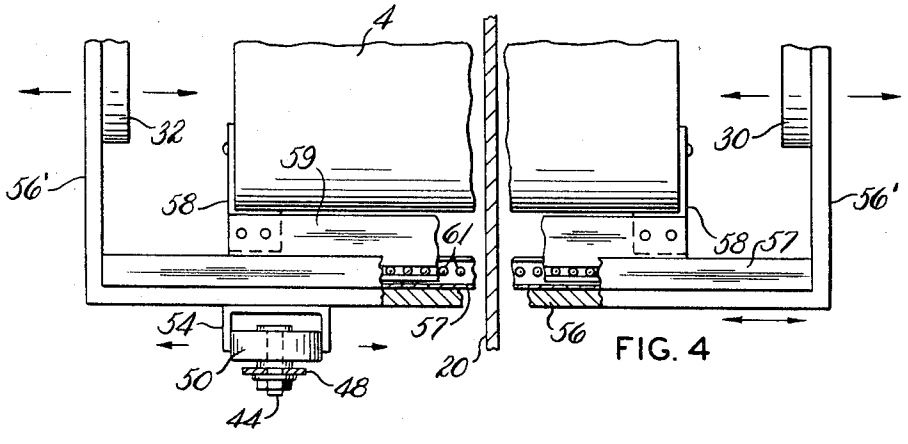


FIG. 4

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PROPORTIONAL CENTRIFUGAL BLOWER

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Filed Mar. 13, 1967, Ser. No. 622,506
Int. Cl. F24f 7/06; F04d 17/08
U.S. Cl. 98—38 3 Claims

ABSTRACT OF THE DISCLOSURE

A centrifugal type blower having two separated inlet ports and one outlet port. A baffle is positioned adjacent each inlet port and mounted for simultaneous movement so that as the amount of gas entering one inlet port may be increased while the air entering the other is simultaneously decreased.

This invention relates to the centrifugal blower art and more particularly to a proportioning centrifugal blower and to a gas circulating system comprising the same.

The present invention is particularly applicable to centrifugal blowers used in ventilating systems, and will be described with reference thereto. However, it will be appreciated that the invention has broader application and may be used in other environments where it is desired to move gaseous mixtures of varying composition.

In recent years, the emphasis in commercial buildings, e.g., banks, office buildings, and schools, has been in the direction of sealed, completely air conditioned structures. In this way temperature, humidity, dust and pollen can all be controlled to within comfortable limits, irrespective of conditions outside the building.

A further refinement in the air conditioning of large buildings involves the use of a series of separate ventilating systems, each of which independently controls the environment of a room, or two or more adjacent rooms. In one conventional form, such a ventilating system comprises a centrifugal blower to circulate a constant volume of air.

Building codes for such structures require that specified minimum amounts of fresh air from outside be drawn into the building. Moreover, fresh air can advantageously serve as a source of heat or a heat sink, and as a source of moisture or a moisture sink, depending on its temperature and humidity, relative to the inside air. In accordance with these considerations, a suitable mix may contain from as little as 20–25% or less fresh air, up to 100% fresh air. Thus, one can recognize the desirability and need of providing a ventilating system of the type described with suitable means for mixing fresh air and recirculated air in varying volumetric ratios while maintaining substantially constant, the total volume of air circulated. The present invention is addressed to filling this need.

The present invention uses a centrifugal blower having a pair of spaced inlets and an outlet. The inlets are isolated from each other, externally of the blower, and each communicates with a different gas stream. As applied to a ventilator system, for instance, one inlet would communicate with a source of fresh air, and the other inlet, with a source of recirculated air. The two streams are admixed within the blower and are discharged as a single, substantially homogenous mixture.

In order to vary the composition of the discharge mixture while maintaining its rate of discharge substantially constant, it is necessary that the effective areas of the two inlets be varied, but that the "equivalent orifice" of the system be held substantially constant. According to the art recognized "equivalent orifice" concept, if the total

pressure delivered to a system is converted to velocity, the equivalent orifice of the system is the area which, multiplied by that velocity, gives the volume flowing through the system. Thus, to hold constant the volume flowing through the system, a reduction in the effective area of one inlet must be compensated by a corresponding increase in the effective area of other inlet.

Therefore, in accordance with the present invention, there is provided, in combination with an open centrifugal blower having a pair of isolated spaced inlet ports and a single outlet port; movable damper means disposed adjacent each inlet port, and driving means operative to simultaneously move one of the damper means toward its inlet port, and move the other damper means away from its inlet port, whereby the amount of gas entering each port is simultaneously increased and decreased but in inverse amounts.

By open centrifugal blower is meant a blower wheel having an interior which is unobstructed or substantially unobstructed so that the aerodynamic center of the wheel can shift in response to variations in the effective areas of the inlets.

In accordance with another aspect of the present invention, there is provided a ventilating system comprising a housing, an open centrifugal blower mounted therein, having a pair of spaced inlet ports and a single outlet port, an opening in the housing communicating with the outlet port of the blower, means dividing the housing into two plenum chambers, each of which communicates with a different one of the blower's inlet ports, movable damper means disposed adjacent each inlet port, and drive means operative to (1) move one of the damper means along a path which reduces the effective cross-sectional area of its corresponding inlet port, and (2) move the other damper means along the path which increases the effective cross-sectional area of its corresponding inlet port, whereby the equivalent orifice of said system is held substantially constant throughout the movement of said damper means.

In accordance with a further aspect of the present invention, sensing means are provided in a ventilating system of the type described which means are effective to energize the damper driving means.

It is, therefore, an object of the invention to provide a proportioning centrifugal blower.

A further object of the invention is to provide a ventilating system containing an improved proportioning centrifugal blower having suitable means for admixing fresh air and recirculated air in varying volumetric ratios while maintaining constant the volume of air circulated.

Yet another object of the invention is to provide in a ventilating system of the type described, sensing means operative to energize the centrifugal blower's proportioning mechanism.

These and other objects and advantages will become apparent from the following detailed description of a preferred embodiment of the invention when read in connection with the accompanying drawings, in which:

FIGURE 1 is a schematic, perspective view, with parts cut away, showing a preferred embodiment of the invention;

FIGURE 2 is a schematic, elevation view, of the right end of the device as viewed in FIGURE 1;

FIGURE 3 is a schematic, partial elevation view, of the rear of the device, taken generally along line 3—3 of FIGURE 2; and

FIGURE 4 is a schematic, partial plan view, of the device shown in FIGURE 1.

Referring now to the drawing wherein the showings are for purposes of illustrating a preferred embodiment of the invention only, and not for purposes of limiting the same, FIGURE 1 shows an outer boxlike main housing 2 having

a conventional centrifugal blower therein comprised of a housing **4** and a squirrel cage rotor **8**, supported for rotation with shaft **10**, which in turn is connected by belt **11** to an electric motor **13**. The shaft **10** is rotatably supported as is conventional in bearings, not shown.

The rotor **8** is preferably supported on the shaft at its ends by spiders (not shown) which enable the air to flow readily therepast. Alternatively, the rotor **8** may be center mounted, but if so, the mounting plate should be provided with large perforations or other openings so as not to interfere with air flow therethrough and thus to permit the aerodynamic center of the rotor to shift. Still further, alternatively the blower may be direct driven by a motor as is conventional in the blower art.

In the embodiment shown, the blower housing **4** is mounted in housing **2** by means of brackets **6** and has inlet ports **12, 14** coaxial with shaft **10** and an outlet port **16**. Housing **2** is provided with opening **18** communicating with outlet port **16** of the centrifugal blower.

Housing **2** is further provided with dividing means, such as partition **20**, dividing the housing into plenum chambers **22** and **24**. Plenum chamber **22** communicates with inlet port **12** of the blower, and plenum chamber **24** communicates with inlet port **14** of the centrifugal blower. Plenum chambers **22** and **24** are further provided with openings **26** and **28**, respectively, each of which communicates with a separate source of gas. These sources may be as desired e.g., a chemical or electrochemical gas generating reactor, a humidifier, furnace, refrigerator or the like but in accordance with the preferred embodiment, one of openings **26, 28** communicates by ducts (not shown) with the air to be recirculated and the other by ducts (not shown) with the outside fresh air. It will thus be seen that the construction of housing **2** is such that gases of different composition or temperature are drawn separately to inlet ports **12** and **14** of centrifugal blower housing **4**, where they will be admixed by the action of the centrifugal blower's rotor **8** and forced out of outlet port **16**.

In accordance with the invention, inlet ports **12, 14** each have disposed adjacent thereto, simultaneously movable damper means such as damper plates **30, 32**, respectively. Both damper plates **30, 32** move along a path so that one moves toward its inlet port to restrict the flow of air thereinto and the other moves away from its port to allow the flow of air thereinto. These damper plates **30, 32** may be supported for movement as desired but in the embodiment shown, each has a central bearing **15** slidably supported on shaft **10**. The plates **30, 32** are held in fixed spaced relationship by a U-shaped member **56** having spaced parallel legs **56** each fastened respectively to one of the plates **30, 32**. The member **56** is supported for longitudinal movement on a guide member **59** mounted at its ends on the blower housing **4** by means of brackets **58**. This support may take a number of different forms but in the embodiment shown, a slide **57**, U-shaped in cross section, has legs extending over and under the base of guide member **59**. Ball bearings **61** disposed therebetween give a low friction support.

The spacing between the damper plates **32, 34** in relation to the axial length of the housing **4** is important to the proper operation of the apparatus. This spacing for any given blower may be calculated but preferably is determined empirically by first placing one damper plate against its inlet port and the other fully removed. The output volume of the blower which will be somewhat less than the maximum without the plate in place is then measured. Thereafter, the two damper plates are each placed against their inlet ports and simultaneously moved away with the spacing always equal until the outlet volume of the blower again equals the output volume as first measured. This spacing then becomes standard for any one size of blower.

On a standard 9 x 9 centrifugal blower manufactured by Morrison Products, Inc., the assignee of this application, Model 90–9HP–1, the spacing of each plate **30, 32** for a 50-50 mix from the ends of the housing was determined to be two inches or a total spacing of four inches. This total spacing thereafter is a constant, e.g. the spacing of one plate for a zero-100% mix is four inches and for the other plate, zero.

It will be seen that simultaneous movement of the damper plates **30, 32** in either direction results in inversely changing the relative effective areas of inlet ports **12, 14** and thus the relative amounts of gases entering from each plenum of housing **2**, while maintaining substantially constant, the total volume of gas flowing through the centrifugal blower. As applied to a ventilating system, the proportioning capability of the centrifugal blower is such that it permits the mixing of fresh air and recirculated air in varying volumetric ratios while maintaining constant, the total volume of air is circulated by the blower.

As best seen in FIGURE 2, drive means are provided to simultaneously move the damper plates **30, 32** in either direction. These drive means may take any one of a number of forms such as mechanical, pneumatic or hydraulic means, but in the preferred form shown, comprise a reversible gear motor **36** secured to housing **2** by mounting bracket **38**. The gear motor **36** has an output shaft **40** on which is mounted a lever arm **42**. A cam **50** is adjustably positioned on the lever arm **42** by means of a bolt **44** extending through a slot **46** in the portion **48** of the arm remote from shaft **40**. The cam **50** slidably engages in the channel of a follower member **54**, which in turn, is secured to the base of the member **56** holding the plates **30, 32** in fixed spaced relationship.

Operation of driving means is as follows. Rotational movement of shaft **40** and lever arm **42** is transmitted by the cam **50** to the follower **54**, which in turn, causes the U-shaped member and damper plates **32, 30** to move either to the left or right with respect to inlet ports **12, 14** of the centrifugal blower. By adjusting the position of cam **50** relative to shaft **40**, the total amount of movement of the plates may be readily adjusted.

As shown in FIGURE 1, sensing means **74** are provided downstream of outlet **16**. Sensing means **74** are connected, as by electrical wires **76**, to the driving means for moving damper plates **30** and **32**. The sensing means may be responsive to temperature, humidity, or to the presence or absence of a predetermined concentration of some component in the gaseous stream. Furthermore, the connection between sensing means **74** and driving means **34** may be by hydraulic or penumatic connection rather than the electrical connection shown.

The present invention enables the effective control of an air mix into a closed building while maintaining a constant flow of air.

The present invention has been described in connection with certain structural embodiments; however, it is to be appreciated that various structural changes may be made in the illustrated embodiments without departing from the intended scope and spirit of the present invention as defined in the appended claims.

Having thus described my invention, I claim:

1. In combination with an open centrifugal blower having a pair of spaced inlet ports and a single outlet port; said blower being adapted to draw ambient air through said inlet ports and mix such air for discharge through said outlet port, movable damper means disposed outside of said blower adjacent each inlet port, and driving means operative to (1) move one of said damper means along a path with reduces the effective cross-sectional area of its corresponding inlet port, and (2) move the other of said damper means along a path which increases the effective cross-sectional area of its corresponding inlet port, whereby the equivalent orifice of said centrifugal blower is held substantially constant throughout the movement of said damper means.

2. The combination as defined in claim **1**, wherein said driving means includes means interconnecting said

damper means exteriorly of said blower for simultaneous movement.

3. In combination with an open centrifugal blower including a housing and a blower wheel rotatably mounted in said housing, said housing having a pair of spaced inlet ports and a single outlet; movable damper means disposed adjacent each inlet port exteriorly of said blower wheel, and driving means interconnecting said damper means exteriorly of said blower wheel for simultaneous movement, said driving means being operative to (1) move one of said damper means along a path which reduces the effective cross-sectional area of its corresponding inlet port, and (2) move the other of said damper means along a path which increases the effective cross-sectional area of its corresponding inlet port, whereby the equivalent orifice of said centrifugal blower is held substantially constant throughout the movement of said damper means.

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U.S. Cl. X.R.

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