Dec. 11, 1945. J. A. McLEAN, JR 2,390,804

PROPELLER TYPE FAN

Filed Oct. 28, 1942

Fig. 1.

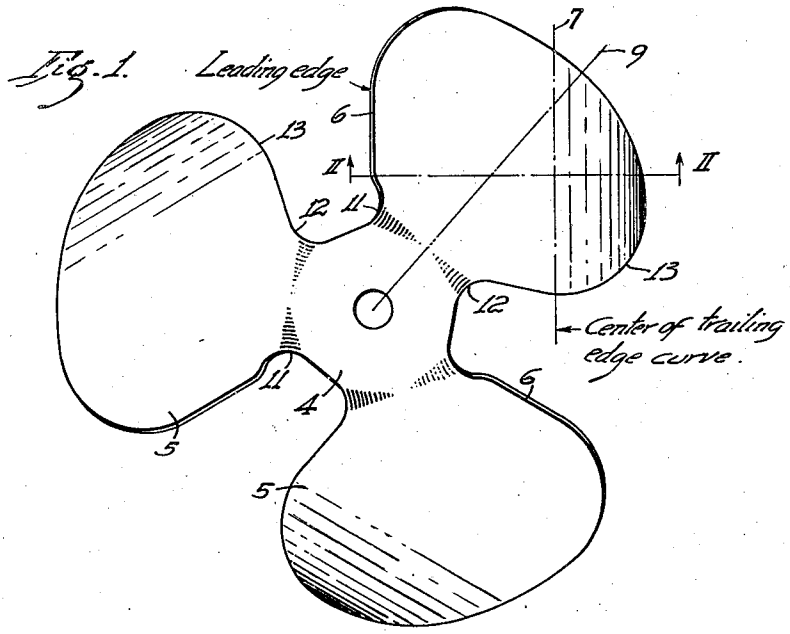


Fig. 3.

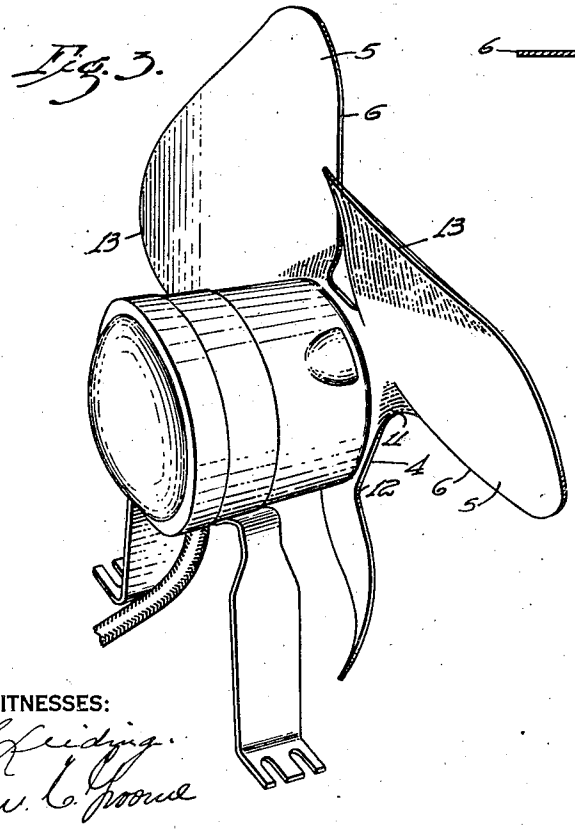
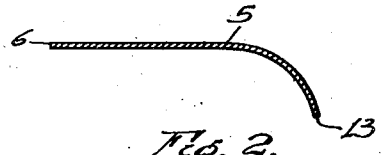


Fig. 2.



WITNESSES:

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UNITED STATES PATENT OFFICE

2,390,804

PROPELLER TYPE FAN

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4 Claims. (Cl. 170—159)

My invention relates to a novel blade-shaping of a propeller-type fan such as is utilized for causing air-flow through a condensing unit. After an expenditure of thousands of dollars in testing old types of fan-blades and designing new ones, for obtaining the lowest noise-level for a given performance of the condensing unit, that is, for the same air-flow, I have been able to achieve a significant noise-reduction in my present design of fan-blade which includes the following unique features:

A. Most of the length of the leading edges of the blades are approximately straight edges lying approximately in radial planes extending through the axis of the fan.

B. Each blade has a relatively flat leading-edge blade-portion and a curved trailing-edge blade-portion, the flat portion being preferably the larger, and the trailing-edge portion of the blade approximating the shape of a segment of the surface of a cylinder, the axis of which is approximately parallel to the straight-edge portion of the leading edge, or the trailing-edge portion of the blade may approximate any other surface which may be conceived as being generated by a straight-line generatrix parallel to said straight-edge portion of the leading edge and moving in a curved line at right angles to the generatrix.

C. The rearmost part of the trailing-edge portion of each blade is preferably approximately parallel to the axis of the fan.

Other features of my fan blade are:

D. A three-bladed fan.

E. An integral sheet-material construction comprising a flat central portion for mounting on a small refrigerator-fan motor, and three twisted blade-portions which are formed as integral extensions of the flat central portion, preferably with sufficient width at the base of each blade to support the blade without additional ribs or supports.

Among the advantages of my blade-design are its simplicity of manufacture, involving only a single cylindrical bend on each blade and a twist of each blade, exceptionally quiet operation as above noted, a slight reduction in the required power-input for a given movement of air, a reduction in the required speed of rotation for the given air-flow, and an absence of radial flow of air from the tips of the blades.

A preferred form of embodiment of my fan is shown in the drawing, wherein

Figure 1 is a front-view of the integral fan-blade construction;

Fig. 2 is a sectional view on a section-plane II—II of Fig. 1 at right angles to the leading edge of one of the blades; and

Fig. 3 is a perspective view of one of my multi-blade fan-members mounted on a small refrigerator-fan motor.

As shown in Fig. 1, my fan is a multi-blade construction, with preferably three blades, formed out of an integral piece of sheet-material, which may be aluminum or a composite molded material. The blank has a flat central portion 4, with a plurality of blade-portions 5 constituting integral extensions of the flat central portion. Each blade has a leading edge 6, the major portion of the contour of which is made up of a radial line of the blade-circle, thus constituting a substantially straight-edge portion. From this straight leading-edge 6, the blade extends back in a substantially flat plane, for well over half of the surface of the blade, until a certain point is reached, indicated by the dotted straight line 7, which is substantially parallel to the straight leading-edge 6, at which point the blade begins to curve, in a direction to increase the pitch of the trailing-edge portion of the blade. This curved trailing-edge portion of the blade may approximate a surface which is generated by a straight-line generatrix, such as the dotted line 7, lying on the surface of the blade, and moving in any curved line at right angles to the generatrix, but preferably the curved line is an arc of a circle, so that the curved portion of the blade is approximately in the shape of a segment of a cylindrical surface, the axis of which is approximately parallel to the straight-edge portion 6 of the leading edge of the blade.

Each blade is twisted on an approximately central radial line 9 so as to provide an entering angle of approximately 15°, this twist resulting in a bending or deformation of the sheet-material at the base of each blade, where it joins the central portion 4, as indicated at 11 and 12. This base-portion 11—12 of the blade is preferably of sufficient width to support the blade without additional ribs or supporting-members.

The rearmost part 13 of the trailing-edge portion of the blade may advantageously be approximately parallel to the axis of the fan, so that the propelled air which leaves the blade is approximately parallel to the axis of the shaft on which the blade is mounted.

As shown in Fig. 1, the curved trailing-edge portion 13 of each blade is generated by a straight-line generatrix, starting with a straight-line blade-element lying in the line 7 of Fig. 1, and containing, further back, other parallel

straight-line blade-elements which are shorter than the element at 7, so that the extreme rear edge or trailing edeg of the blade, at the rear edge of the rearmost part 13, is for the most part curved in contour, with the extreme rear edge of the blade lying on the fan-axis side of a plane normal to the extreme front edge or leading edge 6 of the blade at the inner end of the straight-line portion of said leading edge, referring to a plane such as the section-plane II—II in Fig. 1.

I have no particular theory to explain why my fan is efficient, or why it is so notably quieter than other fans with which I have had experience. Noise-level tests have thoroughly demonstrated, however, its suitability for the condensing unit for which it was particularly designed, in which it is utilized to draw air through the condenser-coil (not shown), and over the fan-motor and the other parts of the condenser-unit. About the best that I can say for my fan is that it works, and that it works with notable quietness, in an application where noise-reduction is of the utmost commercial and engineering importance.

I claim as my invention:

1. A multi-blade fan, characterized by each blade being of sheet-material construction, each blade having a leading edge having a contour consisting for the most part of an approximately straight line lying approximately in a radial plane extending through the axis of the fan, and each blade having a relatively large, relatively flat, leading-edge blade-portion extending back for a considerable distance behind the leading edge, and a smaller, curved, trailing-edge blade-portion extending back from the relatively flat leading-edge blade-portion, said trailing-edge blade-portion approximating a surface generated by a straight-line generatrix-element which remains parallel to the straight-line portion of the leading edge as it moves rearwardly in a curved line, the plane of said curved line being normal to the leading edge at the inner end of the straight-line portion of said leading edge, the generatrix-elements lying in the trailing-edge blade-portion becoming shorter as the generatrix moves to the rear, so that the trailing edge is for the most part curved in contour, the extreme rear edge of the blade being disposed, for the most part, on the fan-axis side of said normal plane.

2. The invention as defined in claim 1, characterized by each blade being twisted so as to provide an entering angle of approximately 15°.

3. The invention as defined in claim 1, characterized by each blade being twisted so as to provide an entering angle of approximately 15°, and the rearmost part of the trailing-edge blade-portion being approximately parallel to the axis of the fan.

4. A three-bladed fan as described in claim 1, characterized by each blade being twisted on an approximately central radial line so as to provide an entering angle of approximately 15°, and the rearmost part of the trailing-edge blade-portion being approximately parallel to the axis of the fan.

JOHN A. McLEAN, JR.