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H. NISHI

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ARRANGEMENT FOR STARTING FLIGHT REQUIRING NO GLIDING

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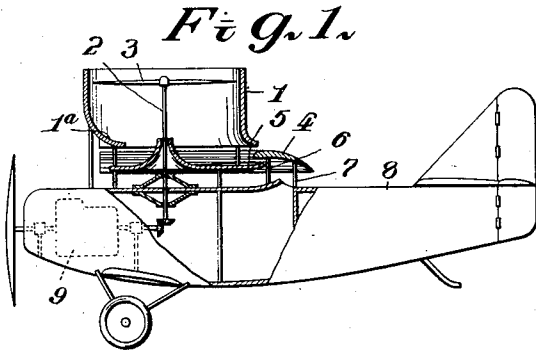


Fig. 2

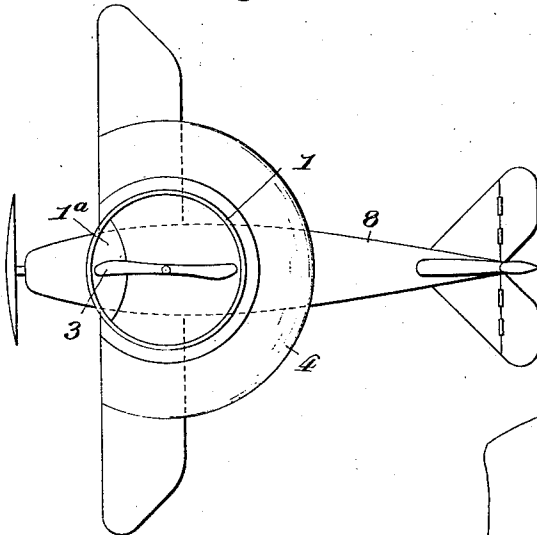


Fig. 5

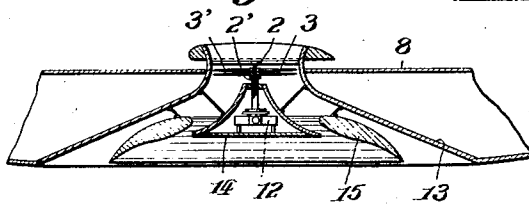
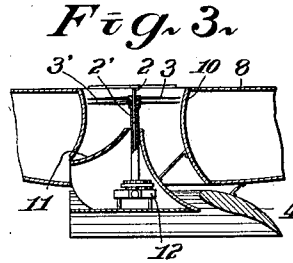


Fig. 4

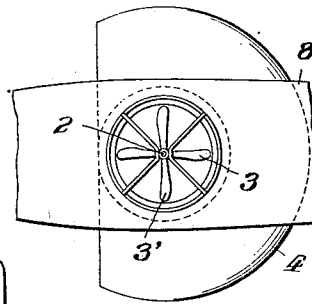
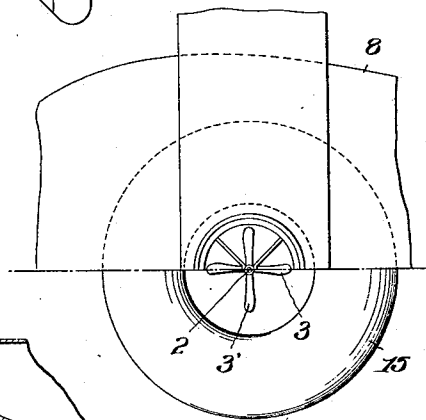


Fig. 6



H. Nishi INVENTOR.

BY: Marks & Clark

ATTORNEYS.

UNITED STATES PATENT OFFICE

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ARRANGEMENT FOR STARTING FLIGHT
REQUIRING NO GLIDINGHirohisa Nishi, Kimiidera-Mura, Kalso-Gun,
Wakayama-Ken, JapanApplication June 8, 1933, Serial No. 674,953
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3 Claims. (Cl. 244—18)

This invention relates in general to flying machines, or aeroplanes and more particularly to arrangements for the starting flight requiring no gliding, such as a lifting arrangement of helicopters, and the object is to provide in an aeroplane an efficient lifting arrangement in vertical direction by a simple construction.

In the accompanying drawing:—

Fig. 1 is a diagrammatic side view of a flying machine, or aeroplane, wherein this arrangement is installed, partly in section.

Fig. 2 is a plan view thereof.

Fig. 3 is a fragmental diagrammatic sectional view, showing the modified form of the arrangement.

Fig. 4 is a plan view thereof.

Fig. 5 is a fragmental diagrammatic sectional view, showing another modified form of the arrangement.

Fig. 6 is a plan view thereof.

Referring to Figs. 1 and 2, 1 represents a cylindrical air duct suitably mounted on the body 8 of a flying machine, or an aeroplane in its center of gravity, the lower end of which is flared and is provided with a rearward turned member 1^a at the front as illustrated in the drawing so as to cause air current created by the horizontal propeller 3 secured on a vertical shaft 2, when rotated, to flow in such direction as to strike against the leading edge comprising the inner edge of the wing 4 which is to be described later. Below the air duct and spaced suitably therefrom, a screen plate 5 is securely mounted on the body of the machine to permit the vertical shaft 2 to be rotated freely, which is of such curved-shape as illustrated in the drawing, and is of such size as to extend its peripheral edge outwardly beyond the lower edge of the air duct. The cylindrical duct 1 and the screen plate 5 are arranged at the forward part of the body of the aeroplane so as to co-operate to cause the air current created by the propeller 3 to flow mainly towards the leading edge of the wing 4.

The wing 4 is formed so as to have substantially in general outline the shape of the crescent, or a ring partly cut off at the forward part as clearly seen in Fig. 2 to avoid the air resistance on the forward part of the trailing edge of the wing, upon the forward flight of the flying machine. The wing 4 is secured to the body of the flying machine at an angle of about 15 degrees to the air current and having its leading edge in the midway of the gap between the air duct 1 and the screen plate 5 by means of stanchions 6 and 7.

In operation, when the horizontal propeller 3 which is supported by a vertical shaft is rotated by a motor 9, an air current is created downwards. The air current will flow to strike against the leading edge of the wing 4 because of the form and arrangement of the air duct 1 and the screen plate 5, and then the air current will be divided into two parts flowing along two surfaces of the wing. In this event, the airflow produces a negative pressure on the upper surface of the wing 4 and a positive pressure on the lower surface of the wing, as the shape of the wing is so constructed, so that these pressures will give the wing a lifting force to cause the machine to be lifted, in vertical direction, with the co-operation of the reaction of the propeller 3.

Figs. 3 and 4 illustrate a modification of the arrangement, in which the cylindrical air duct is indicated by a numeral 10, and is somewhat modified in form as shown therein, and attached to the body 8 of the flying machine, or aeroplane enclosed in the body of the flying machine. The screen plate is indicated by a numeral 11, and is modified so as to form a flared screen and substantially arranged in the air duct as shown. The wing 4 is arranged below the body of the flying machine so as to locate the leading edge of the wing in the midway of the gap between the lower ends of the air duct and the flared screen for the same purpose as the arrangement as shown in Figs. 1 and 2 and described. An additional horizontal propeller 3' is provided beside the propeller 3. One of these propellers is of a right-handed screw, while the other one is a left-handed screw. The propellers 3 and 3' are secured on the vertical shaft 2 and another tubular shaft 2' encircling the shaft 2 respectively preferably in a closely superposed relation. The shaft 2 and the tubular shaft 2' are arranged to be driven in opposite directions by a motor 12 provided for that purpose through the medium of suitable gearings particulars of which are omitted. The driving arrangement for the shafts may be made in any desired manner, and may be easily made by those skilled in the art, and the further description is omitted.

In operation, when the propellers 3 and 3' are driven in opposite directions, air current is created downwards to strike against the leading edge of the wing 4 and to be divided into two parts flowing along the upper and lower surfaces of the wing. The airflow on the upper surface of the wing produces a negative pressure on that side of the wing, while another airflow on the lower surface of the wing produces a positive pressure on

that surface of the wing, so that the flying machine may be lifted because of the combined force of these pressures with the cooperation of the reaction of the propellers.

- 5 In the modification, the air resistance on the air duct protruded from the body of the flying machine upon the forward flight is dispensed with, and as the propellers 3 and 3' are driven in opposite directions, the reactions due to their rotation are counterbalanced, so that the tendency of causing the body of the machine to be inclined and to be distorted may be avoided. Further, the power required to drive both propellers 3 and 3' is nearly equal to that required to drive a propeller in the arrangement shown in Figs. 1 and 2, because of the propellers being arranged in closely superposed relation, while air current created by the two propellers is about fifty per cent more than that created by one propeller.
- 20 Figs. 5 and 6 illustrate another modification of the arrangement, in which the cylindrical air duct is modified so as to be largely flared at the lower part and indicated by a numeral 13. The flared screen is substantially conical shaped and is indicated by a numeral 14 and located in the air duct. The wing is modified so as to have the shape of a complete ring, instead of the shape of the crescent, or a ring partly cut off in the forward part, and is indicated by a numeral 15 and arranged in the air duct, at the lower part of the screen, so as to cause the air current created by the propellers 3 and 3' to flow between the inside wall of the air duct 13 and the outside wall of the screen to strike against the leading, or inner edge of the wing and thence along the upper and lower surfaces of the wing.
- The operation will not need to be described, as it will be understood from the foregoing descriptions.
- 40 In this modification, a greater lifting force is obtained owing to the wing having the shape of a ring in general outline, and the air resistance on the wing upon a forward flight is dispensed with owing to the wing being located within the body of the machine instead of being located out of the
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body, so that total air resistance on the machine upon the forward flight is remarkably decreased.

Having now particularly described and ascertained the nature of this invention and in what manner the same is to be performed, I claim:—

1. An arrangement for starting flight requiring no gliding, comprising a propeller supported by a vertical shaft adapted to be driven by a motor, an annular wing, a cylindrical air duct encircling the propeller and a screen plate, which are formed and arranged so as to cause air currents created by the propeller to flow to strike against the leading edge of the wing, whereby the air current may be divided into two parts to flow on the upper and lower surfaces of the wing.

2. An arrangement for starting flight requiring no gliding, comprising a substantially cylindrical air duct arranged in the body of a flying machine, two propellers supported by vertical shafts in closely superposed relation and to be driven in opposite directions in the air duct by a motor, a flared screen arranged in the air duct and an annular wing, in which the air duct and the screen are formed and arranged to cause the air current created by the propellers to flow to strike against the leading edge of the wing, whereby the air current may be divided into two parts to flow on the upper and lower surfaces of the wing.

3. An arrangement for starting flight requiring no gliding, comprising a substantially cylindrical air duct with a flared lower part and arranged in the body of a flying machine, two propellers supported by vertical shafts in closely superposed relation and to be driven in opposite directions in the air duct by a motor, a flared screen of substantially conical shape arranged in the air duct and a wing having the shape of a ring and arranged in the air duct, surrounding the lower part of the screen, so as to cause the air current created by the propellers to flow between the inside wall of the air duct and the outside wall of the screen to strike against the leading edge of the wing, and thence on the upper and lower surfaces of the wing.

HIROHISA NISHI. 45