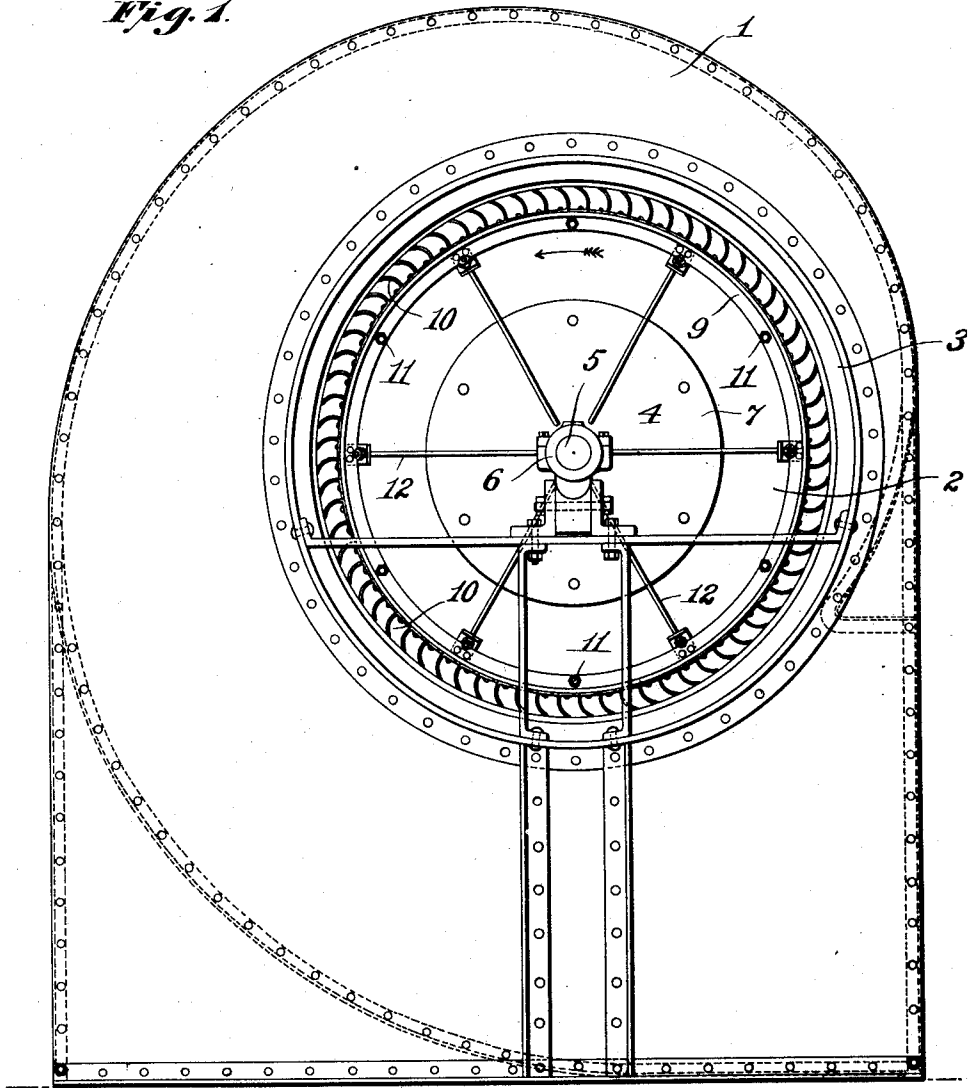


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BLOWER.
APPLICATION FILED SEPT. 8, 1906.

1,128,475.

Patented Feb. 16, 1915.
3 SHEETS—SHEET 1.

Fig. 1.



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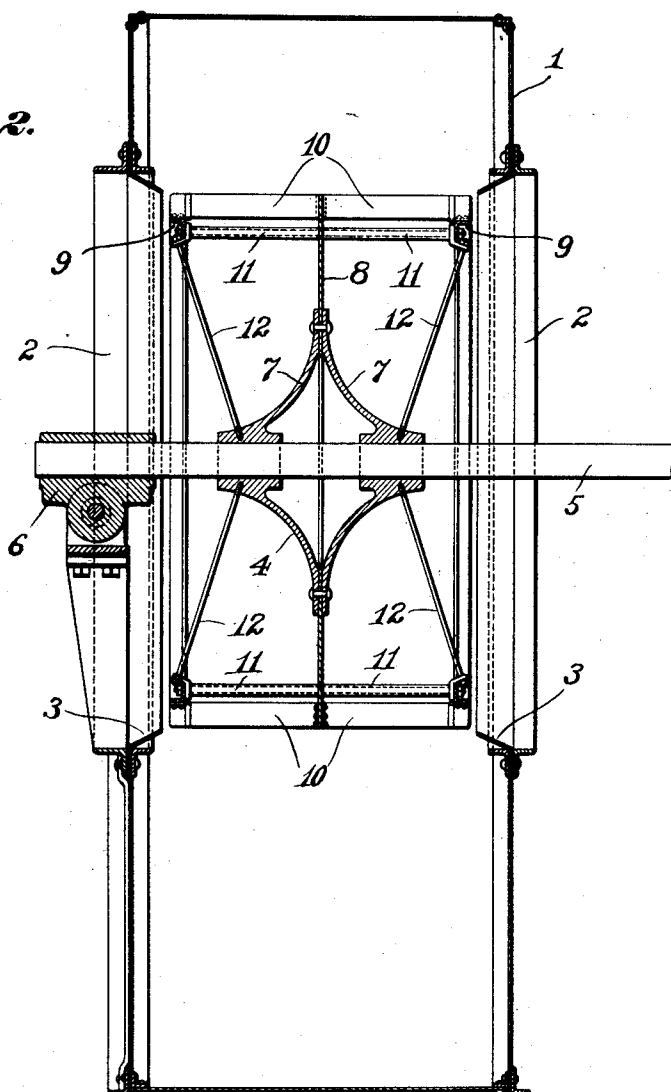
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3 SHEETS—SHEET 2.

Fig. 2.



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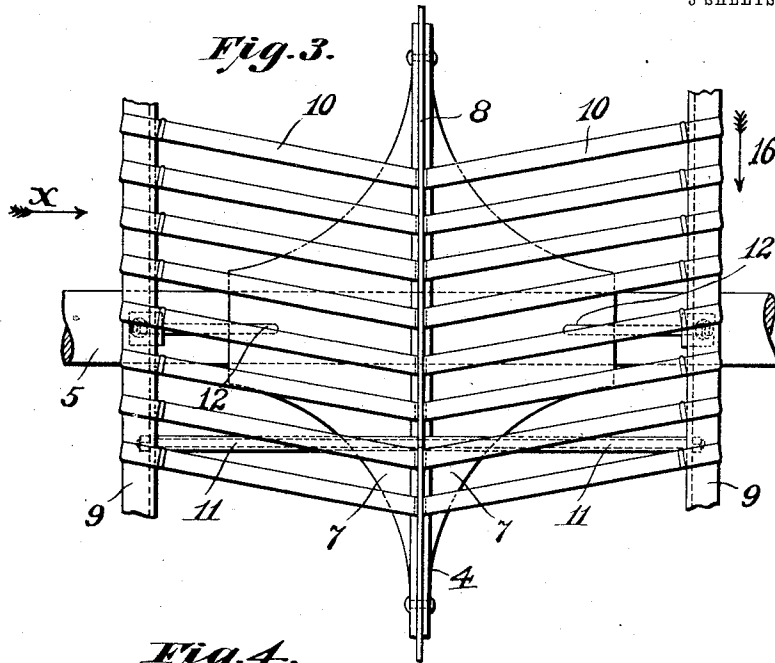
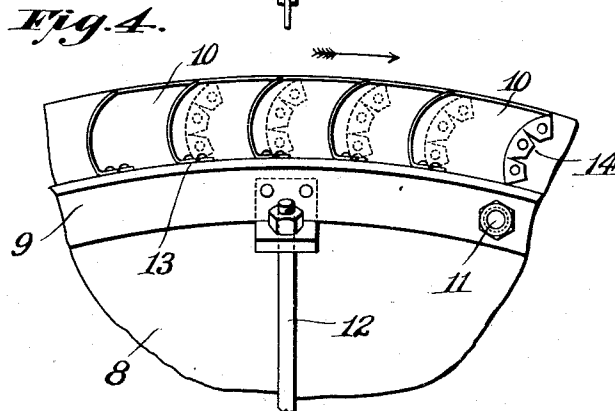
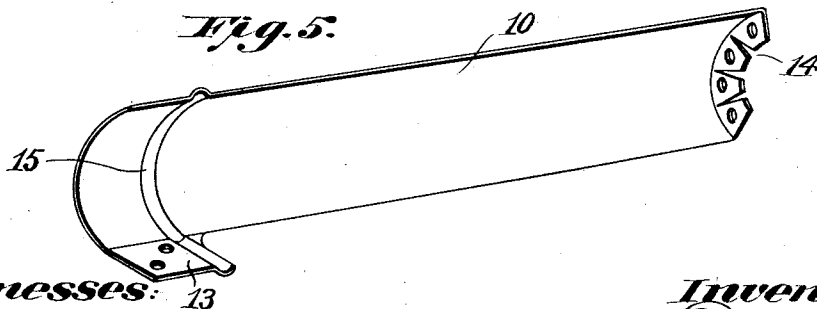
BLOWER.

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3 SHEETS—SHEET 3.



Witnesses: 13

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BLOWER.

1,128,475.

Specification of Letters Patent.

Patented Feb. 16, 1915.

Application filed September 8, 1906. Serial No. 333,775.

To all whom it may concern:

Be it known that I, DANIEL E. MAXFIELD, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Blowers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to an improvement in blowers or exhausters.

The object of the invention is to reorganize and improve the construction and operation of blowers or exhausters and particularly that type of blower or exhauster employing peripherally discharging vanes.

The invention consists in the blower hereinafter described and particularly defined in the claims.

In the accompanying drawings illustrating the preferred form of the invention Figure 1 is a side elevation, Fig. 2 is a sectional elevation of the blower or exhauster, Fig. 3 is a face view of a portion of the wheel, Fig. 4 is an end view enlarged of a portion of the periphery of the wheel looking in the direction of the arrow *x*, Fig. 3, and Fig. 5 is a perspective view of one of the vanes of the wheel.

The casing 1 for the blower is, in the illustrated embodiment shown as made of sheet metal having openings on both sides to permit ingress of air to the interior or intake chamber of the wheel. A guide 3 surrounds the opening and directs the entering air to the wheel 4. The opening in the guide 3 is preferably large enough to permit the passage of the wheel therethrough. See Fig. 2. The wheel is mounted on a shaft 5 supported in a bearing 6 at one end and at the other end connected to an engine, motor or other source of power.

The wheel 4, in the machine of the drawings, comprises two portions operating to draw in the air from opposite sides. The wheel consists of two hub members 7 keyed to the shaft 5 and riveted to a central disk or plate 8 which forms the central support for the wheel. The periphery of the wheel comprises two angle iron rings 9, vanes 10 peripheral braces 11 and radial braces 12. The disk 8, angle iron rings 9 and the braces 11 and 12 form the frame work or skeleton

of the wheel upon which the vanes 10 are mounted. The angle iron rings 9 form the support for the outer ends of vanes 10. The braces 11 consist of bolts extended through the inturned flange of the angle iron rings 9 and through the disk 8, distance pieces, conveniently consisting of pieces of pipe, surround the bolts and space the angle iron at the correct distance from the disk 8. The vanes 10 are secured at their inner ends to the disk 8 and at their outer ends to the flanges of the angle iron rings 9. The vanes 10 act as compression members and the braces 11 as tension members of a sort of truss so that the stresses incident to the rotation of the wheel are distributed through these members so as to avoid undue distortion. The braces 12 comprise means for centering the periphery of the fan with relation to the shaft and for steadying it during rotation, and by reason of their angular position they also act to prevent the periphery of the wheel from moving or swaying longitudinally of the shaft.

The vanes 10 are peculiar in construction. Each consists of a piece of sheet metal, illustrated perhaps the best in Fig. 5, which is longitudinally stiffened by being curved in cross section. An ear 13 is formed at one end of the vane 10 by which it is riveted to the angle iron ring 9. Ears 14 are formed at the other end of the vane by means of which it is riveted to the disk 8. The vanes are secured to the outer surface of the angle iron rings 9 thereby occupying the position of greatest lineal velocity on the wheel so that they are located in the most efficient position. The outer edges of the vanes are supported at their inner ends by the rivets through the ears 14 near the outer edge of the vane. At the outer end of the vane a radial corrugation 15 is formed which stiffens and supports the peripheral portion of the outer end of the vane.

In a fan in which the blades are arranged as elements of the cylindrical surface determined thereby the fan delivers more air from the portion of the periphery the more remote from the intake opening than it delivers at the portion of the periphery the nearer to the intake opening. This is believed to be because of the resistance which the air offers to the change in its direction of motion from an axial direction as it enters the intake to a radial direction as it

passes through the wheel. Tests upon fans of such construction have revealed the fact that the difference between the delivery of the portion of the periphery of the fan remote from the intake opening and the delivery of the portion of the periphery of the fan adjacent to the intake opening is so great that in some cases the portion of the periphery adjacent to the intake openings actually drew in air from the outside. This objectionable mode of operation the applicant has endeavored to overcome and to a large extent has overcome by arranging the vanes at an angle to the element of the surface which they determine. This angular arrangement of the vanes operates to tend to equalize the pressure of delivery over the periphery of the wheel and by virtue of the fact that the vanes tend to force the air passing out through them in the direction toward the rear end of the blade, that is, the portion of the blade striking the air last. This is made clear by reference to Fig. 3. The air entering the end of the wheel tends to pass out through the portion of the wheel remote from the intake but the vanes, arranged at an angle as shown and moving in the direction of the arrow 16, tend to counteract the effect of the inertia of the incoming air and so to equalize the pressure of the air delivered over the surface of the wheel. One important feature of the invention therefore resides in the angular disposition of the vanes with relation to an element of the surface which they determine so as to tend to equalize the peripheral pressure over the whole length of the wheel. In this connection it should be noted that each half of the wheel as shown in drawings, is a complete and independent blower irrespective of the presence or absence of the other half and as a consequence that the foregoing remarks relating to the variation of the pressure of the air discharged by the wheel relate of course, only to one wheel. With a double wheel the pressure of the air delivered would be the greatest in the center in case the vanes were arranged as elements of the cylinder and least (or minus) at the ends. By the arrangement illustrated and described the pressure is made more uniform.

Speaking with strict mathematical accuracy, the peripheral edges of the vanes (provided they are straight) determine, in the construction illustrated in the drawings, a zone of a hyperboloid of revolution. But the zone used in the illustrated embodiment, is approximately cylindrical in form and although the edges of the vanes should perhaps be regarded as elements of the surface of a hyperboloid, speaking with substantial, and perhaps equal, correctness, they may be said to determine a

cylindrical surface and to be arranged in that surface at an angle to an element thereof. The end of a vane the more remote from an intake opening is in advance (with relation to the direction of rotation of the wheel) of portions of the vane nearer the intake opening. The vanes are arranged obliquely with relation to their direction of motion and their intake ends are behind their other ends. It will also be observed that it is impossible to pass a plane through the axis of the wheel that will not be angularly disposed to every vane of the wheel. All of these modes of describing the arrangement of the vanes may find their brief equivalent in the statement that they have a "skew" arrangement. It is to be noted that whether the vanes are arranged to determine the surface of a cylinder or other surface of revolution they always have a skew arrangement.

The use of the word "blower" herein is not intended to limit the invention to use in a machine employed for blowing air as it is equally useful in machines for exhausting air. The medium operated upon by the blower has, for convenience, been referred to as "air" but it should be understood that other fluids or vapors are equally adapted to be operated upon by the apparatus.

Where reference is made in the claims to the "axial elements" of a blade this is to be understood as meaning the lines of intersection of the blade and concentric cylinders, the axis of which coincides with the axis of the wheel.

Having thus described the invention, what is claimed is:

1. A blower having a wheel provided with peripherally discharging skew vanes having their intake ends behind with relation to their direction of motion, substantially as described.

2. A blower having a wheel provided with peripherally discharging vanes, a support to which the vanes are secured, the vanes being provided with a supporting ear and with a radial corrugation extending into the ear to stiffen the vanes and to contribute to the support of their peripheral edges, substantially as described.

3. A blower having a wheel provided with an intake chamber within the periphery thereof, and also provided with peripherally discharging skew vanes having their intake ends behind with relation to their direction of motion, substantially as described.

4. A blower, having a wheel provided with peripherally discharging vanes the intake ends of which are open, a support to which the vanes are secured, the vanes being provided with a supporting ear projecting from the edge of the vane and with

a corrugation extending into the ear, substantially as described.

5 5. A blower, having a wheel provided with peripherally discharging vanes the intake ends of which are open, a support to which the vanes are secured, the vanes being provided with a supporting ear projecting from the edge of the vane and adjacent the open end, substantially as described.

10 6. A blower having a wheel provided with two sets of peripherally discharging skew vanes, ring supports for the outer ends of said vanes, means for supporting the inner ends of the vanes, the vanes in each set having their inner ends in advance of their outer ends with relation to their direction of rotation, and a casing having intake openings on each side of the wheel, substantially as described.

20 7. In a blower, the combination with a casing having an intake opening in its side, of a wheel rotatably mounted within the casing adjacent said opening and provided with peripherally discharging vanes, the ends of the vanes distant from the intake opening being in advance of the ends adjacent said opening with relation to the direction of rotation of the wheel, substantially as described.

30 8. A centrifugal fan wheel of the multi-blade drum type, comprising blades, the axial elements of a portion of said blades being oblique with reference to a plane passing through the axis of rotation and intersecting the blade, with the ends remote

from the intake in advance with respect to the direction of rotation, whereby said portions tend to force the air along the same toward the intake ends of the blades and to thereby equalize the discharge along the outer edge of the blade, substantially as described. 40

9. A centrifugal fan wheel of the multi-blade drum type, comprising blades having their outer edges arranged obliquely to the axis, said edges at their ends remote from the intake being in advance of their inlet ends. 45

10. A centrifugal fan wheel of the multi-blade drum type, comprising blades curved in cross section with their concave sides leading, and with their outer edges at the disk end in advance of said edges at the intake end. 50

11. A centrifugal fan wheel of the multi-blade drum type comprising blades, the axial elements of the greater portion of said blades being oblique with reference to the plane passing through the axis of rotation and intersecting the blade, with the ends remote from the intake in advance with respect to the direction of rotation, substantially as described. 60

In testimony whereof I affix my signature, in presence of two witnesses.

DANIEL E. MAXFIELD.

Witnesses:

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ALFRED H. HILDRETH.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."