Sept. 29, 1931. F. W. KENNEDY 1,825,622

HIGH SPEED BLOWER

Filed Dec. 23, 1924

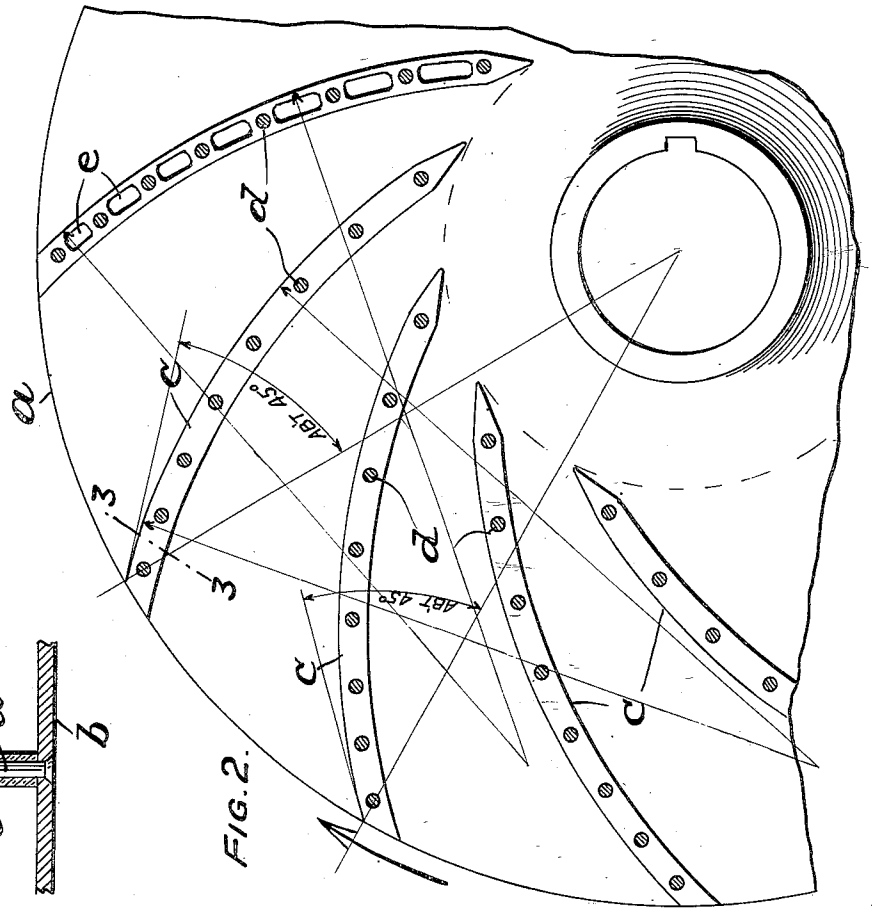

FIG. 2.

FIG. 3.

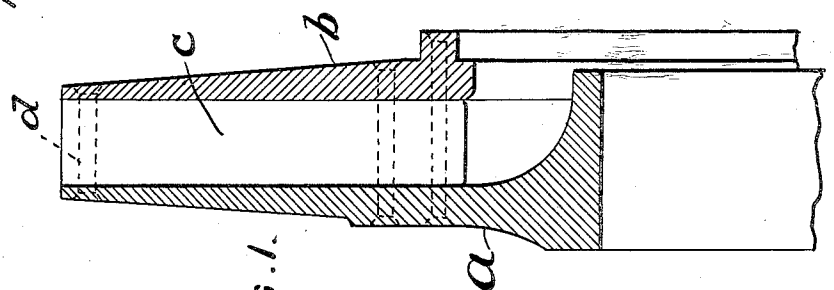

FIG. 1.

WITNESS:
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UNITED STATES PATENT OFFICE

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HIGH SPEED BLOWER

Application filed December 23, 1924. Serial No. 757,585.

In wheels for high speed blowers comprising a wheel hub, side plate and connecting steel vanes, it has been found essential to make the vanes of comparatively thin sheet steel, in order to secure lightness, as heavy vanes would result in an impracticably great stress both on the vanes and on the hub and side plates. In the usual construction these vanes are provided with side flanges (so as to have an approximately trough-shaped or shallow U-shaped form in cross-section), which flanges are riveted respectively to the hub and the side plate.

I have found that it is highly desirable to so shape the vanes that, as they approach the periphery of the wheel, they will extend backward relatively to the direction of rotation of the wheel at a pronounced angle to the radius—at least in excess of twenty degrees. The most efficient shape is that of a simple curve extending throughout most of its length, and particularly as it approaches the peripheral outlet, at an angle more or less approximating forty-five degrees to the radius. This construction, however, has been found to be wholly impracticable with vanes of sheet steel, especially with wide wheels rotating at a high rate of speed, the vanes having a strong tendency to bend at the outlet due to centrifugal force. For this reason, it has been found necessary that, as they approach the outlet, the vanes shall be curved toward the radius of the wheel on a center outside the periphery of the wheel, so that their outer ends extend radially to the wheel, or nearly so. The best compromise construction is that of a compound curve which, near the inlet, is at a pronounced angle (say sixty degrees) to the radius and which is thence curved outward toward the outlet at a rapidly diminishing angle to the radius so that its rear face is convex in its longitudinal direction of extension, until, as it approaches the outlet, it extends radially, or nearly so, as above stated. This gives a reasonably strong construction, but only at the sacrifice of efficiency. The construction is also relatively expensive.

I have found that it is possible to provide wheels—even those having great width and high velocity—with vanes shaped to give the highest efficiency and at the same time avoid the stresses above mentioned and the danger of bending at the outlet, and provide a construction that is substantially cheaper to manufacture.

My new vane comprises a relatively thick vane having the hereinbefore specified desirable direction of extension relatively to the wheel, the thickness of the vane being sufficient to allow rivets to extend entirely through the same from edge to edge, so that a single rivet may extend through the wheel hub, the vane and the side-plate. The vanes are preferably unflanged, as flanges are unnecessary for reinforcement or to provide rivet-engaging means. A construction embodying my invention is, however, impracticable if the vanes are made of steel, because of their excessive weight and resultant great stresses, as above explained.

I find, however, that if the metal duralumin be substituted for steel, it will afford the necessary strength, being almost as strong as steel, and being so light that the stresses resulting will not be greater than in the old structure.

With vanes shaped as above described to give the highest efficiency, the tendency to bend at the outlet due to the great centrifugal force will be successfully resisted due to the thickness of the vanes.

A preferred embodiment of my invention is shown in the drawings, in which—

Fig. 1 is a cross-sectional view through half the wheel.

Fig. 2 is a face view of Fig. 1 with side plate omitted.

Fig. 3 is a detail section on line 3—3 of Fig. 2.

Between the hub *a* and the side plate *b* extend the vanes *c*. It will be observed that the direction of extension of the vanes as they approach the outlet is backward relative to the direction of rotation of the wheel and at a pronounced angle (approximating forty-five degrees) to the radius of the wheel. The vane, preferably substantially throughout its length, and particularly the outer part thereof, is curved on a center within the periphery of the wheel, its rear face being con-

cave in its longitudinal direction of extension; and, preferably throughout its length, and particularly along its outer part, extends at an angle to the wheels radius which does not vary greatly from forty-five degrees. In some cases, however, said center of curvature would be outside of the wheel's periphery. The angle of extension of the vane, to the radius of the wheel, and even the angle of extension of the outlet end portion thereof, may be varied from the angle specified; but the angle of extension of the outlet end of the vane to the radius of the wheel should not be less than about twenty degrees. It is not necessary that the vane should be curved throughout its length, although that is preferable, as it may extend for part of its length in a straight line, or even may be reversely curved, provided the direction of extension of its outlet end portion is as specified. However, the most efficient shape is that illustrated, wherein the rear face of the vane is substantially continuously concave in its longitudinal direction of extension.

Rivets *d* extend through the hub, vane and side plate, as shown.

The vanes may be lightened by coring out the metal, as shown at *e*, between the rivets.

Duralumin is a commercial alloy known in commerce only by that name. Its precise composition is not a matter of general knowledge, but it is believed to be an alloy of aluminum, copper, manganese and magnesium.

In place of duralumin, there may be used any other aluminum composition or alloy that, while of a lightness comparable with duralumin, also possesses sufficient strength. The construction herein described is deemed to be novel, independently of the composition of the vanes, in high speed blowers, but unless such construction comprises vanes made of duralumin or its equivalents, it is impracticable or inoperative. It will be understood that I do not claim as my invention the mere substitution of duralumin or its equivalent for steel, but claim only the described construction in which the vanes are made of such metal alloy; the two features of construction and composition cooperating to attain the objects and secure the advantages herein set forth; it being understood, also, that if the vanes should be made of steel or the ordinary alloys thereof the construction would be impracticable as being too heavy, while most other materials as light as duralumin would produce a construction that would be impracticable as being too weak.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:

1. A blower wheel for high speed blowers comprising a hub, a side plate, duralumin vanes extending between them, and rivets uniting the vanes to the hub and side plate, vanes adjacent the rivets being solid and substantially thicker than the shanks of the rivets and the rivets which unite a vane to the hub and side plate extending through all three members and from edge to edge and between the faces of the vane, the outlet end portion of the vane extending backward relative to the direction of rotation of the wheel at an angle not less than twenty degrees to the radius of the wheel.

2. A blower wheel for high speed blowers comprising a hub, a side plate, duralumin vanes extending between them, and rivets uniting the vanes to the hub and side plate. the vanes adjacent the rivets being solid and substantially thicker than the shanks of the rivets and the rivets which unite a vane to the hub and side plate extending through all three members and from edge to edge and between the faces of the vane, the rear face of the outlet end portion of the vane being concave in its longitudinal extension.

3. A blower wheel for high speed blowers comprising a hub, a side plate, duralumin vanes extending between them, and rivets uniting the vanes to the hub and side plate, the vanes adjacent the rivets being solid and substantially thicker than the shanks of the rivets and the rivets which unite a vane to the hub and side plate extending through all three members and from edge to edge and between the faces of the vane, the outlet end portion of the vane being curved on a radius whose center is within the periphery of the wheel.

4. A blower wheel for high speed blowers comprising a hub, a side plate, duralumin vanes extending between them, and rivets uniting the vanes to the hub and side plate, the vanes adjacent the rivets being solid and substantially thicker than the shanks of the rivets and the rivets which unite a vane to the hub and side plate extending through all three members and from edge to edge and between the faces of the vane, the vane being curved throughout the major part of its length in such direction that its rear face is concave in its longitudinal extension.

5. A blower wheel for high speed blowers comprising a hub, a side plate, duralumin vanes extending between them, and rivets uniting the vanes to the hub and side plate, the vanes adjacent the rivets being solid and substantially thicker than the shanks of the rivets and the rivets which unite a vane to the hub and side plate extending through all three members and from edge to edge and between the faces of the vane, the vane being curved throughout the major part of its length on a radius whose center is within the periphery of the wheel.

6. A blower wheel for high speed blowers comprising a hub, a side plate, duralumin vanes extending between them, and rivets uniting the vanes to the hub and side plate,

the vanes being substantially thicker than the shanks of the rivets and the rivets which unite a vane to the hub and side plate extending through all three members and from edge to edge and between the faces of the vane, the vanes being cored between adjacent rivets and at their outlet portion extending backward relative to the direction of rotation of the wheel.

7. In a compressor wheel, the combination with the wheel discs, of hollow blades between the discs, said blades having transverse ribs contacting the inner faces of the discs, and means securing the blades to the discs.

8. A blade for rotary compressors comprising wall portions with intervening transversely extending ribs connecting the wall portions in spaced relationship.

9. Blade construction for rotary compressor wheels comprising a body portion formed with ribs projecting from one side, a cooperating wall portion secured to the tops of the ribs and marginal connecting means.

10. A blade construction for rotary compressor wheels comprising cooperating wall portions arranged in spaced relationship, spacing members between the wall portions and secured thereto, and attaching members projecting from the ends of the spacing members.

In testimony of which invention, I have hereunto set my hand, at Trenton, New Jersey, on this 19th day of December, 1924.

FRANK W. KENNEDY.