Feb. 16, 1965 A. G. BORCHERS 3,169,694

PROPELLER FANS AND THE LIKE

Filed April 8, 1963

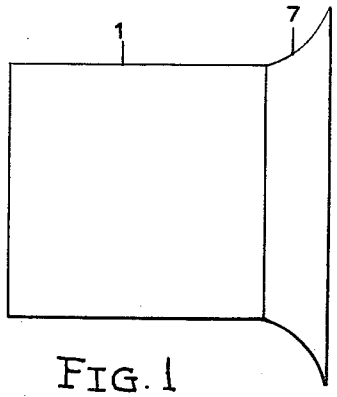


FIG. 1

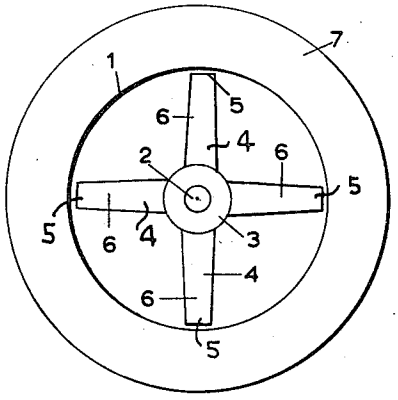


FIG. 2

FIG. 3

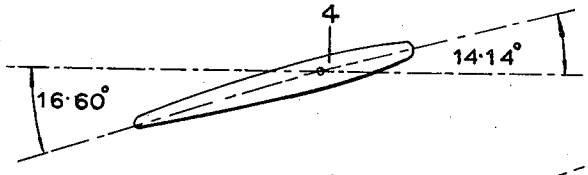


FIG. 4

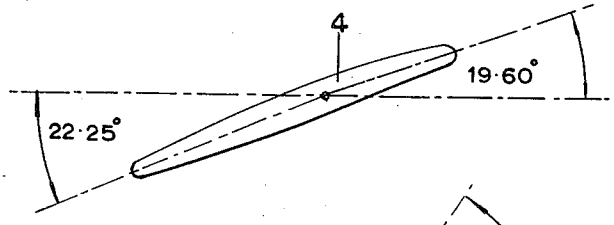
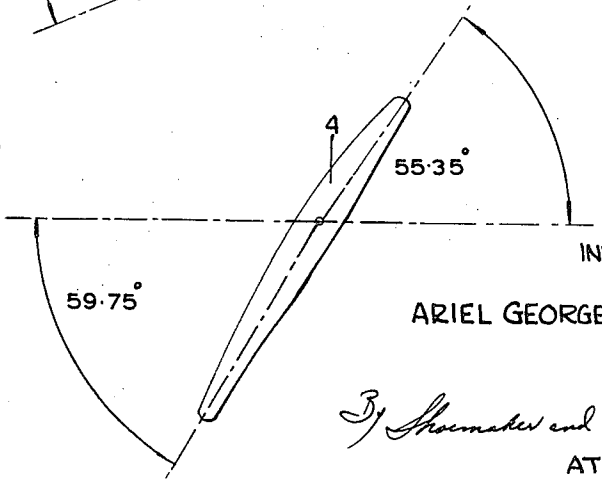


FIG. 5



INVENTOR

ARIEL GEORGE BORCHERS

By Shoemaker and Mattare

ATTORNEYS

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3,169,694

PROPELLER FANS AND THE LIKE

Ariel George Borchers, 10 4th Ave., Lambton, Germiston, Transvaal, Republic of South Africa

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This invention relates to propellers for the movement of fluids and more particularly to the control of the vortex produced in the fluid during its propulsion.

The fluid discharged by a propeller necessarily has been given rotation, which rotation is, practically, the only way that the total energy can be put into the fluid and often much of such rotational energy is wasted.

This invention is concerned with the moving of a fluid to obtain a force reaction for the propulsion of, for instance, aircraft or ships or for the movement of air for ventilation.

The object of the invention is to improve the propulsion of a fluid by an axial flow fan or screw propeller so that the power required for discharge into the ambient fluid is much reduced compared with the ordinary requirements of similar propellers.

In accordance with this invention a propeller for fluids running at a definite speed, has its blades so shaped that the centrifugal force generated at the periphery of the vortex will provide a radial pressure equal approximately the static pressure of the ambient fluid at the outlet of the propeller.

For convenience in describing the invention air will be the fluid considered and referred to, but it will be understood that the invention also applies to liquids.

The invention provides that an encased propeller air fan when running at a definite speed shall have its blades proportioned and shaped for the created vortex to be projected with a centrifugal force at its periphery approximately equal to the static force of the ambient air.

The invention further provides that a propeller fan blade is set to produce on rotation, a vortex having a velocity to cause a radial pressure rise by centrifugal force at the design point equal to half the static pressure existing at the entrance to the rotational area of the fan and the static pressure of the ambient air at the exit.

If, for the purpose of understanding the advantages of this invention, it is assumed that diffuser vanes are fitted to straighten out the vortex from the fan then the radial pressure gradient due to centrifugal force would not exist. The static pressure rise required from the fan would at least have to be equal to the full static pressure difference between the pressure condition immediately at the rotational area of the fan and the pressure of the ambient air. In a fan constructed and run according to this invention the energy of the fan is used to move the maximum quantity of air through the fan in any particular time.

It should be mentioned that experiments leading up to this invention indicate that the generally used formulas for work done on the air do not apply, since these will show an efficiency exceeding one hundred per cent if the fan has a high vortex generating efficiency.

In the drawing:

FIGURE 1 is an elevational view of the casing and the bell mouth inlet thereof of the present invention,

FIGURE 2 is an end view of the structure shown in FIGURE 1 illustrating the propeller within the casing,

FIGURE 3 is a cross section of one of the blades of the propeller at the tip portion thereof,

FIGURE 4 is a cross section of one of the blades of the propeller at the design point thereof,

FIGURE 5 is a cross section of one of the blades of the propeller at the hub thereof.

Referring now to the drawings wherein like reference characters designate corresponding parts throughout several views, the casing 1 is provided for enclosing the propeller and is provided with a bell mouth 7 at the inlet of the casing. The propeller is provided with a driving shaft 2, a hub 3 and four blades 4. The tips of the blades are indicated by reference numerals 5, and the design point of each of the blades is indicated by reference numeral 6.

As can be clearly seen from FIG. 2, the blades 5 define a circular disc of rotation within the enclosure 1. This enclosure has a cylindrical inner surface as can be clearly seen in the same figure.

As an example of this invention a propeller fan with four blades rotates in the throat of a bell mouthed inlet at 2890 r.p.m. The diameter of the fan at its tip is 23 inches and of its hub 4 inches. The design point of the blades is at 8.13 inches radius. The air stream velocity through the fan is 73 f.p.s. which causes a water gauge static pressure drop of 1 inch. That is there is a drop in static pressure at the entrance to the fan from ambient air pressure of 1 inch water gauge. This would require a radial pressure rise by centrifugal force in the vortex of ½ inch water gauge necessitating a rotational velocity at the design point of the fan of 31.75 ft. per second allowance being made for frictional losses. To obtain these conditions the inlet angle at the blade tip is 14.14° as seen in FIGURE 3, at the design point 19.6° as seen in FIGURE 4 and at the hub 55.35° as seen in FIGURE 5. The outlet angles of the blades are 16.6° at the tip as seen in FIGURE 3, at the design point 22.25° as seen in FIGURE 4 and at the hub 59.75° as seen in FIGURE 5. The estimated output volume of the fan is 12,000 c.f.m. and the power absorbed 1½ H.P. On test the result was within 5% of this estimate.

The essential curves of the blades and the proportions required cannot be depicted since these will vary with the duties required at a given speed.

The fan according to this invention is made to produce a controlled vortex with a predetermined angular velocity which is projected from the fan as a rotating stream in diameter substantially equal to the diameter of the fan.

What I claim as new and desire to secure by Letters Patent is:

1. A propeller for air including a casing having a bell mouthed inlet portion and including an outlet portion and having a throat portion, a propeller mounted for rotation within said throat portion and including a plurality of blades, each of said blades including a tip portion, a design point disposed inwardly of the tip portion, and each of said blades having a hub portion, a hub mounting each of said blades, and a driving shaft connected with said hub for rotating the blades, the inlet angle at the tip portion of each of said blades being approximately 14.14 degrees, the inlet angle at the design point of each of said blades being approximately 19.6°, and the inlet angle at the hub portion of each of said blades being approximately 55.35°, and the outlet angle of each of the blades being approximately 16.6° at the tip portion of the blades, the outlet angle of each of the blades at the design point being approximately 22.25°, and the outlet angle of each of the blades at the hub portion being approximately 59.75°.

2. An apparatus for moving fluid comprising an enclosure havin a substantially cylindrical inner surface and having inlet and outlet ends, a screw propeller means within said enclosure having a plurality of blades defining a disc of rotation, means for driving said propeller at a predetermined speed, the blades having surface means thereon which on rotation of said blades at said pre-

determined speed provide a free vortex stream outwardly of said outlet end of said enclosure having a diameter substantially equal to the diameter of the disc of rotation, said vortex stream generating a centrifugal force at its periphery which provides that the radial pressure of the discharged fluid will equal approximately the static pressure of the ambient fluid into which the fluid moved by the apparatus is discharged.

References Cited by the Examiner

UNITED STATES PATENTS

1,887,417	11/32	Mawson	230—120
1,892,303	12/32	Hagen	230—120
2,027,647	1/36	Montgomery	230—120
2,084,111	6/37	Schicht	230—120
2,611,533	9/52	Herrman et al.	230—133

JOSEPH H. BRANSON, JR., *Primary Examiner.*