

May 5, 1953

J. G. SAWYER

2,637,487

BLOWER

Filed March 9, 1948

2 SHEETS—SHEET 1

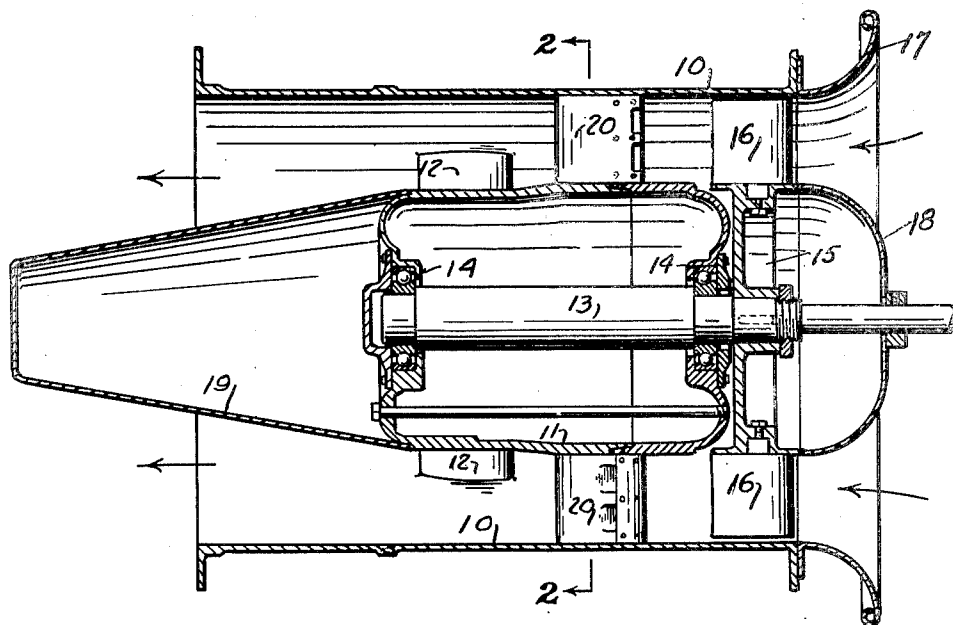


Fig. 1

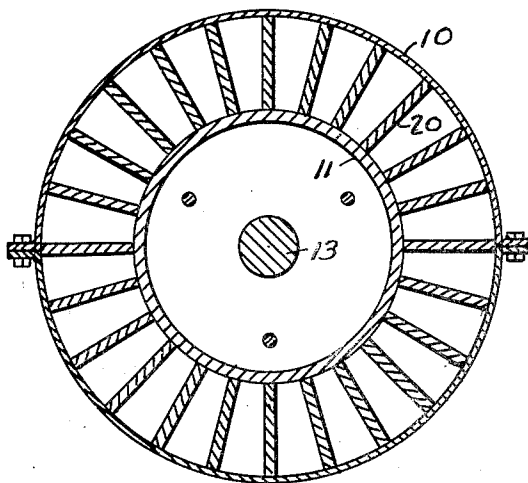


Fig. 2

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2 SHEETS—SHEET 2

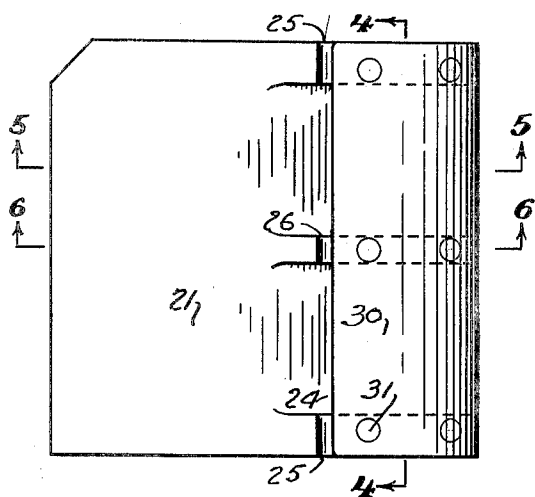


Fig. 3

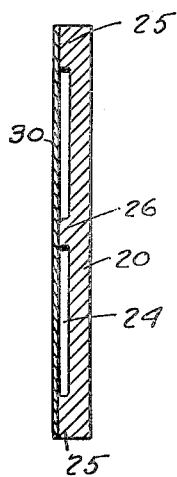


Fig. 4

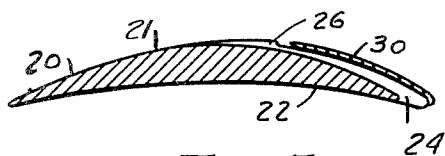


Fig. 5

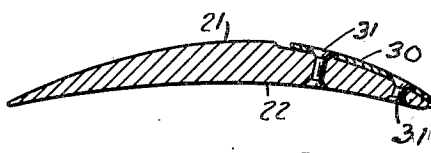


Fig. 6

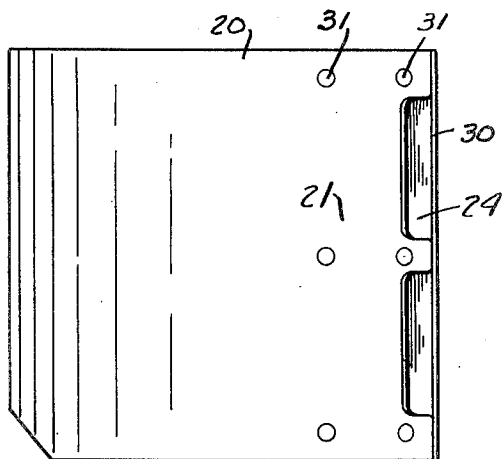


Fig. 7

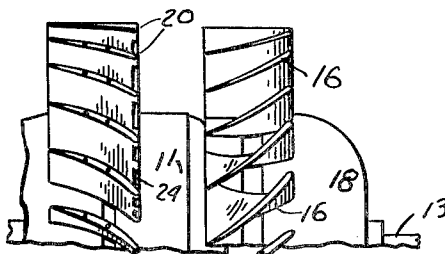


Fig. 8



Fig. 9

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UNITED STATES PATENT OFFICE

2,637,487

BLOWER

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Application March 9, 1948, Serial No. 13,820

4 Claims. (Cl. 230—120)

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This invention relates to a blower which is an improvement on the blower shown and claimed in my pending application Ser. No. 737,672, filed March 27, 1947, now Patent No. 2,552,178, issued May 8, 1951. The blower of the present application, like that of the former application, provides an outer shell, a drum spaced within the shell, a rotary impeller for forcing a stream of air along the annular passageway between the shell and drum and an annular row of straightening vanes in such passageway to cause the air to assume a comparatively straight course to its discharge from the shell. It has been found in such a blower that there is a tendency of eddy currents to form on the surface of the straightening vanes and in effect to build up into an annular mass of air interfering with the continuous flow of the annular stream and reducing the efficiency of the blower. The present invention is directed to means for preventing such local accumulation of air on the straightening vanes.

In accomplishing the result, I provide means for forcing a local current of air across the face of each straightening vane adjacent the discharge portion thereof, preventing the building up of an air obstruction in this region. This constitutes the main feature of the present invention. More particularly, I provide a wide, shallow passageway through the straightening vane from its leading edge to an intermediate region to form a layer of traveling air along the discharge portion of the vane, and I provide this passageway without changing the external contour of the vane or materially interrupting its smooth surface. These are also features of the present invention.

My invention is illustrated in the drawings hereof and is hereinafter more fully explained and the essential novel features are summarized in the claims.

In the drawings, Fig. 1 is a longitudinal section through a turbine blower embodying my invention; Fig. 2 is a transverse section thereof, as indicated by the line 2—2 on Fig. 1; Fig. 3 is a face view of one of the straightening vanes looking at the convex side thereof; Fig. 4 is a section through one of the vanes, as indicated by the line 4—4 on Fig. 3; Figs. 5 and 6 are sections through such a vane, as indicated by the lines 5—5 and 6—6 on Fig. 3; Fig. 7 is a face view of one of the straightening vanes looking at the concave side thereof; Fig. 8 is a fragmentary longitudinal view just inside the shell looking toward the axis of the blower and showing the relation of the straightening vanes to the impeller blades; Fig. 9 is a diagrammatic view illustrating the tendency of the air to build up on a straightening vane not having my improvement.

Briefly, the turbine blower shown in Figs. 1 and 2 comprises an outer shell 10, an inner drum 11, radial supporting bars 12 connecting the drum and shell, and a shaft 13 journaled in bearings 14 carried by the drum and carrying an impeller 15 having an annular row of impeller blades 16.

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A flaring bell 17 connected to the shell and a dome-shaped shield 18 on the shaft direct the air in an annular course to the impeller blades, which force the air along the space between the drum and shell. In this space I provide an annular row of straightening vanes 20 which straighten out the stream of air so that it passes across the narrow supports 12 and is discharged in an annular stream about the stationary conical shield 19.

Referring now more particularly to Figs. 3 to 9 inclusive, each straightening vane 20 is a concavo-convex plate accurately curved to provide a convex surface 21 and a concave surface 22 designed to straighten the helical stream of air coming from the impeller blades. The camber of the straightening vanes is preferably similar to that of the impeller blades though in opposite direction. This camber is determined very accurately according to the conditions of the blower, having regard for instance to the diameter of the impeller, the speed of rotation, the cross sectional area of the air passageway, the pressure to be obtained by the machine.

Explanation of a method of arriving at the proper camber may be found in my copending application, Serial No. 692,207, filed August 22, 1946, now Patent No. 2,592,471 issued on April 8, 1952. However, the present invention is not limited to any particular camber of the blades or vanes, and reference to it is made to show the importance of preserving the designed camber in any particular blower notwithstanding my improvement in the straightening vanes, as hereinafter explained.

A straightening vane, if of solid formation, as indicated at 20a in Fig. 9, and accurately designed, operates well at the start of the blowing operation but, as the operation continues, eddy currents from on the convex side of the vane adjacent its discharge end build up into an air mass indicated at A in Fig. 9, which really has the effect of changing the external shape of the vane, as such mass causes the impelled air to pass, to quite an extent outside of the mass. This gradually reduces the efficiency of the blower as the operation continues.

In order to prevent the building up of an air mass on the convex side of the straightening vane, I have provided shallow wide passageways 24 extending from the leading edge of the vane to an intermediate position on the convex side thereof, such passageways preferably discharging at a region about one third of the way from the leading end to the discharge end of the vane. Some of the air forced by the impeller travels through these passageways and continues along the convex faces of the vanes adjacent their discharge ends and prevents the accumulation of eddy currents. I effect these passages without interfering with the camber of the vane or its comparatively smooth surface along which the major portion of the impelled air passes.

I provide the passageways 24 in the vanes preferably by forming shallow cuts in the convex surface, starting about the mid-region of such surface and becoming gradually deeper to the leading end, and adjacent the leading end terminating by intersection with the inner or concave surface of the vane, and surmounting such cuts by thin arcuate plates 30. These cuts do not reach the inner or outer radial edge of the vane and thus leave edge ribs 25 the outer surfaces of which are uniformly lowered from the original curvature of the vane in such region by a distance equal to the thickness of the plate 30.

I have shown an intermediate rib 26 similar in configuration to the ribs 25 for supporting the plate in a mid-position and I regard such rib as preferable to insure the holding of the plate in a perfectly smooth condition throughout. It is desirable, however, that sufficient shallow air space be provided to cover substantially the entire length of the vane in its trailing region with the moving air passing through the passageways.

I secure the thin metal plate 30 of proper arcuate form to the ribs 25 and 26 preferably by countersunk rivets 31 passing through them, as shown in Figs. 3, 6 and 7. It will be seen that the arcuate plate 30 continues the convex curvature 21 of the vane with only a slight interruption at the discharge end of the plate.

By making the entrance to the passageways 24 on the concave side of the vane, as shown in Figs. 5 and 7, I provide an ample orifice for the entrance of air and still allow the vane to be brought to a thin leading edge. Moreover by taking the air for the passageway from the outermost portion of the air between any vane and the adjacent vane on its concave side, I do not stir up the air which passes from the impeller along the convex surface of the vane.

I have found that the provision of the passageway described through the vanes themselves without materially altering their contours produces the desired effect of preventing an accumulation of air on the convex side adjacent the discharge end and enables the blower to maintain a continuous stream at high efficiency throughout the operation of the blower.

I claim:

1. A straightening stator vane for an axial flow blower comprising a generally concavo-convex member having a shallow cut in its convex surface starting intermediate the leading and trailing edges of said surface and terminating at the leading edge thereof, spaced projecting, integral, parallel ribs extending from the leading edge of the convex surface towards a point intermediate the leading and trailing edges and terminating by merging at such point into the convex surface, the convex surface of each rib being recessed below the general convex curvature of said member from the leading edge to a point short of the rib termination and of lesser vertical extent than the shallow cut, and a plate portion having a curvature substantially complementary to the convex surface of said member positioned in the recessed convex rib surfaces and bridging across the space between said ribs, to form a passageway for air therethrough.

2. An axial flow blower comprising a shell, a drum axially disposed within the shell and defining an annular space therebetween, an axial flow fan operatively disposed at one end of the shell to force air in an annular course through the space between the drum and the shell, an annular row of straightening vanes in the space between the drum and the shell, each vane com-

prising a generally concavo-convex member having a shallow cut in its convex surface starting intermediate the leading and trailing edges of said surface and terminating at the leading edge thereof, spaced projecting parallel ribs extending from the leading edge of the convex surface towards a point intermediate the leading and trailing edges and terminating by merging at such point into the convex surface, the convex surface of each rib being recessed below the general convex curvature of said member from the leading edge to a point short of the rib termination and of lesser vertical extent than the shallow cut, each vane having a thin plate portion positioned in the recessed convex rib surfaces and bridging across the space between the ribs to form a passageway for air therethrough, said plate portion having a curvature substantially complementary to the convex surface of the plate.

3. A straightening stator vane for an axial flow blower comprising a generally concavo-convex member having a shallow cut in its convex surface starting intermediate the leading and trailing edges of said surface and terminating substantially at the leading edge thereof, spaced projecting, integral, parallel ribs extending from the leading edge of the convex surface towards a point intermediate the leading and trailing edges and terminating by gradually and smoothly merging at such point into the convex surface, and a thin plate portion having a curvature substantially complementary to the convex surface of said member overlying the convex rib surfaces and bridging across the space between said ribs, to form a passageway for air therethrough.

4. An axial flow blower comprising a shell, a drum axially disposed within the shell and defining an annular space therebetween, an axial flow fan operatively disposed at one end of the shell to force air in an annular course through the space between the drum and the shell, an annular row of straightening stator vanes in the space between the drum and the shell, each vane comprising a generally concavo-convex member having a shallow cut in its convex surface starting intermediate the leading and trailing edges of said surface and terminating substantially at the leading edge thereof, spaced projecting parallel ribs extending from the leading edge of the convex surface towards a point intermediate the leading and trailing edges and terminating by gradually and smoothly merging at such point into the convex surface, each vane having a thin plate portion overlying the convex rib surfaces and bridging across the space between the ribs to form a passageway for air therethrough, said plate portion having a curvature substantially complementary to the convex surface of the plate.

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