May 21, 1940. M. S. KICE, JR 2,201,437

VOLUME CONTROL FOR FANS

Filed May 26, 1937 3 Sheets-Sheet 1

Fig. 1

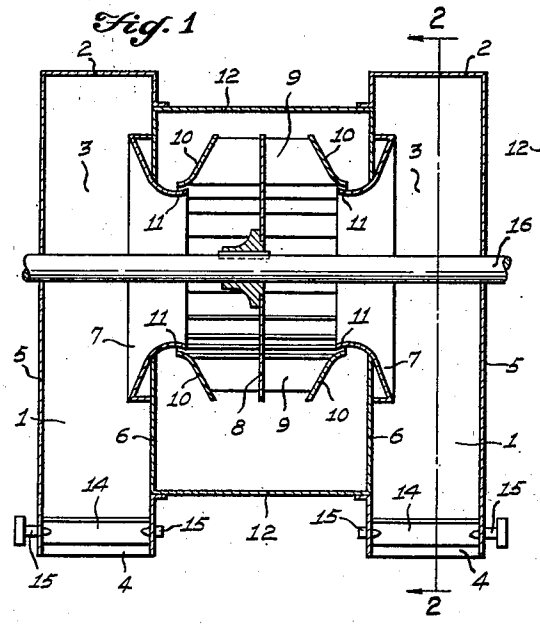

Fig. 2

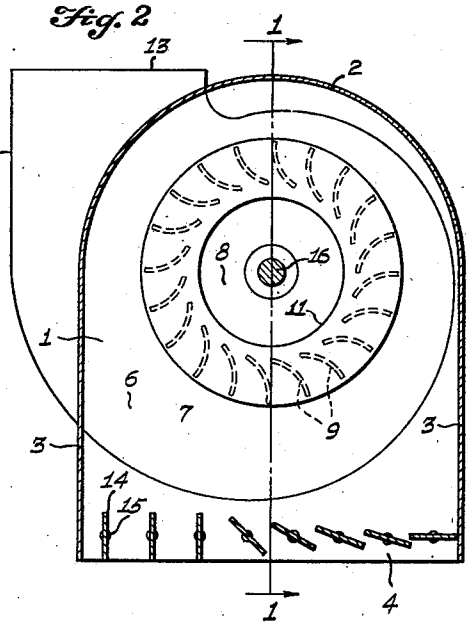

Fig. 3

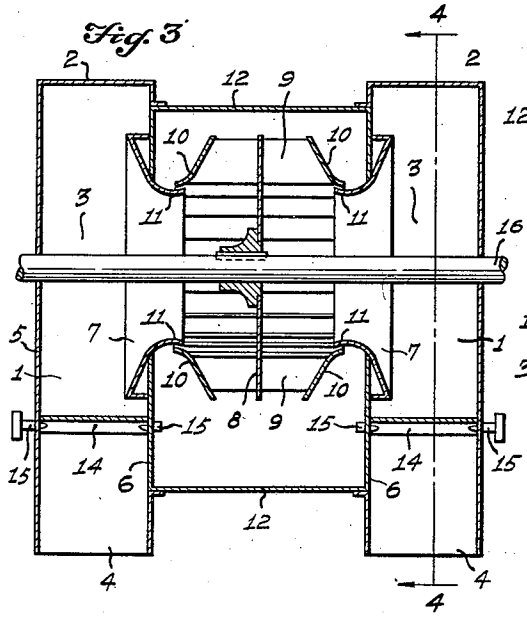

Fig. 4

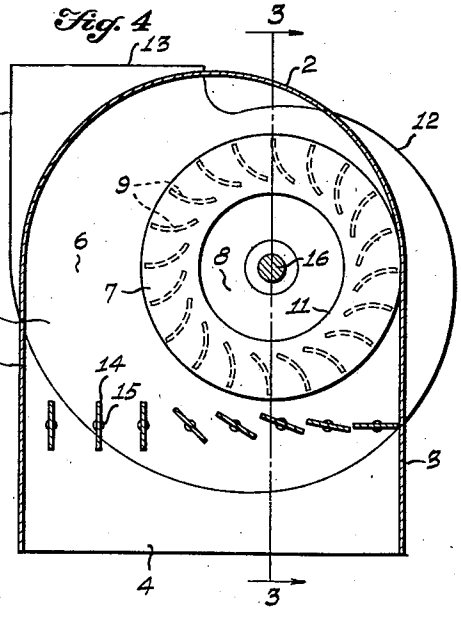

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Fig. 5

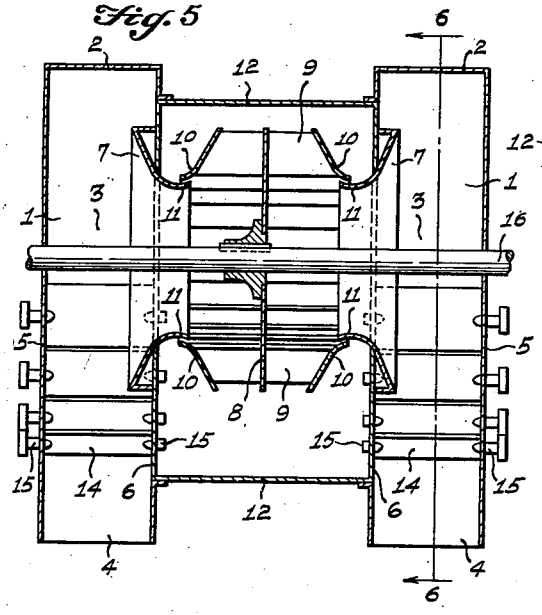

Fig. 6

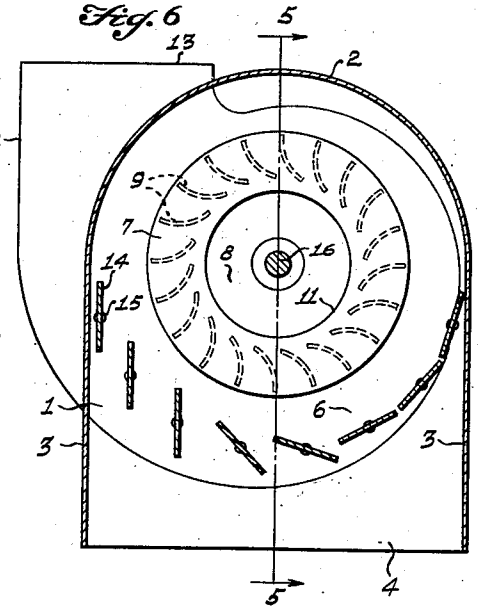

Fig. 7

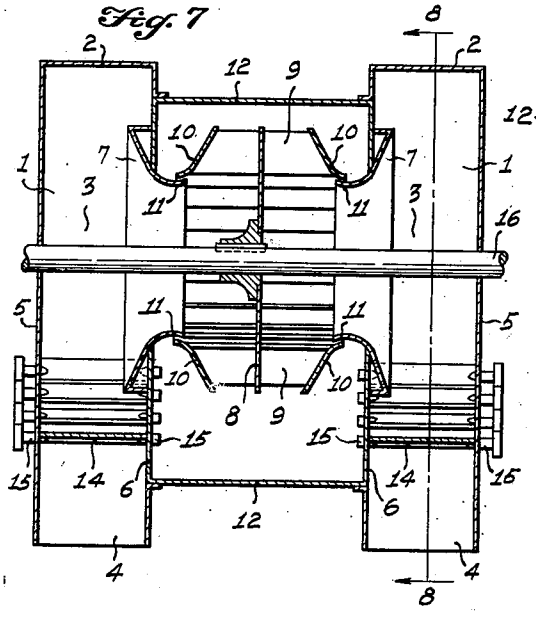

Fig. 8

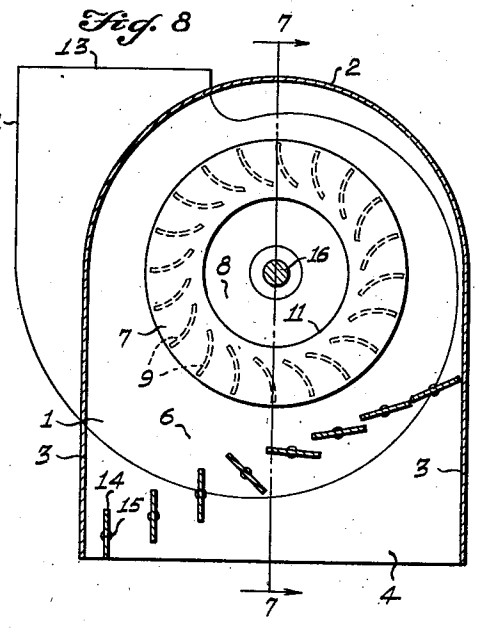

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Fig. 9

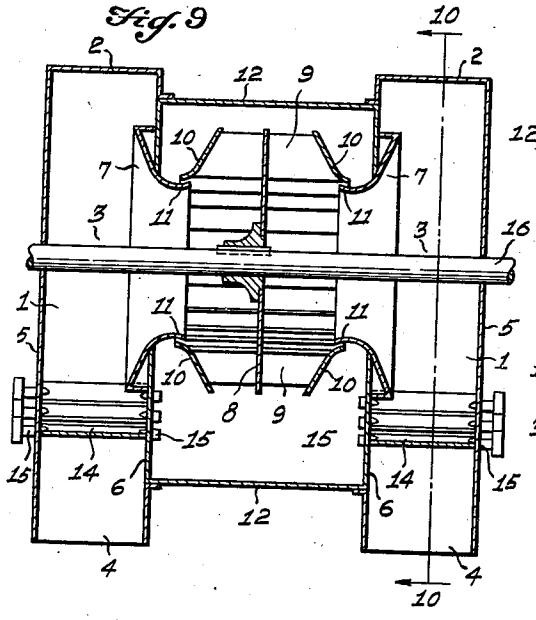


Fig. 10

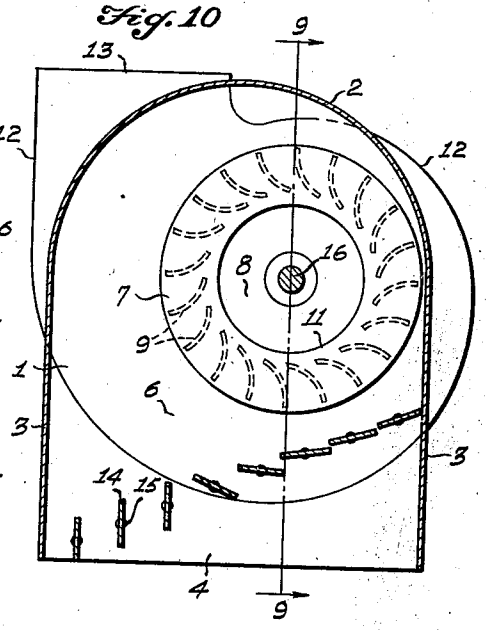


Fig. 11

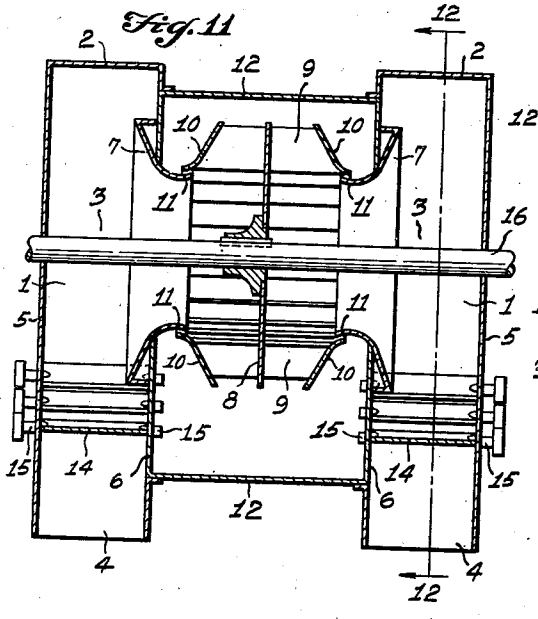
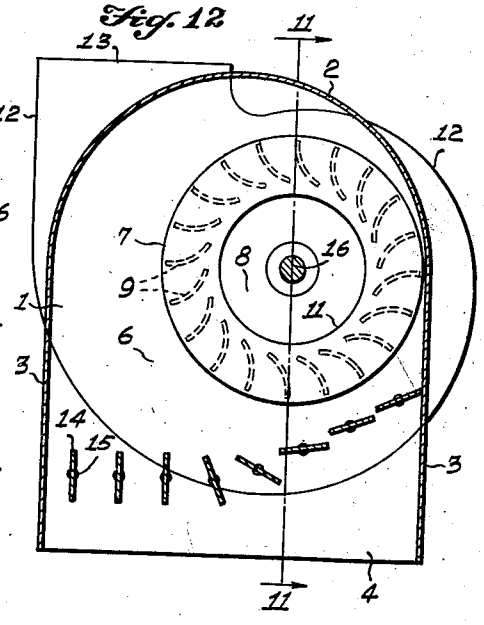


Fig. 12



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Patented May 21, 1940 2,201,437

UNITED STATES PATENT OFFICE

2,201,437

VOLUME CONTROL FOR FANS

Murray S. Kice, Jr., Detroit, Mich., assignor to American Blower Corporation, Detroit, Mich., a corporation of Delaware

Application May 26, 1937, Serial No. 144,892

5 Claims. (Cl. 230—114)

My invention relates to fans and in particular to the control of the volume of air delivered by the fan.

In particular, it is my object to provide a plurality of independent adjustable dampers in the inlet of the fan casing, and so distributed with respect to the position of the fan rotor and the inlet casing so that the dampers regulate the efficiency of the fan in conjunction with the varying volume as controlled by the dampers, utilizing the dampers for regulating the preliminary whirl of the air in the inlet casing before it enters the rotor of the fan.

Referring to the drawings in detail:

Figure 1 is a vertical section on the line 1—1 of Figure 2.

Figure 2 is a transverse section on the line 2—2 of Figure 1. In this view and the preceding view, the inlet control dampers are disposed in horizontal line across the inlet opening of the air inlet casing, with respect to which the fan rotor is concentrically disposed.

Figure 3 is a view similar to Figure 1 of a modification with the dampers arranged in a line remote from the entrance of the air inlet casing and the independent dampers and at different distances from the fan rotor which is eccentrically located with respect to the axis of the inlet air casing. This figure is on the line 3—3 of Figure 4.

Figure 4 is a section on the line 4—4 looking in the direction of the arrows on Figure 3.

Figure 5 is a vertical section through a second modified form in which the dampers in the air inlet casing are concentrically arranged with respect to the center of the rotor axis which is concentrically disposed with respect to the air inlet casing. This figure is on the line 5—5 of Figure 6.

Figure 7 is a view similar to Figure 1 of a third modification, being a section on the line 7—7 of Figure 8. In the construction shown in this view, the dampers are diagonally disposed with respect to a concentrically located rotor and therefore are located at varying distances from said rotor.

Figure 8 is a section on the line 8—8 of Figure 7.

Figure 9 is a view of a fourth modification which is similar to that shown in Figure 7, except that the rotor is eccentrically located with respect to the air inlet casing. Figure 9 is a section of the line 9—9 of Figure 10.

Figure 10 is a section on the line 10—10 of Figure 9.

Figure 11 is a view of a fifth modification which is similar to that shown in Figure 9, except that the line on which the dampers are located is an angular line, a portion of the dampers being located on a diagonal portion of that line, and another portion on a horizontal portion of that line. Figure 11 is a section on the line 11—11 of Figure 12.

Figure 12 is a section on the line 12—12 of Figure 11.

Referring to the drawings in detail, a fan air inlet chamber 1 is formed by a casing having a rounded end wall 2 and parallel side walls 3 forming an air inlet opening 4 in conjunction with a covering plate 5 and the side wall 6 of a fan casing.

The side wall 6 is provided with an air inlet passageway 7 which extends from the exit of the air inlet casing chamber 1 to the rotor of the fan. The rotor of the fan is provided with a supporting central plate or spider 8, fan blades 9 and their shrouds 10, or without shrouds.

It will be noted that the shrouds 10, if used, overlap, but are spaced from similarly spaced ends 11 of inlet passageway 7. This passageway is Venturi shaped, but not necessarily so.

It will be noted that the inlet passageway 7 is constituted of a casing which extends from the base of the shrouds 10 into the interior of the inlet chamber and is provided with a peripherally flared edge. The annular space left between the peripheral edge of said casing and the inner side wall 6 of the inlet chamber 1 is closed by a narrow cylindrical strip of metal. It has been found that by extending the passageway 7 for a considerable distance into the chamber 1 and providing a flared edge, the air flowing through the inlet opening 4 is readily changed from a radial to an axial direction without the formation of eddies or other conditions which signify inefficient flow.

Surrounding the rotor is the volute fan casing 12, having discharge opening 13. There are similar air inlet chambers and casings and air inlet passageways 7 on both sides of the fan casing of a double inlet fan, or one air inlet chamber and casing and inlet passage on one side of a single inlet fan.

The volume of the air entering the air inlet casings and the direction of the air is controlled by the setting of the dampers, which are either independently controlled or controlled in harmony with one another and in unison by any desired mechanism which determines their relative position and angularity. These dampers

are denominated 14 and are mounted upon axles 15.

In the construction of Figures 1 and 2, the axle for the fan 16 supports the fan rotor concentrically with the center of the air inlet casing. The dampers in these two views have their axes arranged on a straight line adjacent the mouth of the air inlet casing.

In the construction of Figures 3 and 4, the construction arrangement is the same except that the fan rotor is located eccentrically of the air inlet casing and the dampers are moved inwardly on a line placed closely adjacent the rotor and relatively remote the entrance of the air inlet casing.

In the construction of Figures 5 and 6, the dampers are arranged on an arc concentrically with the rotor;

In the construction of Figures 7 and 8 the dampers are arranged on a line diagonal to the axis of the air inlet casing and are therefore arranged at varied distances with respect to the rotor.

In the construction of Figures 9 and 10 the same alignment of the dampers is maintained with the dampers arranged progressively away from the air inlet opening and closer to the fan rotor, except that the rotor is eccentrically located with respect to the longitudinal axis of the air inlet casing, which brings about a different relationship of the dampers with respect to the air inlet casing to the rotor.

In the construction of Figures 11 and 12, the construction illustrated in Figures 9 and 10 is somewhat modified, in that a portion of the dampers are arranged on a line transverse to the line of the air inlet casing and a portion on a line diagonal thereto.

The principle running through these various modifications is this:

By utilizing an air inlet casing which has a curved inner wall and a straight walled inlet passageway with a plurality of volume and direction controlled dampers, and by adjusting these dampers to vary the volume, the efficiency of the fan can be maintained more nearly constant through adjusting the preliminary whirl of the air in harmony with the variation in volume of the air. Heretofore the difficulty with varying the volume of the air has been a variation in the efficiency of the fan which I now improve by being able to vary the volume and at the same time, regulate the preliminary whirl of the air.

The position of the dampers in the several views illustrates my invention. By reducing the volume through closing some of the dampers and partially closing others, and using the remainder as air guiding vanes, it is possible to cause the air to partake of a preliminary whirl prior to entering the air inlet passageway 7, and then being discharged radially over the blades 9 through the volute casing 12 and thence out the discharge opening 13. Concerning the positions of these blades, with respect to the fan rotor and the position of the fan rotor as to its eccentricity with respect to the air inlet casing, both have advantageous features.

By using an angular and progressive displacement of the dampers with respect to the rotor, the volume and preliminary whirl can be controlled, and the preliminary whirl can be regulated, that is, increased and decreased, by some of the dampers while the rest are controlling the volume.

It will be understood that I desire to comprehend within my invention such modifications as may be clearly embraced within the claims and scope of my invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination, a fan comprising a fan casing, a rotor therein, said casing having a side inlet opening adapted to communicate with the interior of said rotor, an inlet box mounted with respect to said fan casing so as to communicate therewith through said opening and through the side of said inlet box, said inlet box comprising an arcuate end and longitudinally extending walls to form an open end into said box, and a plurality of independently operable transversely disposed dampers arranged across said inlet box, whereby the amount of whirl of gas leaving said box and the volume of gas entering the box may be controlled, said dampers being arranged with their rotating axes parallel to the axis of the fan rotor, said damper axes being arranged in the same plane.

2. In combination, a fan comprising a fan casing, a rotor therein, said casing having a side inlet opening adapted to communicate with the interior of said rotor, an inlet box mounted with respect to said fan casing so as to communicate therewith through said opening, and a plurality of independently operable transversely disposed dampers arranged across said inlet box whereby the amount of whirl of gas leaving said box and the volume of gas entering the box may be controlled, said fan casing projecting into the inlet box and provided with a flared edge whereby the gas passing through the inlet box into the rotor has its direction changed without any disturbances of the whirl of the gas, said dampers being arranged with their rotating axes parallel to the axis of the fan rotor and said damper axes being arranged in the same plane.

3. In combination, a fan comprising a fan casing, a rotor therein, said casing having a side inlet opening adapted to communicate with the interior of said rotor, an inlet box mounted with respect to said fan casing so as to communicate therewith through said opening, and a plurality of independently operable transversely disposed dampers constituting at least three arranged across said inlet box, whereby the amount of whirl of gas leaving said box and volume of gas entering the box may be controlled, said fan casing projecting into the inlet box and provided with a flared edge whereby the gas passing through the inlet box into the rotor has its direction changed without any disturbance of the whirl of the gas, said dampers being arranged with their rotating axes parallel to the axis of the fan rotor and said damper axes being arranged in the same plane.

4. In combination, a fan comprising a fan casing, a rotor therein, said casing having a side inlet opening adapted to communicate with the interior of said rotor, an inlet box mounted with respect to said fan casing so as to communicate therewith through said opening, and means including a plurality of transversely disposed dampers across said inlet box for controlling the amount of whirl of gas leaving said box and the volume of gas entering the box, said dampers being arranged with their rotating axes parallel to

the axis of the fan rotor and the said axes being arranged in the same plane, and said dampers being constructed and arranged so that when closed they will practically cut off the in-flow of air.

5. In combination, a fan comprising a fan casing, a rotor therein, said casing having a side inlet opening adapted to communicate with the interior of said rotor, an inlet box mounted with respect to said fan casing so as to communicate therewith through said opening, and a plurality of transversely disposed dampers arranged across said inlet box whereby the amount of whirl of gas leaving said box and the volume of gas entering the box may be controlled, said fan casing projecting into the inlet box and provided with a flared edge whereby the gas passing through the inlet box into the rotor has its direction changed without any disturbance of the whirl of the gas, said dampers being arranged with their rotating axes parallel to the axis of the fan rotor and said damper axes being arranged in the same plane, said dampers being constructed and arranged so that when closed they will practically cut off the in-flow of air.

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