Nov. 30, 1943. W. J. CALDWELL 2,335,734

CENTRIFUGAL FAN

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FIG. 2

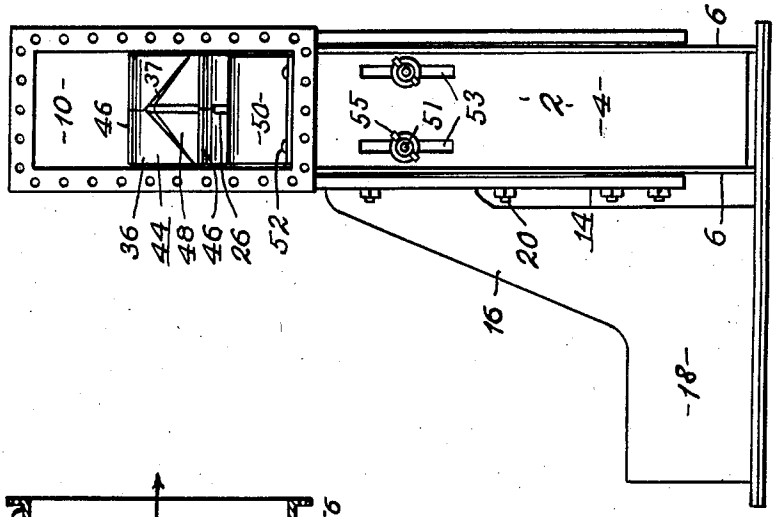
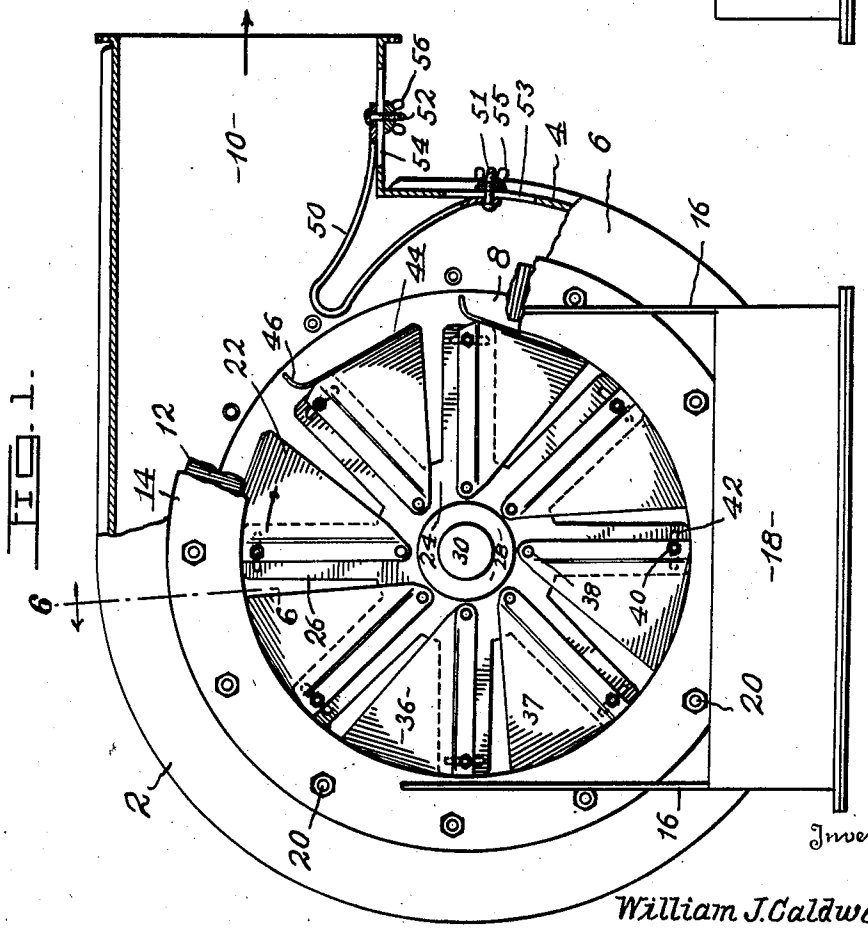


FIG. 1.



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FIG. 6.

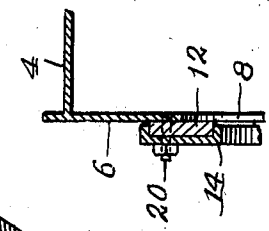


FIG. 5.

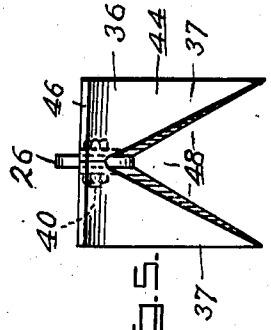


FIG. 4.

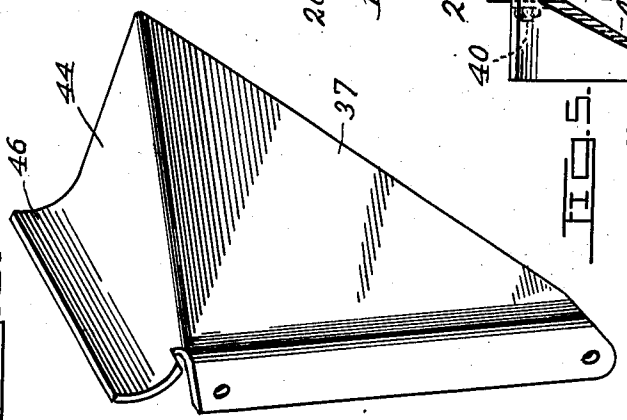


FIG. 7.

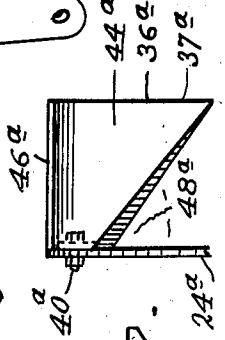
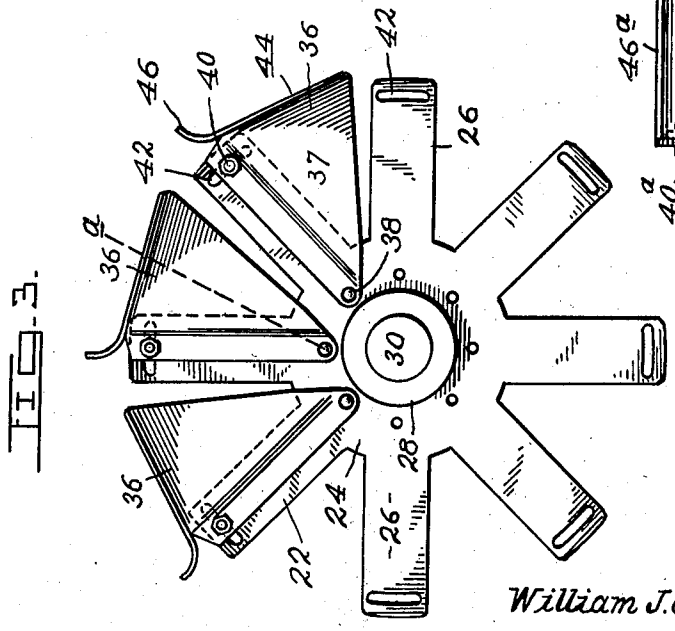


FIG. 3.



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Patented Nov. 30, 1943 2,335,734

UNITED STATES PATENT OFFICE

2,335,734

CENTRIFUGAL FAN

William J. Caldwell, Independence, Mo.

Application March 10, 1942, Serial No. 434,095

5 Claims. (Cl. 230—134)

My invention relates to centrifugal fans and one object of the invention is the provision of a new and efficient fan of this character whereby an air blast of maximum volume and density may be delivered at high velocity with a minimum expenditure of power.

Another object is the provision of an impeller having blades of novel shape to progressively compress and accelerate the flow of air from the inlet to the outlet of the fan housing and to discharge it at high velocity in a compact stream.

A still further object is the provision of a high speed fan having an impeller which effects sufficient air compression in both the impeller and the housing to largely negative the air noise which restricts conventional fans to low or medium velocities.

Another object is the provision of an impeller having blades adjustably mounted so that each may be inclined forwardly relative to a radial line to increase the pressure and velocity of the air, or inclined rearwardly of said radial line to lower the pressure and increase the volume of the air flow, thereby making available a wide range of performance with the same component parts of the impeller.

A further object is the provision of a housing having an adjustable gate whereby the volume of air discharged from the housing can be regulated as desired.

Another object is the provision of a housing which is adjustably mounted so that it may be turned axially to discharge an air blast either in a horizontal plane, or at various angles to such plane.

Another object is the provision of a centrifugal fan which is so constructed that its component parts can be economically manufactured and assembled.

Other objects will hereinafter appear and in order that the invention may be fully understood, reference will now be had to the accompanying drawings in which:

Fig. 1 is a side elevation of the fan with some of the parts broken away.

Fig. 2 is a front elevation of the fan.

Fig. 3 is a side elevation of the impeller with some of the blades removed.

Fig. 4 is an enlarged detail of part of one blade.

Fig. 5 is a plan view of one of the blades mounted upon a spoke.

Fig. 6 is a fragmentary vertical section of the housing and part of its mounting, on line 6—6 of Fig. 1.

Fig. 7 is a fragmentary detail of a modified form of impeller.

In carrying out the invention I provide a housing 2 comprising a circumferential wall 4 and two side walls 6, which latter have large air inlets 8. A discharge nozzle 10 is provided through which an air blast may be discharged from the forward portion of the housing.

When installing the fan for use it may be found desirable to point the nozzle 10 in other directions than the horizontal plane as shown by Fig. 1, so I mount the housing 2 in such manner that it may be turned axially. his is accomplished by providing one of the side walls 6 with a ring 12 which is welded or otherwise appropriately fixed to said wall in concentric relation to the associated air inlet 8 and rotatably mount said ring in the channel of a stationary ring 14 fixed to the flanges 16 of a housing base 18. The ring 12 may be secured against rotation in the channel of the companion ring 14 by any appropriate means, such, for instance as a plurality of bolts 20 which extend through transverse registering holes in the rings 12 and 14.

Referring now more particularly to the rotary impeller 22 forming an important feature of the invention, 24 designates a hub provided with radial spokes 26 and reinforced with centrally-disposed, oppositely arranged, annular shoulders 28 fixed upon a shaft 30 extending transversely through the housing 2. The shaft 30 is concentric with the rings 12 and 14 and may be driven by an electric motor, pulley, or other conventional driving means, not shown. The shaft 30 may be mounted in suitable bearings, not shown, or if driven by an electric motor may be coupled directly to and driven by the motor shaft.

The impeller 22 includes a plurality of blades 36 which are adjustably associated with the spokes 26, for a purpose which will hereinafter appear. Each blade may be made in one piece, but in the present instance I have shown each blade comprising two members 37 mounted on opposite sides of the hub 24 and the associated spoke 26. Each blade 36 is adjustably connected at its inner end to the hub 24 by any appropriate means, such as a pivot 38, and connected at its outer end to the spoke 26 by a bolt 40 which extends through an arcuate slot 42 concentric with the shaft 30 and extending through the spoke. The outer end of each member 37 is bent backward at, substantially, right angles as indicated at 44 and terminates at its rear end in an outturned offset vane 46. The members 37 diverge towards their leading edges to provide a V-

shaped air channel 43, which faces the direction of travel and extends from the inner end of the blade to the rearwardly bent portions 44. Although I prefer to make the blade V-shaped it may be of concave or U-cross section. The impeller 22 is of slightly less diameter than either of the air inlets 8, so that it can be readily installed in the housing 2.

A flexible gate 50 of approximately inverted V-form is adjustably mounted in the forward portion of the housing 2 to regulate the volume of air discharged through the nozzle 10. In the present instance I have provided the respective legs of the gate with bolts 51 and 52 adjustably mounted in slots 53 and 54 in the circumferential wall 4 of the housing and the bottom wall of the nozzle 10. The bolts 51 and 52 are secured in their adjusted positions by nuts 55 and 56, respectively.

In practice, when the impeller 22 is rotating at normal speed it creates a suction that draws air into housing 2 through the inlets 8. As the impeller blades 36 impinge against the inflowing air it is compressed into the channels 43 and progressively accelerated and then ejected from the outer ends of said channels by centrifugal force into the path of the respective vanes 46 which further compress and accelerate the air and discharge it at a high velocity in the form of a dense stream from the housing 2 through nozzle 10.

The V-shape of the blade adds to its stability and forces the air to the center of the channel 43, thereby reducing side slippage of the air and increasing the efficiency of the blade. By pivotally mounting the blade it may be adjusted forward relative to a radial line *a*, Fig. 3, to increase the velocity-pressure of the air stream, and by adjusting the blade rearward relative to said radial line the pressure is reduced and the volume of the air flow is increased. Thus it will be understood that I have provided an impeller whereby control of the air stream may be varied by adjusting some of the component parts of the impeller.

By tapering the blades towards their inner ends as shown in the drawings, their weight and centrifugal loading on the impeller is reduced.

Fig. 7 shows a fragmentary portion of a modified form of impeller in which the blade 36*a* comprises a single member 37*a*, secured to one side of the hub 24*a* which is enlarged diametrically to dispense with the spokes 26 and cooperate with the single blade member 37*a* in providing the channel 43*a*.

While I have shown two forms of the invention, I reserve all rights to such forms and modifications thereof as properly fall within the scope of the claims.

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

1. In a centrifugal fan, an impeller comprising rotary supporting means, a series of radial blades pivotally mounted upon said rotary supporting means to permit forward or backward adjustment relative to a radial line extending through each blade, and means for securing each blade in adjusted position.

2. In a centrifugal fan, an impeller comprising rotary supporting means, a series of blades radially disposed with respect to said rotary supporting means, pivotal means connecting the inner end of each blade to the rotary supporting means to permit inclination of the blade forward or backward relative to a radial line extending through each blade, and means near the outer free end of each blade for securing the same in adjusted position.

3. A centrifugal fan system comprising a housing having an air inlet and an air outlet, and a rotary impeller in said housing including a series of blades spaced about the axis of the impeller to progressively accelerate the flow of air from the inlet to the outlet of the housing, each blade being of approximately V-cross section to provide a channel extending longitudinally of the blade and into which air is compressed and then ejected from the outer end of said channel in a compact stream by centrifugal force, means whereby each blade may be inclined forward or backward relative to a radial line extending through each blade, and a transverse outturned vane at the outer end of each blade adapted to impinge against the ejected air stream to further increase acceleration thereof and direct the stream against the circumferential wall of the housing, the exact angle of the discharge being controlled by the curvature of the vane and the angle at which the blade is adjusted forward or backward of a radial line.

4. In a centrifugal fan, rotary means, and a blade suitably secured to said rotary means and bent to project therefrom at an angle to provide an air channel extending longitudinally of the blade, the outer part of said blade being bent backward at approximately right angles to the main portion of the blade and terminating in an outturned vane which extends transversely to the axis of the rotary means.

5. In a centrifugal fan, an impeller comprising rotary means, and a series of radial blades each comprising two members secured to opposite sides of said rotary means and bent in opposite directions to provide an air channel, the outer part of each member being bent backward and terminating in an outturned vane which extends transversely to the axis of the rotary means.

WILLIAM J. CALDWELL.