Sept. 14, 1948. N. LEE, JR 2,449,531

IMPELLER

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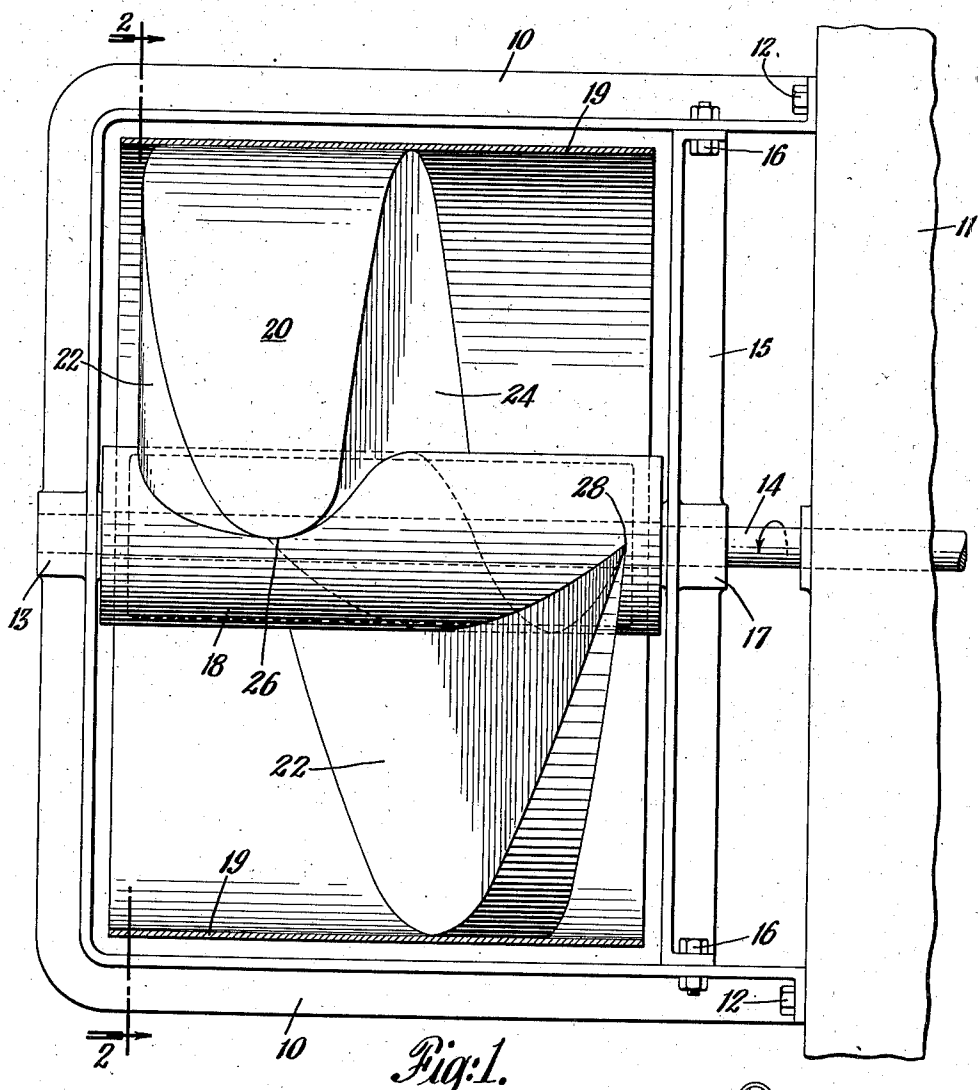


Fig:1.

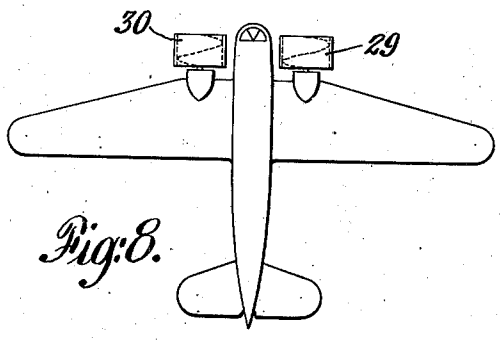


Fig:8.

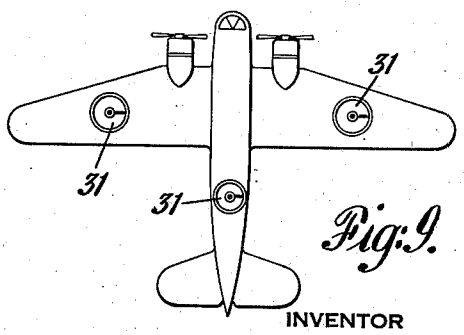


Fig:9.

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Fig. 2.

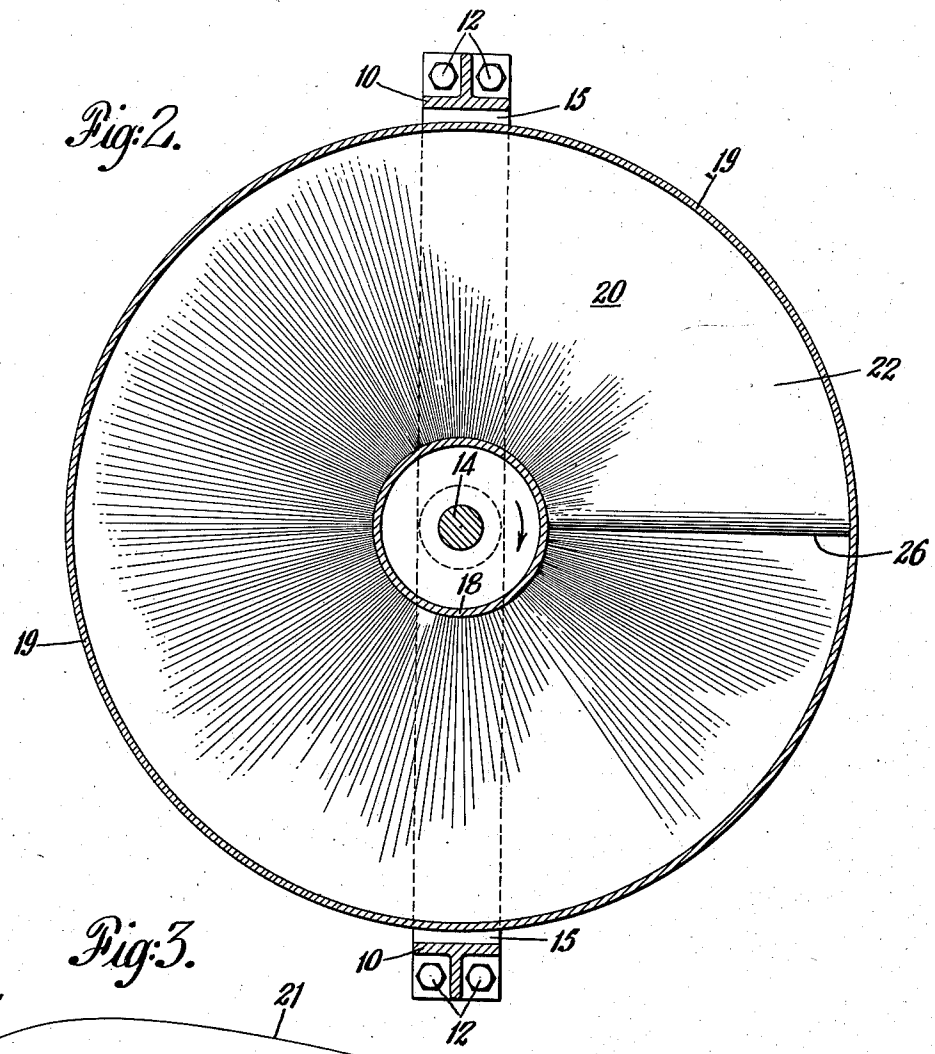


Fig. 3.

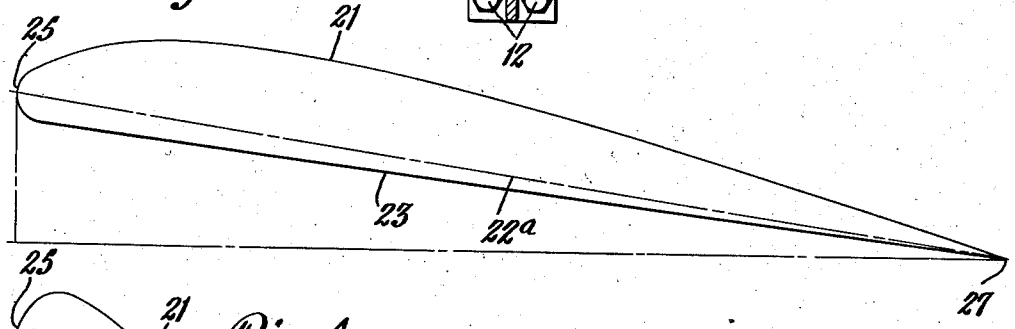
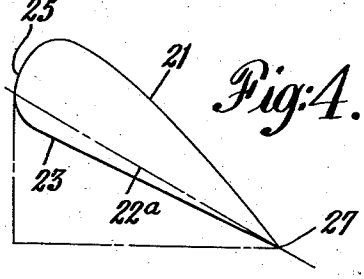


Fig. 4.



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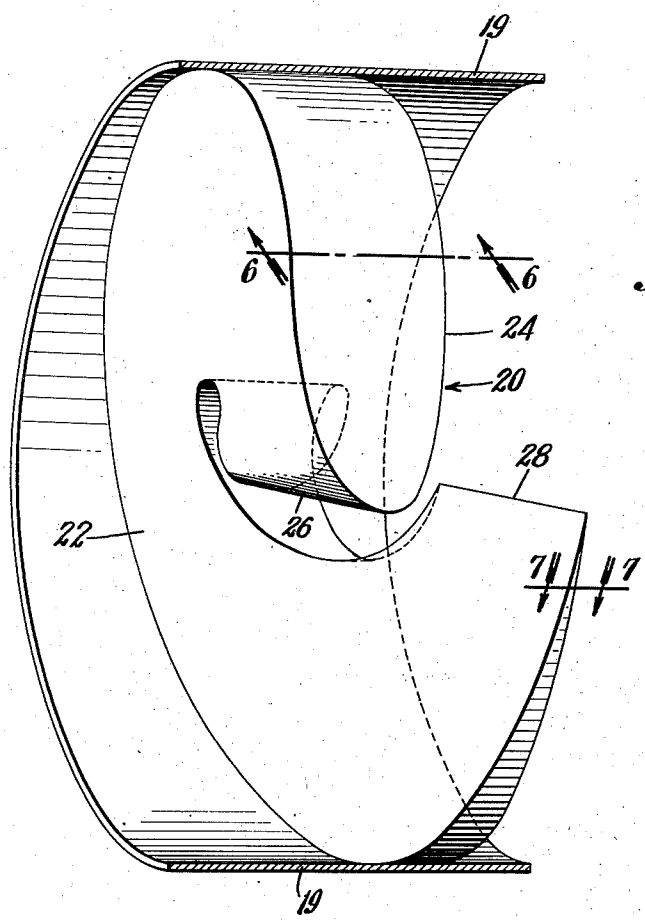


Fig:5.

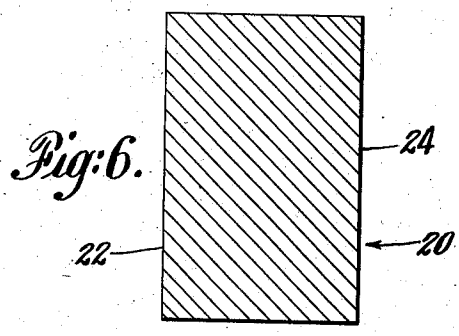


Fig:6.

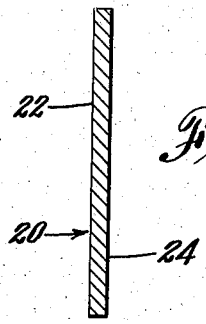


Fig:7.

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Patented Sept. 14, 1948 2,449,531

UNITED STATES PATENT OFFICE

2,449,531

IMPELLER

Nixon Lee, Jr., Forest Hills, N. Y.; Nixon Lee, executor of said Nixon Lee, Jr., deceased

Application June 2, 1942, Serial No. 445,416

1 Claim. (Cl. 170—156)

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This invention relates to an impeller, and more particularly an impeller device that is particularly adapted for operation in gaseous fluids such as air.

One object of my invention is the provision of a rotary impeller provided with a spiral blade that utilizes to best advantage both of its surfaces simultaneously to force a gas in a given direction.

A further object of the invention is the provision of an impeller in which a blade is mounted in the form of a spiral between a hub and a shield, the blade being essentially a section of an airfoil.

A further object of the invention resides in the combination of such an impeller with an aircraft to produce either forward motion or lift of the aircraft, or to perform both of these functions.

In order that my invention may be readily understood, reference is made to one embodiment thereof illustrated in the accompanying drawings, in which

Fig. 1 is a side view of the impeller with one-half of the outer shield broken away to show the internal construction.

Fig. 2 is a sectional view of the impeller taken upon the line 2—2 of Fig. 1.

Fig. 3 is a cross sectional view of an airfoil that is projected as a spiral to form the impeller blade.

Fig. 4 is a projection diagram of the airfoil section on a smaller scale corresponding to the circumference of the impeller hub.

Fig. 5 is a perspective view of the impeller blade showing the rear half of the shield attached thereto.

Fig. 6 is a radial sectional view through the impeller blade taken on the line 6—6 of Fig. 5.

Fig. 7 is another radial sectional view taken through the blade on the line 7—7 of Fig. 5.

Fig. 8 is a diagrammatic plan view showing an adaptation of the impeller for imparting forward motion to an aircraft.

Fig. 9 is a diagrammatic plan view showing an adaptation of the impeller of this invention for producing lift in an aircraft.

In the drawings, numeral 10 indicates a U-shaped bracket or frame which may be secured to a suitable support 11 by means of the bolts 12. This U-shaped frame is provided at its central point with a bearing 13 to receive one end of the axle 14. Axle 14 may be rotated in the direction indicated by the arrow in Fig. 1 by a motor, engine or other suitable source of power (not shown). The axle 14 also extends through a second frame member 15 secured at its ends to the frame 10 by bolts 16 and provided centrally with a bearing

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17 to support the axle. Inside the frame members 10 and 15, a hub 18, which may be in the form of a hollow or solid cylinder of considerable diameter, is splined or otherwise secured to the axle 14 for rotation therewith. An outer shield 19 in the nature of a cowling or shroud is provided in the form of a thin-walled cylindrical member spaced some distance from and concentric with the hub 18. The blade 20 of the impeller is in the form of a spiral attached to both the hub 18 and the shield 19 by any suitable means such as welding. This blade 20 is shown as solid to simplify its illustration, although it is preferably made of sheet metal or other sheet material in order to reduce its weight.

Blade 20 is essentially a spiral projection of a segment or section of an airfoil of the shape shown in cross section in Fig. 3. The upper surface of the airfoil 21 becomes the forward surface 22 of the blade and the lower surface 23 of the airfoil section becomes the rear surface 24 of the blade. The leading edge 25 of the airfoil section is similarly the leading edge 26 of the impeller blade and the rear or trailing edge 27 of the airfoil section becomes the tail or rearmost edge 28 of the impeller blade. Thus, a radial section taken through the impeller blade at any point is in the shape of a rectangle such as shown in Figs. 6 and 7, its proportions depending upon the thickness of the blade at the point of sectioning. Also, the surface 21*a* (Fig. 5), assuming the blade 20 to be solid, is simply a spiral projection of Fig. 3 and the surface 21*b* is a spiral projection of Fig. 4.

Neither the upper nor the lower surface of the airfoil is necessarily parallel to its major axis 22*a*, and the projection of these airfoil surfaces is preferably based upon the projection of this major axis around the hub 18 as a true spiral.

In the operation of this device, rotation of the impeller blade 20 in the direction of the arrow shown in Fig. 1 advances the leading edge 26 of the blade or airfoil section through the air and creates a flow of air over both the surfaces 22 and 24 of the blade. The flow of air over the rear surface 24, which is shaped for the most part like a true spiral surface, forces the air by a direct thrust in the direction of the support 11, and produces a reaction force tending to move the impeller in a direction away from the support 11.

When the speed of rotation of the blade becomes sufficient to create a very rapidly moving stream of air over the surface 22, a partial vacuum is created adjacent this surface in much the same fashion that a partial vacuum is created over the upper surface of an airplane wing during flight.

This likewise creates a force tending to move the impeller blade in a direction away from the support 11, so that in effect both surfaces of the blade are doing useful work, tending to move the impeller in one direction.

In the design of this impeller, it is desirable to have a hub of substantial diameter in order to move the blade surfaces adjacent the hub sufficiently rapidly to do useful work. At the same time, it is necessary to confine the stream of air flowing over the blade surfaces, so that the effect of centrifugal force on this air stream will not cause the air stream to flow outwardly and over the sides of the blade. The shield 19 is one simple way of avoiding this difficulty and preventing centrifugal force from distorting the stream of air in which the impeller blade is working.

An impeller of this type is capable of exerting very efficiently a force tending to move the impeller and anything attached to it in a given direction. It is thus well adapted for use in the aircraft, either to impart forward motion to the aircraft as indicated in Fig. 8, or to provide lift for the aircraft as indicated in Fig. 9. In Fig. 8, for example, two impellers 29 and 30 are substituted for the usual airplane propeller blades and may be rotated by suitable motors. In Fig. 9, the impellers 31 are shown as mounted in the wings and also in the fuselage of the plane at a point rearwardly of the wing. It is quite possible that by the use of such an impeller as this to provide lift for an airplane, the size of the wing of the plane may be greatly reduced.

Although an impeller with a single blade has been described, it will be apparent that two or more of such blades can be used in a single impeller with the leading edge of a second blade immediately following or somewhat offset with respect to the trailing edge of the first blade. Multiple blades with each extending less than 360° around the hub have some advantage in that a greater pitch may be used successfully.

The terms and expressions which I have employed are used as terms of description and not of limitation, and I have no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof, but recognize that various modifications are possible within the scope of the invention claimed.

I claim:

An impeller comprising a hub, a cylindrical shield surrounding and spaced from the hub, a blade connecting said hub and shield comprising a section of an airfoil projected in a spiral around said hub, said blade tapering with diminishing rectangular cross section to a terminal sharp edge and having a substantially uniform thickness in a direction radially outward from the hub, and means for rotating the blade.

NIXON LEE, JR.

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