

Nov. 30, 1937.

W. H. HOWDEN

2,100,481

FAN

Original Filed Jan. 26, 1933

3 Sheets-Sheet 1

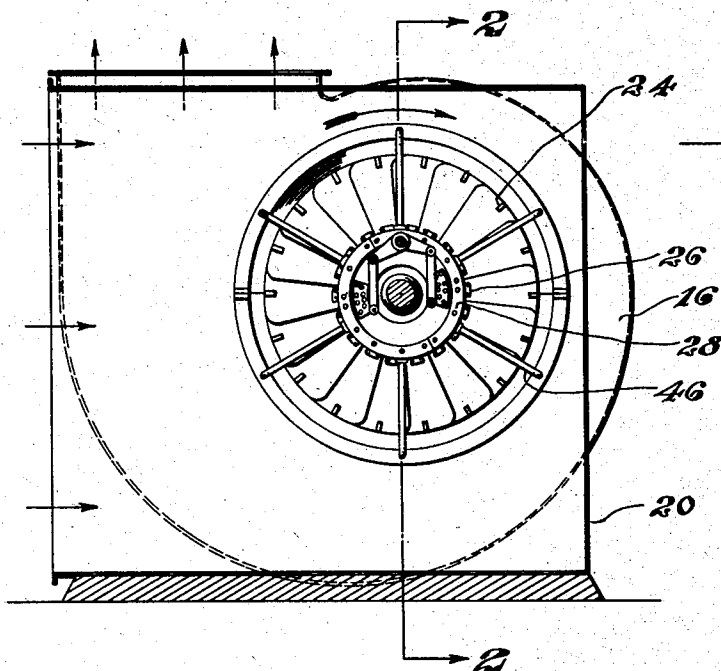


Fig. 1

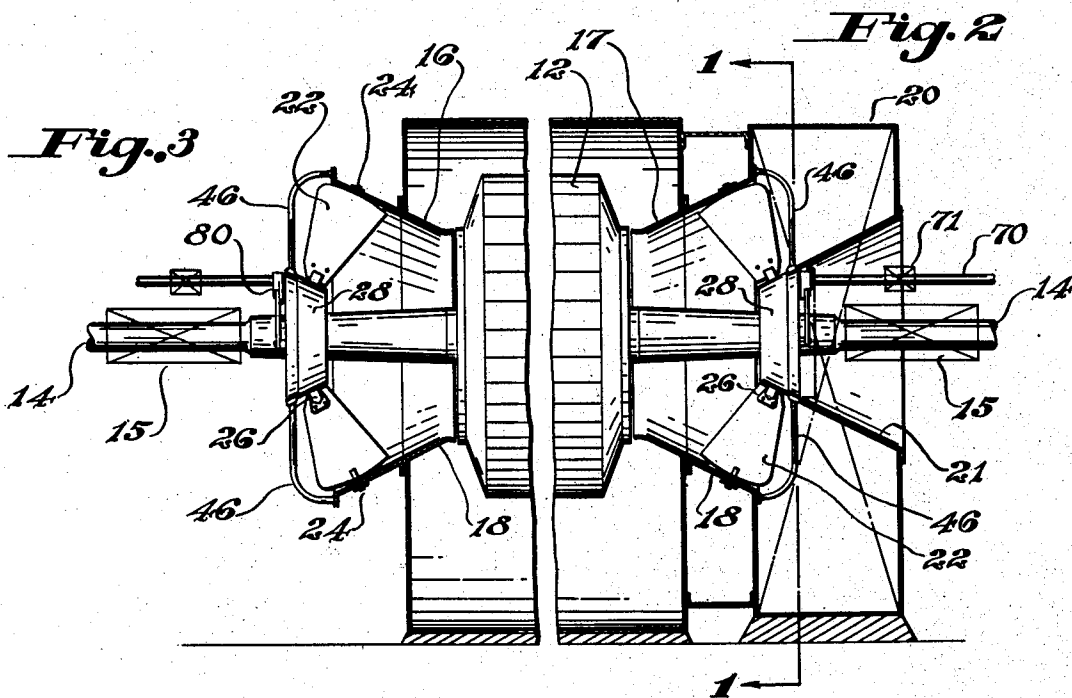


Fig. 2

Fig. 3

Witness

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Fig. 4

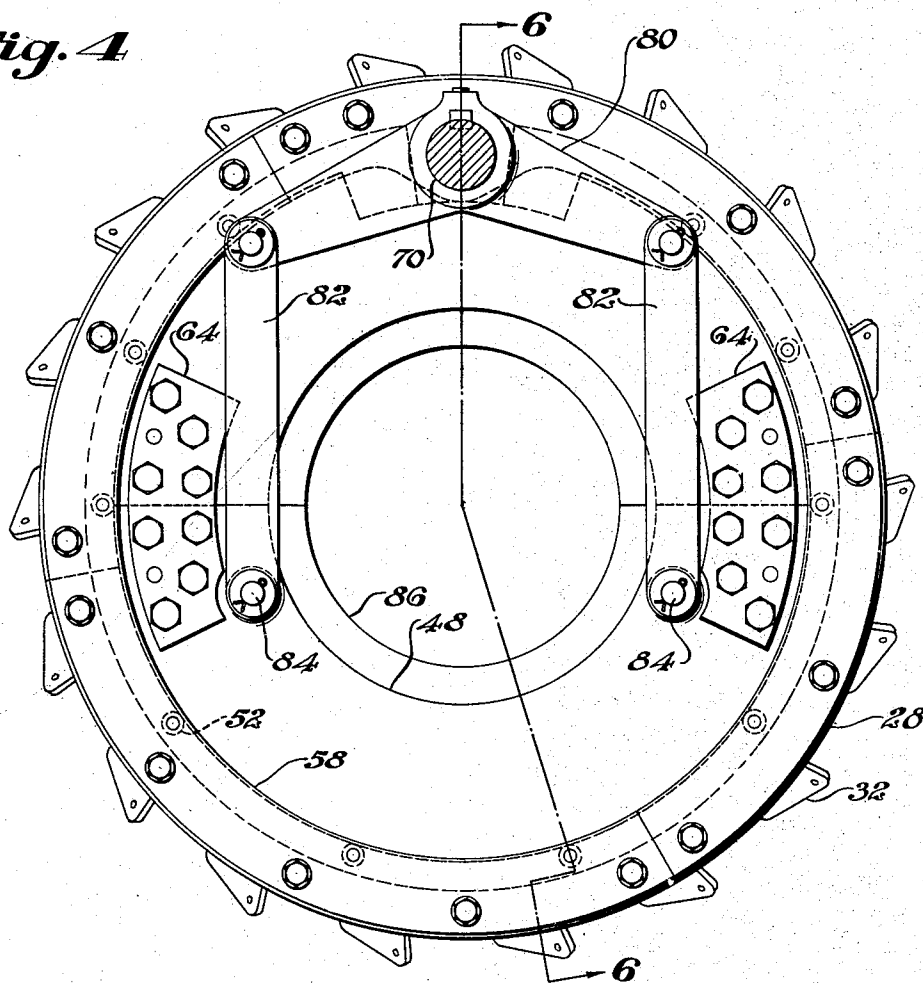
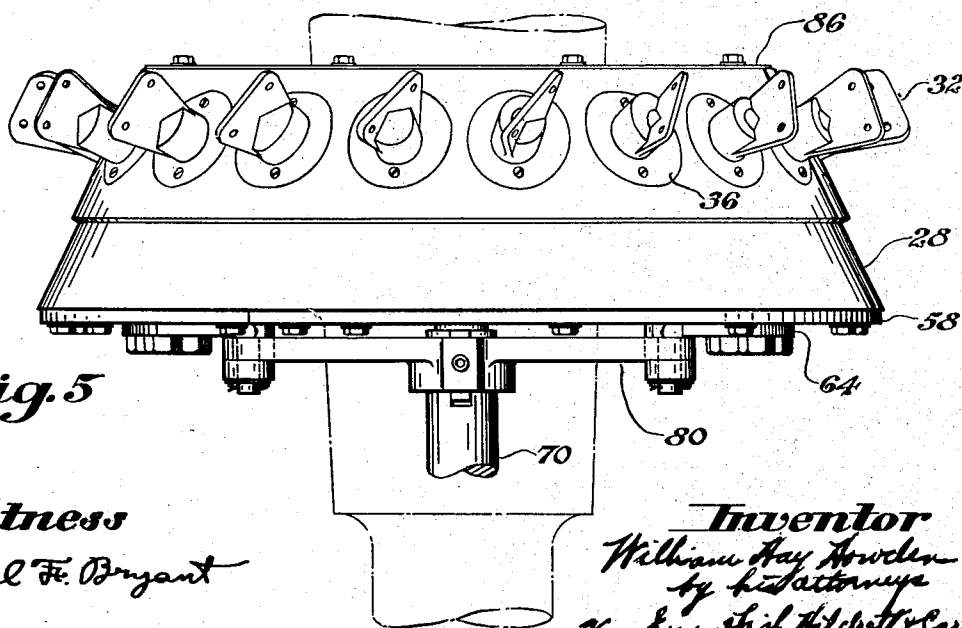


Fig. 5



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Fig. 6

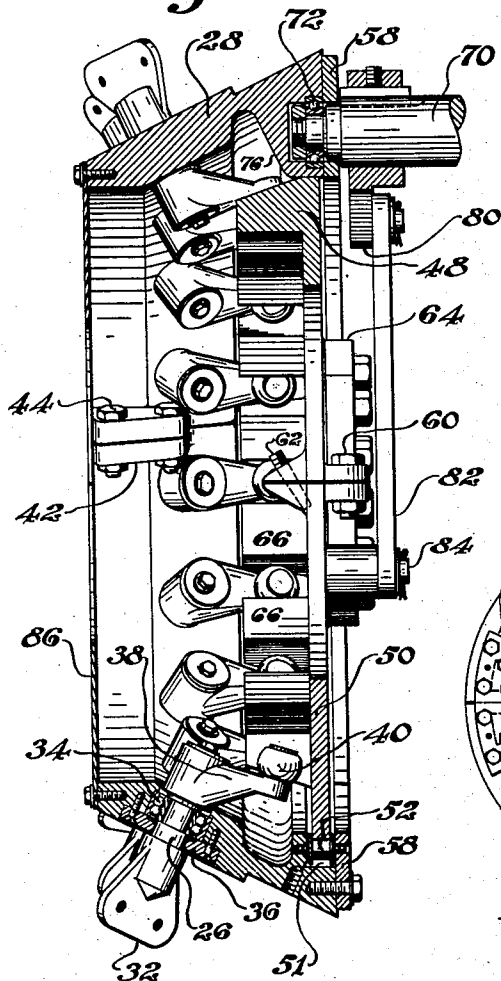


Fig. 7

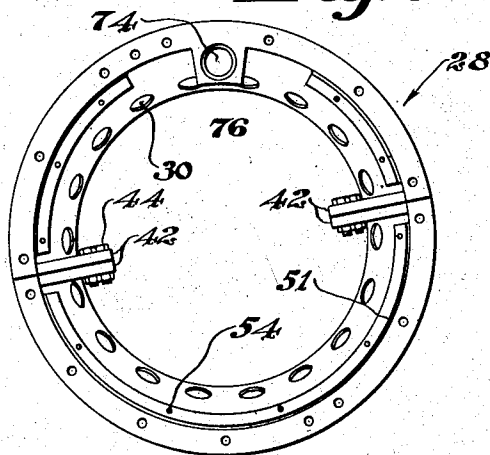
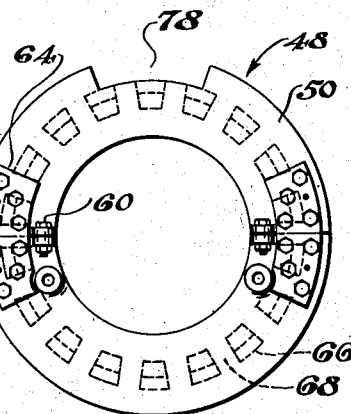


Fig. 8

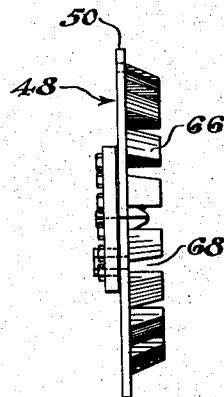


Fig. 9

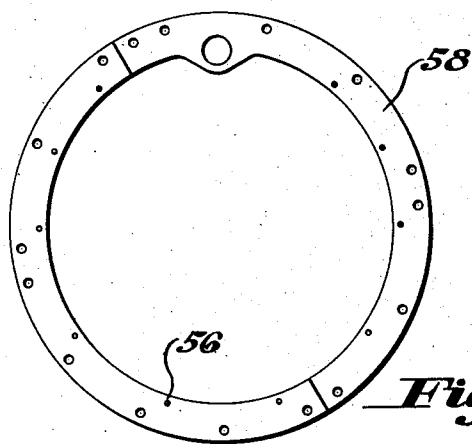


Fig. 10

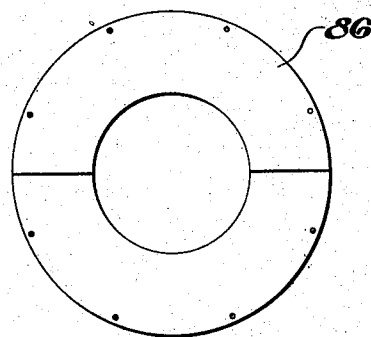


Fig. 11

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UNITED STATES PATENT OFFICE

2,100,481

FAN

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Application January 26, 1933, Serial No. 653,643
Renewed September 17, 1936

1 Claim. (Cl. 230—114)

The present invention relates to centrifugal fans and more particularly to fans provided with inlet vanes adapted to be adjusted to control the output of the fan.

5 In United States Letters Patent of Hagen No. 1,846,863, granted February 23, 1932, is shown a centrifugal fan of the induced draft type provided with such adjustable inlet vane for varying the spin imparted to the entering fluid. In the 10 Hagen application Serial No. 403,753, filed October 31, 1929, is shown a forced draft fan provided with such adjustable spin controlling vanes. While both designs of fan operate in an entirely satisfactory manner, so far as controlling the 15 output of the fan by varying the spin of the entering air is concerned, the specific designs of vane mechanism are objectionable in that they are different for the two types of fan, and expensive to construct, must be built into the fan 20 casing while the latter is being assembled, and are difficult to inspect and lubricate and to adjust and repair when necessary.

The primary object of the present invention is to provide a single design suitable for both forced 25 and induced draft fans which shall be of unitary construction and practically independent and separate from the fan casing, and which, as to the fan supporting and actuating mechanism, may be largely assembled apart from the fan casing and 30 with the vanes may be subsequently applied to or removed from the fan casing without disturbing the latter or the rotor and its supports.

A further object is to provide a fan supporting and assembling mechanism which shall be easily 35 accessible at all times for the purpose of inspection, lubrication, and repair.

Another object is to provide a mechanism which shall operate positively to position all of the vanes with exactness and with a minimum of wear and 40 lost motion even after long periods of use.

Another object is to simplify the vane supporting and assembling mechanism with a view to reducing the cost of manufacture, and minimizing the frictional resistance to facilitate the operation 45 of the vanes.

With these and other objects in view as will herein appear, the present invention comprises the fan and fan supporting and assembling mechanism hereinafter described and more particularly 50 ly defined in the claim.

In the accompanying drawings illustrating what is now considered the preferred form of the invention, Fig. 1 is a sectional view of an induced draft fan taken on line 1—1 of Fig. 2; 55 Fig. 2 is a section on line 2—2 of Fig. 1; Fig. 3

is a similar sectional view of a forced draft fan; Fig. 4 is an end view of the unit construction of actuating mechanism, Fig. 5 is a plan view, and Fig. 6 a vertical section on line 6—6 of Fig. 4, all on an enlarged scale; Fig. 7 is a detail end elevation of the conical hub looking to the left of Fig. 6, Fig. 8 is an end elevation and Fig. 9 a side elevation of the adjusting ring, Fig. 10 a detail elevation of the face plate, and Fig. 11 is a detail elevation of the rear guard ring, all on 10 substantially half scale of Figs. 4, 5, and 6.

The present invention is illustrated in connection with a centrifugal fan of the common and well known type provided with the customary involute casing with axial intake opening and 15 tangential discharge. These parts are all of old and well known construction and are illustrated in Figs. 1, 2 and 3 of the drawings, and comprise the rotor 12 mounted on a shaft 14 which is journaled in suitable bearings 15. The casing 16 is formed 20 with a conical eye 17 and communicating and merging with the eye is the conical inlet 18. For an induced draft fan, as shown in Figs. 1 and 2, an inlet box 20, which connects with a suitable duct, is mounted at the inlet of the fan and 25 is provided with the axial, frusto-conical wall or partition 21 to form a chamber or recess in the outer end of the box, which gives free and easy access to the vane supporting and controlling mechanism and within which certain parts of 30 such mechanism are positioned. For a forced draft fan of the type shown in Fig. 3, the inlet box is omitted and the air passes directly from the atmosphere through the inlet cone 18.

The vanes and their mountings are, in a general way, similar to that shown in the Hagen application Serial No. 403,753, wherein a circular series of vanes are pivotally mounted in the inlet of the fan and are arranged to be simultaneously 35 adjusted by a single actuating means to vary the spins imparted to the air entering the intake of the fan, and thus to vary the output of the latter. These vanes are shown at 22 and each is provided at its outer end with a pivot pin 24 which is journaled in the cone inlet 18 and at its inner 40 end is attached to the pivot 26 which is journaled in a conical hub 28 presently to be described in detail. As shown in Figs. 2 and 3, the axis of each vane is perpendicular to the conical inlet wall and is therefore at an angle with respect to 50 the axis of the shaft. The arrangement is such that the vanes, when closed, lie on an approximately conical surface.

The conical hub 28, as shown separately in detail in Fig. 7, comprises a casting having a 55

series of regularly spaced openings 30 to receive the inner pivot pins 26 of the vanes. On each pin is integrally formed a clip or bracket 32 to which the vane is attached. A ball race 34 is received in a counter-sunk recess adjacent to each opening 30 and is held in place by a guard plate 36. Attached to the inner end of each pivot pin 26 is a crank 38 having at its end a freely rotatable roller 40 with spherical surface to be engaged by the actuating mechanism.

In order to facilitate the assembly around the fan shaft of the vane supporting and actuating mechanism, the conical hub 28, like other parts of the apparatus, is split diametrically. The split portions are provided with opposed lugs 42 which are secured together by bolts 44. The hub is supported by standards or curved arms 46 secured to the outer end of the inlet cone 18.

The mechanism for actuating the crank arms 38 to turn the vanes upon their pivots comprises an actuating ring mounted within the conical hub 28 to have slight rotational movement therein, and is provided with a series of projections or shoulders on one face to engage the crank arm. This actuating ring 48 is shown in axial section in Fig. 6, and in front and side elevation, on a reduced scale, in Figs. 8 and 9. It comprises a plate 50 the peripheral margin of which is received within an annular recess 51 provided in the inner face of the larger end of the conical hub 28.

The plate 50 is freely supported on rollers 52 which are journaled at opposite ends in openings 54 of the hub 28 and openings 56 of a face or cover plate 58 secured to the hub. As in the case of the conical hub, the actuating ring is formed in two parts which are secured together by bolts 60, the two parts being positioned by a dowel pin 62 to assure preservation of alignment. The two parts of the actuating ring are reinforced by bolted web plates 64.

The rear face of the plate 50 is provided with a series of projections or shoulders 66 defining spaces 68 which receive the rollers 40 of the vane operating cranks 38. As shown in Figs. 8 and 9, these projections 66 are pyramidal in shape to conform to the general conical structure of the hub. Since the rollers 40 are closely engaged between adjacent projections 66, any rotation of the actuating ring causes simultaneous uniform adjustment of all of the vanes.

The actuating ring is given rotational movement by means of a control shaft, the outer end of which extends to some convenient point for manual or automatic actuation, while the inner end is connected by suitable linkage with the actuating ring 48 so that rotation of the control shaft rotates the ring and causes the adjusting movement of the vanes. As shown in Figs. 2 and 6 of the drawings, the control shaft 70, mounted intermediate its length upon the bearing 71, is journaled at its inner end in the ball bearings 72 received in a recess 74 in an inwardly projecting portion 76 of the conical hub. As shown in Fig. 8, the actuating ring 48 is provided with a recess 78 to embrace the projection 76. Attached to the control shaft 70 is a double crank arm 80, at the ends of which are pivoted links 82 connected to pins 84 projecting from the actuating ring 48, the double crank and link arrangement

facilitating the movement of the actuating ring by eliminating the tendency, as where force is applied at a single point, to cause the link to twist or bind. It will be seen that rotation of the shaft 70 in either direction produces a corresponding rotation of the actuating ring and consequent adjustment of the inlet vanes.

In order to prevent passage of air to the rotor except through the vanes 22, the inner face of the conical hub 28 is provided with a split guard ring 86, as shown in Fig. 11, the inner diameter of which is only slightly larger than the diameter of the shaft.

In the operation of my improved construction the rotation of the control shaft imparts through the connecting cranks and link a rotational movement to the actuating ring, which in turn through shoulders or projections actuate the crank arms and turn the vanes upon their pivots. When the shaft is rotated in one direction the vanes will be turned in the direction toward parallelism with the fan shaft to reduce the amount of spin and increase the output of the fan. When the control shaft is turned in the opposite direction the vanes will be turned toward closed position to increase the amount of spin applied to the air and thereby reduce the fan output.

By the use of the split or divided conical hub, actuating ring and plates, the supporting and actuating devices may be assembled in halves and then mounted in position surrounding the fan shaft without disturbing the rotor or its supports. When assembled in the fan the parts are easily accessible for inspection and lubrication since the actuating and control mechanisms are all located at the inner ends of the vanes and free access is provided even in the induced draft type through the conical chamber or recess in the side of the inlet box. The annular space between the inner edge of the plate 50 of the actuating ring and the fan shaft is sufficient to permit inspection and lubrication of the operating parts within the conical hub.

While the method of supporting and actuating the inlet vanes has been shown and described in connection with a fan construction wherein the vanes operate to vary the spin imparted to the air entering the fan and thus control the output of the latter, the present invention is not necessarily limited thereto but may be embodied in other constructions and arrangements wherein the vanes operate to control the output of the fan more or less by throttling the incoming air instead of varying its spin velocity.

Having thus described the invention, what is claimed is:

A fan comprising a rotor, a casing, a conical inlet, a hollow conical hub within the inlet, a series of vanes having at their inner ends pivots journaled in the hub, the axis of each vane being perpendicular to the conical wall of the hub, a crank on each pivot extending perpendicularly therefrom, a rotatable ring within and peripherally supported by the hub and having a series of inwardly extending projections forming slots to receive the ends of the cranks, and control means to rotate the ring to adjust the vanes uniformly.

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