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(54) Propeller for toy aircraft.

(57) A propeller for use in a toy aircraft has a hub (2) for being fixed to the output shaft of a driving electric motor, and three blades (3) fixed to the hub (2) at equal intervals. Each blade (3) has a curved leading edge and a curved trailing edge of a curvature smaller than that of leading edge. Each blade (3) is fixed to the hub (2) and twisted at a blade angle of about 45° to 55° with respect to the axis of the hub (2).

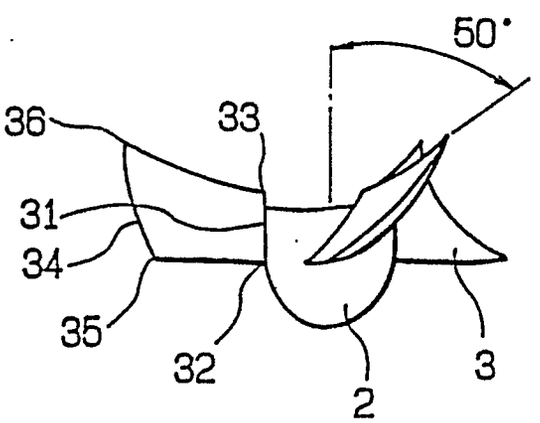

FIG. 1

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BACKGROUND OF THE INVENTION

The present invention relates to a propeller for a toy aircraft. More particularly it relates to a propeller for producing a thrust on a toy aircraft.

Figs. 8 to 13 and Figs. 14 to 19 show known propellers 5 and 6 respectively which are provided with hubs 51, 61 for being fixed to motor shafts (not shown) and having four to five fan blades 52, 62 fixed to the hubs 51, 61 at blade angles of about 60° to 70° with respect to the axes 55, 65 of the hubs 51, 61. The leading and trailing edges 53, 63 and 54, 64 of the blades are straight.

These known propellers having a large number of blades cause a problem that they cannot be driven at high speed by using electric motor because the power of electric motor is not so strong as to resist the power of the air. In addition these propellers tend to stir the air in vain, rather than catch the air, thus failing to produce the required thrust.

Figs. 20 to 23 show another known propeller 7. In this propeller, the trailing edge 74 of the blade 72 is coplanar with the rear end of the hub 71. In this propellr, since the surface area of each blade is comparatively small, the blade cannot catch the air sufficiently and as the result, the thrust is decreased unintentionally. Furthermore, since the trailing edge 74 of the blade 72 are coplanar with the rear end of the hub 71, it is impossible to obtain a large sweepback to prevent stall of the propeller during the flight of the toy aircraft.

SUMMARY AND OBJECT OF THE INVENTION

An object of the present invention is to provide a propeller for toy aircraft which can be driven at high speed using an electric motor. Another object of the present invention is to provide a propeller for toy aircraft which can generate sufficient thrust to fly the toy aircraft.

To attain the above objects, the present invention is comprising;

(a) a hub being fixed to the output shaft of a driving electric motor, and at least three blades fixed to the hub at equal angular intervals;

(b) each bale having a curved leading edge interconnects the leading end of the base end edge at which the blade is fixed to the hub and leading end of the free end edge opposite to the base end edge.

(c) each blade having a curved trailing edge interconnects the trailing end of the base end edge and the trailing end of the free end edge, the curvature of which is smaller than that of leading edge; and

(d) each blade is fixed to the hub and twisted at a blade angle of about 45° to 55° with respect to the axis of the hub.

The propeller for a toy aircraft in accordance with the present invention, having at least three blades which rotate with a reduced resistance of the air so that the driving power of the motor can be transmitted efficiently. Furthermore, since the leading edge of the blade is curved, the fan rotates smoothly in a manner to "cut" the air, thereby further reducing the resistance produced by the air. In addition, the blades secured to the hub and twisted at an angle of about 45° to 55° with respect to the axis of the hub make it possible to have wider blades to catch the air sufficiently, thus generating a thrust large enough to propel the toy aircraft even though the number of the blades is reduced to three. Furthermore, since the trailing edge of the blade has a smaller curvature than the leading edge thereof, it is possible to obtain a large sweepback of the blade sufficient to suppress any tendency of stall of the fan during flight of the aircraft.

BRIEF DESCRIPTION IF THE DRAWINGS

Figs. 1 to 6 are illustrations of an embodiment of the propeller in accordance with the present invention;

Fig. 7 is a side elevational view of a toy aircraft incorporating an embodiment of the present invention; and

Figs. 8 to 23 are illustrations of known arts.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to Figs. 2, 3, 4 and 7, a propeller of the present invention for use in a toy aircraft is denoted by 1. The propeller 1 has a hub 2 and three blades 3. The hub 2 has a generally U-shaped cross section which has a open end. An electric motor shaft receiving portion 22 is constructed in the hub 2 for receiving the shaft of a drive motor 43 is formed. The three blades are fixed to the outer peripheral surface of the hub 2 at equal intervals. Each blade 3 is shaped so as to spread or increase in width from the base end 31 towards the free end 34. The line constituting leading edge 38 of the blade which interconnects the leading end 32 of the base end edge 31 and the leading end 35 of the free end edge 34 of the blade 35 is curved. The line constituting trailing edge 39 of the blade which interconnects the rear end 33 of the base end edge 31 and the rear end 36 of the free end edge 34 of the blade is also curved. The curvature of the leading edge 38 is larger than that of the trailing edge 39. Consequently, the width of the blade is greater at the free end edge 34 than the base end edge 31 so that a

sweepback is formed at the trailing end of the free end edge 34. Each blade 3 is fixed to the hub 2 and twisted at a blade angle of about 50° with respect to the axis of the hub.

The propeller 1 having the construction described above is attached to the output shaft 44 of a driving electric motor 43 which motor is fixed by means of stays 42 in a tubular body 41 of a toy aircraft.

In operation, since the number of the blade is reduced to three, the propeller of this embodiment encounters reduced air resistance so that the driving power of the motor 4 can effectively be transmitted at minimus loss. Furthermore, since the leading edge 38 of each blade is curved, the propeller 1 rotates smoothly in a manner to "cut" the air, whereby the resistance of air is further reduced. In addition, since the blades 3 are secured to the hub 2 and twisted at a blade angle of about 50° with respect to the axis of the hub, it is possible to make the surface of the blade 3 larger so that air is caught at a large rate to generate a large thrust.

The propeller 1 of this embodiment, as well as the known propellers denoted by 5, 6 and 7 mentioned before in connection with Figs. 8 to 13, 14 to 19 and 20 to 23, were tested by using a electric motor driven by a power supplied from a 2.4V D.C. battery. The known 4-blade propeller 5 produced a thrust of 19.1g, while the known 5-blade propeller 6 produced a thrust of 18.75g. The known propeller 7 showed only a very small thrust of 11.3g. Meanwhile, described embodiment of the propeller of the present invention showed a much greater thrust of 21.10g.

In conventional propeller for toy aircraft driven by internal combustion engines, thrust increases in proportion to the number of the blades regardless of the resistance of the air. When an electric motor is used as the driving power source, since the power of the electric motor is comparatively weak, the resistance produced by the air cannot be negligible and thrust decreases substantially in propotion to the number of blades.

However, the propeller of the present invention for use in toy aircraft encounters a reduced resistance produced by air because the number of the blades is reduced to three. In addition, since each blade has a wider surface, each blade can catch larger amount of air than that of known propellers. For these reasons, the propeller of the present invention can produce much greater thrust than known propellers. Furthermore, since the angle of the blades to the boss 2 is larger than that of known propeller, the blades themselves do not resist against the inflow of the air. Rather the inflow of the air accelerates the rotation of the three blades 3. Furthermore, the sweepback formed on the trailing end 36 of the blade 3 effectively prevents stall of the propeller assisted by inflow of the air.

Thus, the present invention offers a propeller suitable for use in a toy aircraft and operates with an improved thrusting efficiency.

Claims

1. A propeller for toy aircraft, comprising:

   a hub for being fixed to the output shaft of a driving electric motor and three blades fixed to the hub at equal angular intervals, said hub having an axis about which said propeller rotates;

   each blade having a curved leading edge, a curved trailing edge, a free end and a base end fixed to said hub, the curvature of said trailing edge being less than the curvature of said leading edge to provide said blade with a width that increases from the base end towards the free end;

   each blade being twisted at a blade angle of about 45° to 55° with respect to said axis.

2. A propeller for toy aircraft according to claim 1, wherein a sweepback is formed at the trailing end of the free end edge.

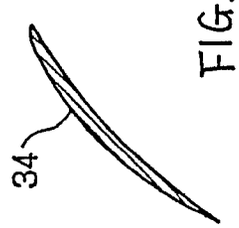

FIG. 6

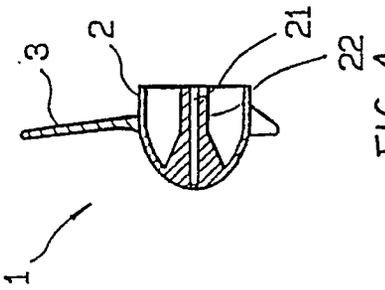

FIG. 4

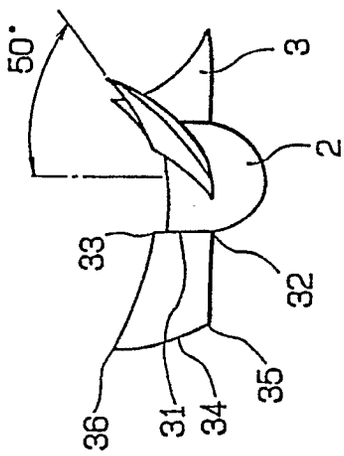

FIG. 1

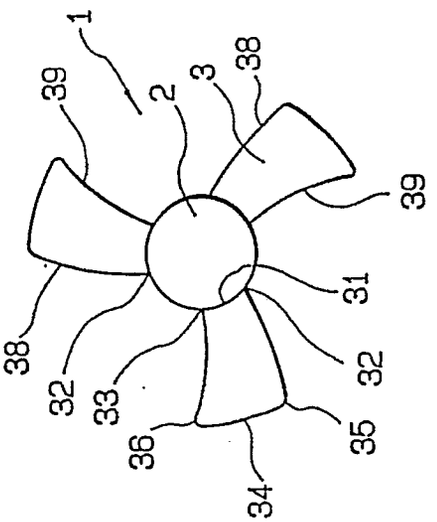

FIG. 3

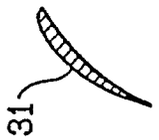

FIG. 5

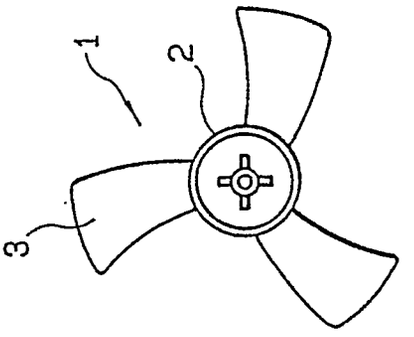

FIG. 2

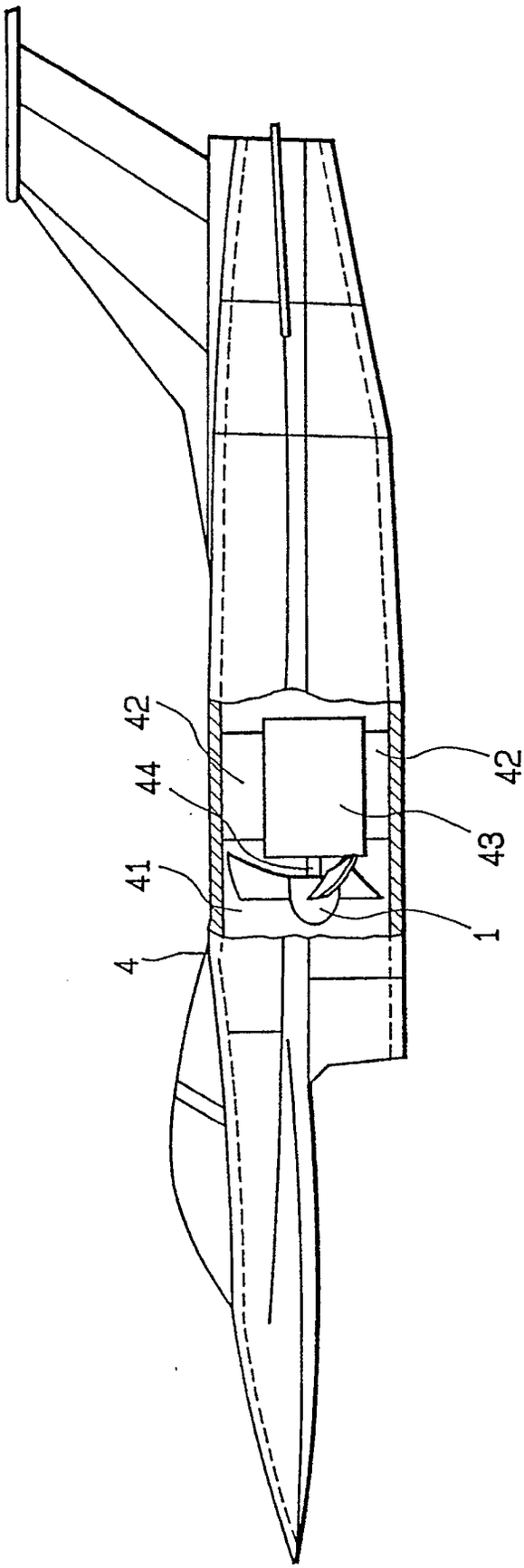

FIG. 7

FIG. 19

FIG. 17

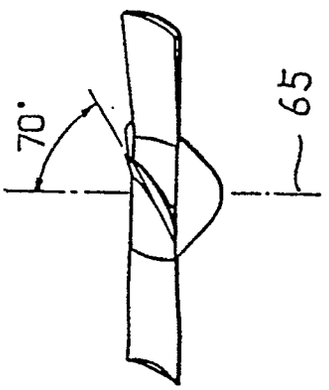

FIG. 14

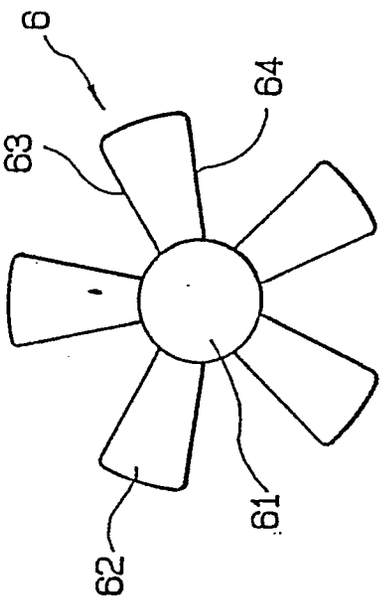

FIG. 16

FIG. 18

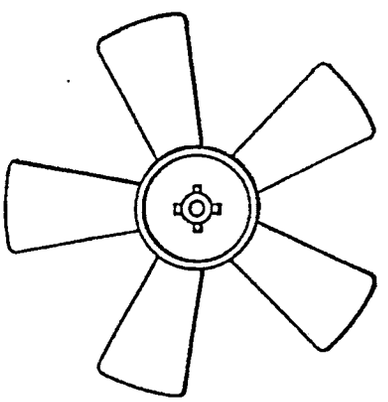

FIG. 15

FIG. 13

FIG. 11

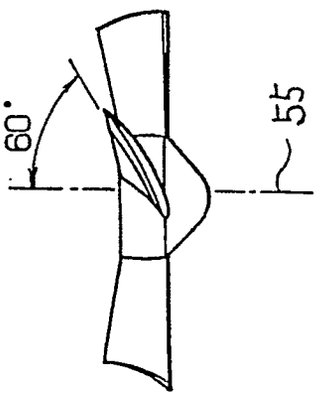

FIG. 8

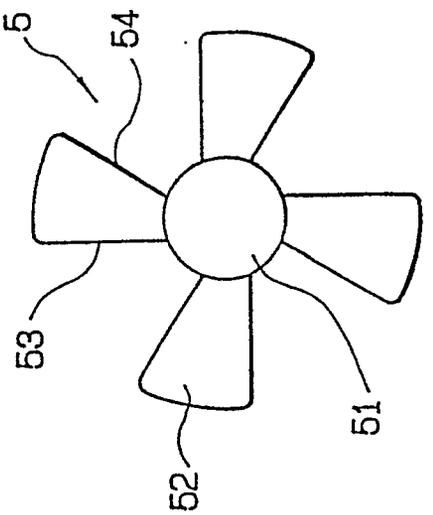

FIG. 10

FIG. 12

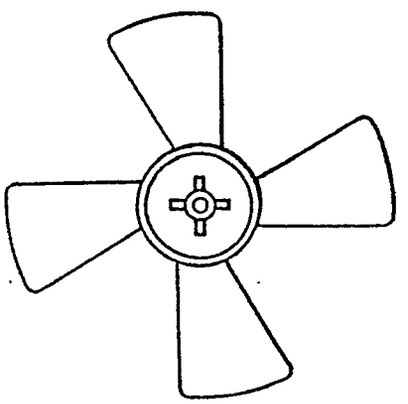

FIG. 9

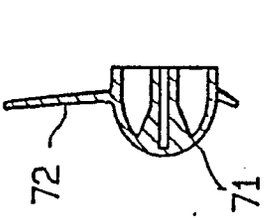

FIG. 23

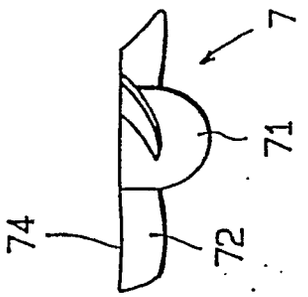

FIG. 20

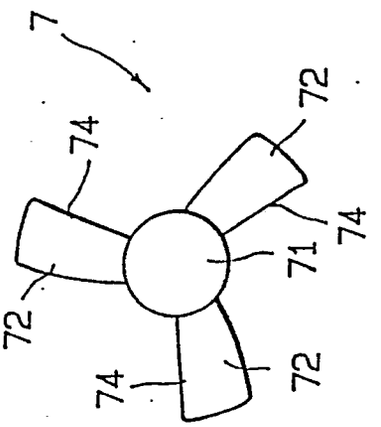

FIG. 22

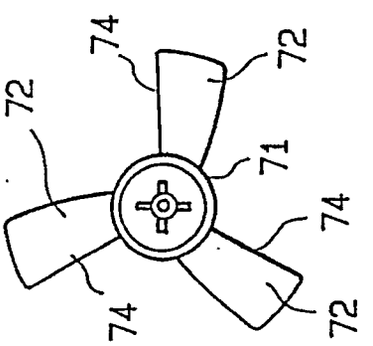

FIG. 21

European Patent Office

EUROPEAN SEARCH REPORT

Application Number EP 90118333.5

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US - A - 2 689 617 (BOULEY) * Fig. 1 * --	1	A 63 H 27/30
A	US - A - 2 563 020 (GEMEINHARDT) * Fig. 1 * --	1	
A	US - A - 2 535 527 (BARKLEY) * Fig. 2 * --	1	
A	US - A - 3 796 005 (CHANG et al.) * Column 2, lines 32-35; fig. 4 * ----	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

A 63 H 27/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	13-12-1990	WEISS

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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