Sept. 10, 1935. V. W. SHARPE ET AL 2,014,032

FAN AND THE LIKE

Filed Oct. 24, 1934

FIG 1

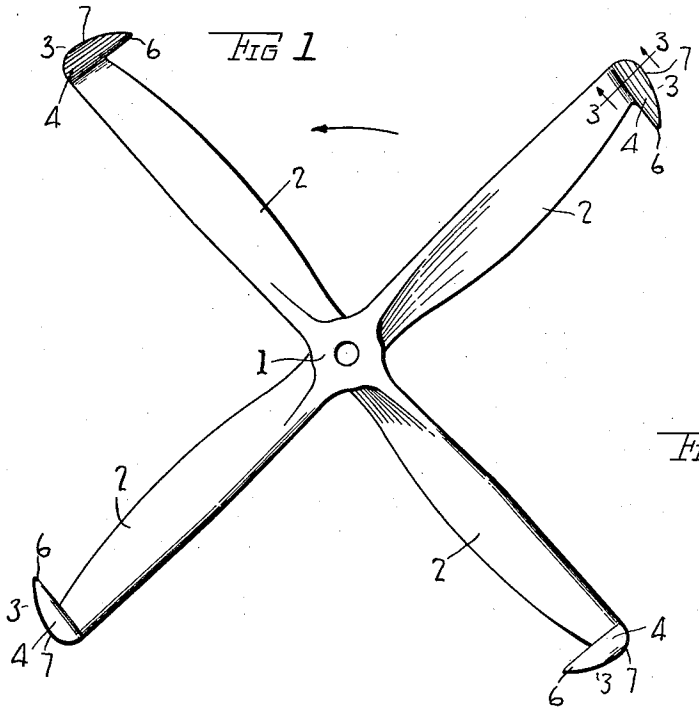


FIG 2

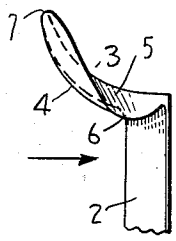


FIG 3

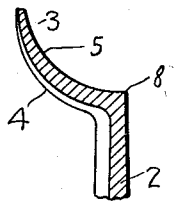


FIG 4

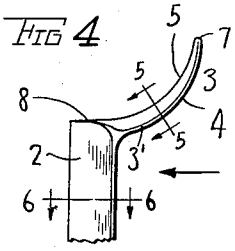


FIG 5

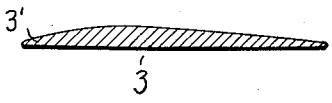


FIG 6

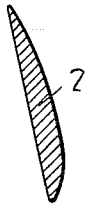
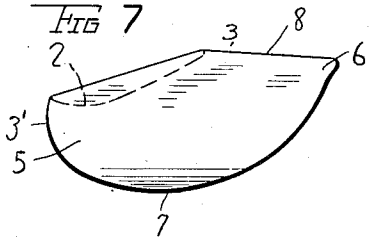


FIG 7



Vernon W. Sharpe
John A. Castor
INVENTORS.

BY

Staley & Welch
ATTORNEYS.

Patented Sept. 10, 1935

2,014,032

UNITED STATES PATENT OFFICE

2,014,032

AN AND THE LIKE

Vernon W. Sharpe and John A. Castor, Springfield, Ohio, assignors to Robbins & Myers, Inc., Springfield, Ohio, a corporation of Ohio

Application October 24, 1934, Serial No. 749,790

10 Claims. (Cl. 170—170)

This invention relates to fans for ventilating purposes and more particularly to fans of the airplane propeller aerofoil-section type; it more especially relating to a fan of this type which is designed for creating a circulation in a room as distinguished from a fan which is intended to exhaust air from the room.

It is well known that with fans of this type, unless provision is made for overcoming it, there is a blade tip loss; that is, the diameter of the column of air leaving the fan is less than the diameter of the fan. This is due to the fact that, while the air flow through the central portion of the fan is essentially parallel to the axis of rotation, at the tip the direction of flow is inclined toward the axis of rotation because the air drawn by the tips of the blades flows not only from the region behind the propeller but also from the region immediately beyond the propeller tip, thus producing two velocity components which direct air in the direction of the resultant, which resultant velocity is inclined toward the axis of rotation. This has the effect of reducing the diameter of the column of air leaving the fan blades, as a part of the air which has previously passed through the tips of the blades flows outwardly and then reversely through the tips again producing a circulatory flow of air at the tips of the blades. To overcome this, and provide for causing a flow of air in a column equal in diameter to the diameter of the fan so that the entire surface of the blades will be effective it has been the recent practice to mount the fan in an orifice consisting of a ring having a flaring entrance, the inner diameter of the ring being but slightly greater than the diameter of the fan, it having been found that when a fan of the type mentioned is so mounted, the flaring inlet will regulate the diameter of the flow stream to such an extent as to render the entire length of the blades of the fan effective and oppose any reverse currents of air which would otherwise occur at the tips of the blades. It has also been found that providing the flaring entrance of the orifice with walls which are of a rounded character furnishes the most efficient flow of air through the orifice or enclosures for the fan. While a fan of this type mounted in such an orifice with a rounded flaring entrance is suitable for installation in the wall of a room when air is to be exhausted from the room, it is impractical or at least not desirable to equip a fan with an orifice or ring with a flaring entrance when the fan is designed merely to circulate air in a room, in which case the fan is usually provided with a base so that the fan may be set upon the floor of the room or upon a desk or other piece of furniture in the room, or with a bracket by which it may be supported from the wall of the room.

The object of our invention is to so equip a fan having blades of the airplane propeller aerofoil-section type and which is designed to merely circulate air in a room, and therefore be set in some open place in the room, in a way by which it will have all the advantages of a fan with blades of that type which is placed in an orifice with a flaring rounded entrance.

To that end, we equip the tip of each blade of the fan with a projection of peculiar formation which projections when the fan is in operation will produce in effect an orifice in the form of a ring surrounding the tips of the blades which has a flaring entrance preferably with walls of the more efficient rounded type.

In the accompanying drawing:

Fig. 1 is a rear elevation of a fan embodying the improvements.

Fig. 2 is a view of the trailing edge of the outer end of one of the fan blades.

Fig. 3 is a section on the line 3—3 of Fig. 1, said line being at right angles to the plane of rotation of the fan.

Fig. 4 is a view of the leading edge of the outer end of one of the fan blades.

Fig. 5 is a section on the line 5—5 of Fig. 4.

Fig. 6 is a section on the line 6—6 of Fig. 4.

Fig. 7 is a view of the outer side of one of the projections with which each fan blade is equipped.

Referring to the drawing, 1 represents the hub and 2 the blades of a fan, the blades being of the airplane propeller aerofoil-section type. The tip of each blade has preferably integrally formed therewith a projection indicated in a general way at 3. Each of these projections is located on the extreme end of the tip of the blade and extends rearwardly and outwardly with relation to the back side of the blade; or, in other words, the projection extends from the intake side or from the negative pressure side of the blade. The inner face of each projection is curved as indicated at 4 so as to provide a convex surface, while the outer face of the projection is curved as indicated at 5 to provide a concave surface. Any circumferential line on the projection is concentric to the axis of rotation of the fan and the convex surface forms in effect an outwardly flaring rounded entrance for the passage of air to the tip of the blade and the outer concave sur-

face is so formed that the air offers the least resistance to the rotation of the fan. The direction of rotation of the fan is indicated by the arrow in Fig. 1, and the direction of movement of the column of air is shown by the arrows in Figs. 2 and 4. The leading edge of each projection is preferably substantially flush with the leading edge of the fan blade and the projection is elongated reversely to the direction of rotation so as to provide a tail piece 6, which extends beyond the trailing edge of the blade, the rear edge 7 of the projection being curved and the forward edge inclined as indicated at 8 so that the tail piece or extension 6 is of gradually decreasing width and preferably terminates in a point at its rear end. The purpose of this tail piece or extension is to cooperate with the main body of the projection to prevent centripetal flow and it also cooperates with the main body of the outer surface of the projection to reduce air resistance. The forward or leading edge of each projection is beveled as indicated at 3' and the rear portion of the projection gradually decreases in thickness as clearly shown in Fig. 5.

By this construction it has been found that when the fan is in operation the direction of air flowing into the tip is changed from one which is inclined to the axis of rotation to one which is substantially parallel with the axis of rotation of the fan so that a column of air is created moving in a direction parallel to the axis of the fan which has a diameter substantially equal to that of the fan. In other words, these projections form in effect a rotating orifice which has a flaring rounded entrance and acts in a manner similar to a stationary ring which surrounds the fan and is provided with a flaring rounded entrance.

The hub of the fan is secured in any suitable way to the shaft of an electric motor (not shown) and fans of this type are suitable for all ordinary speeds.

While the invention has been referred to as more particularly adapted to fans for creating a circulation in a room, it will be suitable also for other purposes requiring similar characteristics, such for instance as airplane propellers.

Having thus described our invention, we claim:

1. In a device of the character described having blades of the airplane propeller aerofoil-section type, and elements carried by the outer ends of the blades projecting from the intake sides of the blades formed to prevent reverse and centripetal flow of the air.

2. In a device of the character described having blades of the airplane propeller aerofoil-section type, an element on the outer end of each blade extending in a direction reverse to the flow of the air and being outwardly flared, said element when the fan is rotating forming in effect a rotating ring surrounding the fan having a rounded flaring mouth.

3. In a device of the character described having blades of the airplane propeller aerofoil-section type, a projection on the tip of each blade extending rearwardly and outwardly from the intake side thereof.

4. In a device of the character described having blades of the airplane propeller aerofoil section type, a projection on the tip of each blade lying on the intake side thereof and curved outwardly with respect to the tip of the blade so as to provide an inner face for each projection substantially convex in form.

5. In a device of the character described having blades of the airplane propeller aerofoil section type, a projection on the tip of each blade lying on the intake side thereof and curved outwardly with respect to the tip of the blade so as to provide an inner surface on each projection substantially convex in form and an outer surface on each projection substantially concave in form.

6. In a device of the character described having blades of the airplane propeller aerofoil section type, a projection on the outer end of each blade lying on the intake side thereof, said projection being curved outwardly with respect to the blade so as to provide a substantially convex inner surface and a substantially concave outer surface for said projection, said projection being extended circumferentially beyond the trailing edge of said blade in a direction reverse to that of the rotation of said blade.

7. In a device of the character described having blades of the airplane propeller aerofoil section type, a projection on the outer end of each blade lying on the intake side thereof, said projection being curved outwardly with respect to the blade so as to provide an inner face substantially convex in form and an outer face substantially concave in form, said projection being extended circumferentially beyond the trailing edge of the blade in a direction reverse to that of the rotation of said blade, said extended portion being gradually reduced in width.

8. In a device of the character described having blades of the airplane propeller aerofoil section type, a projection on the outer end of each blade lying on the intake side thereof, said projection where it joins the fan blade being formed on the arc of a circle concentric with the axis of the fan.

9. In a device of the character described having blades of the airplane propeller aerofoil section type, a projection on the outer end of each blade lying on the intake side, said projection where it joins the fan blade being formed on the arc of a circle concentric with the axis of the fan, the inner face of said projection being curved outwardly with respect to the fan blade so as to provide a substantially convex inner surface for said projection.

10. In a device of the character described having blades of the airplane propeller aerofoil section type, a projection on the outer end of each blade lying on the intake side thereof, said projection where it joins the fan blade being formed on the arc of a circle concentric with the axis of the fan, said projection being curved outwardly with respect to the fan blade so as to provide a convex inner surface and a concave outer surface for said projection.

VERNON W. SHARPE.
JOHN A. CASTOR.