Aug. 7, 1934.

J. TOTH

1,968,918

AIR PROPELLER

Filed June 15, 1932

FIG. 1.

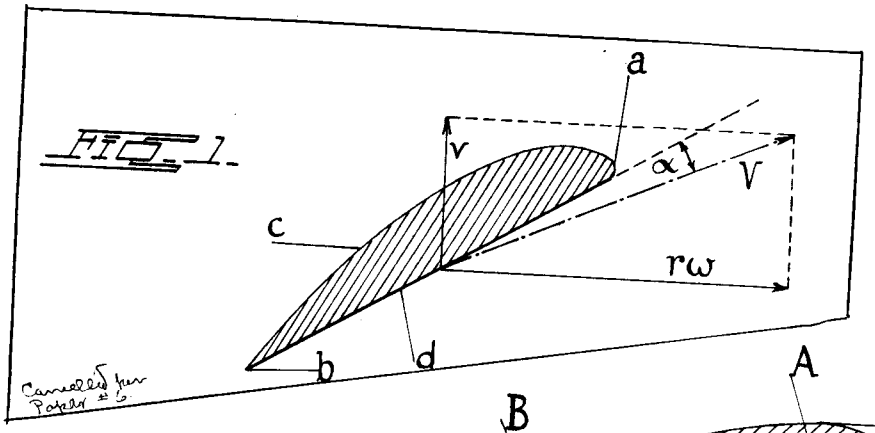


FIG. 1.

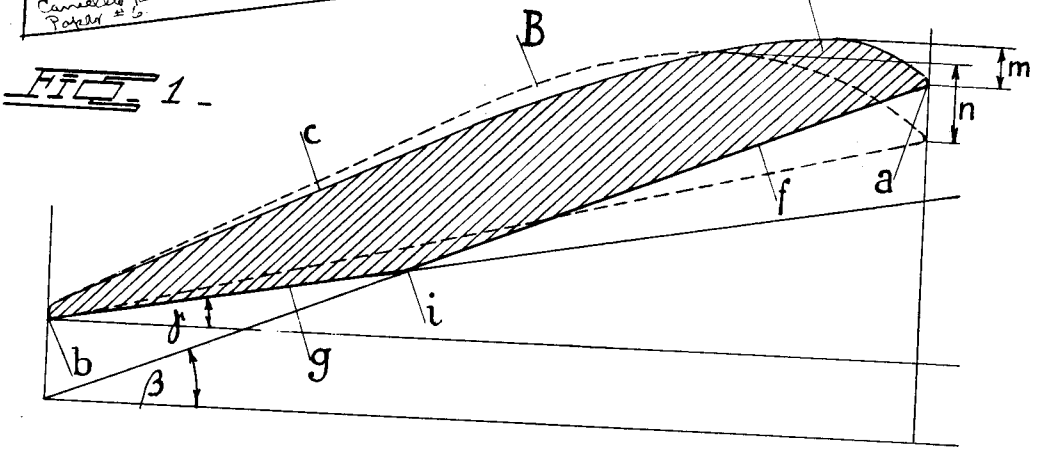
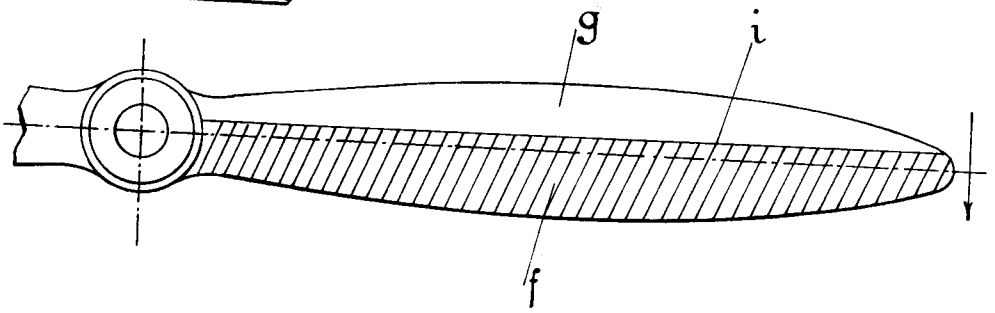


FIG. 2.



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AIR PROPELLER

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In Hungary December 31, 1930

5 Claims. (Cl. 170—159)

This invention relates to screw propellers of the kind in which the rear or suction faces of the blades are curved in known manner, and has for its object to provide a propeller, more particularly for use with aircraft, of equally good efficiency both during horizontal flying and when climbing.

The cross-section of the blade of an air propeller of the type usually employed on airplanes generally possesses a well known shape with a contour line consisting of a curve and a straight line, respectively. The curve between the leading edge and the trailing edge is the directrix of the surface forming the suction side of the propeller blade whilst the straight line is the directrix of the surface forming the pressure side of the propeller blade.

In air propellers it has been found to be a general rule, that if the starting angle of the individual blades is increased or diminished, it is possible to ensure that the output of the engine is employed for increasing the flying speed, for instance when flying at the same level, or of developing an increased tractive effort as, for example, when ascending.

I am aware that it is already known to form one side of a propeller blade with faces disposed in different transverse planes. For example, it has hitherto been known to construct a screw propeller for ships in which the rear or suction side of each blade is formed by two faces arranged at an angle to each other, that face adjacent the leading edge being concave whilst that adjacent the trailing edge is flat. In another form of screw propeller for ships hitherto suggested the forward or leading portion is slightly inclined inboard with relation to the major portion of the blade.

Experiments made with air propellers have led to the surprising result, that air propellers will develop an amount of performance exceeding all expectations, and also ensure a degree of quietness of running most favourable in view of increasing the life of the airplane, if, differently from the types of design known and usual up to now, the pressure surface of the propeller blade is, as shown on the embodiment shown by way of example on Fig. 1, made of two plane surfaces f and g, of which the surface f, the first in order of sequence when proceeding from the inlet edge to the outlet edge, forms with the direction of rotation an angle β, which is larger than the angle γ formed with the said direction of rotation by the second surface g.

Notably when, at the occasion of trial flights a propeller A having a cross-section according to the invention dimensioned for a certain output and number of revolutions per minute has repeatedly been compared with an ordinary propeller B as shown in dotted lines on Fig. 1 dimensioned for the same output and number of revolutions per minute, it was shown by reliable and accurate instruments that with a propeller A having a cross-section according to the present invention it is possible when flying at a level to attain a higher flying speed and when ascending to realize a larger tractive effort per horse power, than can be realized with the ordinary type B of propeller of usual cross-section.

The comparative controlling experiments for instance were carried out with a Fokker C. V. D. type airplane, fitted with a W. M. Jupiter 420 H. P. engine, with the ordinary propeller of the airplane, and with the propeller according to the present invention, immediately one after the other, in identical conditions, the two propellers being interchanged after each flight.

The barograph measuring the rising of the airplane, as well as the instruments measuring its speed, were officially attested instruments, the correct functioning of which was ascertained before, and after.

The controlling measurements showed the following, almost identical results:

Rising with full gas, at 120 km. speed per hour, and identical number of revolutions	With the original propeller	With the propeller according to the invention
a. From 100 m. to 1100 m.		
According to barograph	2'57" resp. 3'02"	2'28" resp. 2'30"
Re-calculated to sea-level air-pressure	3'23" resp. 3'30"	2'40" resp. 2'41"
b. From 100 m. to 2100 m.		
According to barograph	6'45" resp. 7'03"	4'54" resp. 5'03"
Re-calculated to sea-level air-pressure	7'18" resp. 7'45"	5'14" resp. 5'26"

Maximal speed with full gas pressed forward at 100 m. height-line, equals:

With original propeller: 196 km/hours.

With the propeller according to the invention: 214 km/hours.

I believe that the surprising success achieved may be ascribed to the fact that on that section of the pressure surface of propeller A which extends from the inlet or leading edge a to the outlet or trailing edge i the starting angle has been chosen so as to be larger than that of the ordinary propeller indicated at B, whilst the

starting angle of the part of the delivery surface which extends from edge *i* to outlet edge *b* has been chosen so as to be smaller than the starting angle of the propeller blade B. Now, it is known that by increasing the starting angle while output and number of revolutions per minute remain unchanged it is possible to increase the flying speed, whilst, by diminishing the starting angle, it is possible to increase the tractive effort per horse power.

In order to obtain the best possible performance from an airplane it would be advisable to fit two propellers of different type on it, one of which would serve for flying at the same level i. e. for attaining as high a flying speed as possible whilst the other propeller would be employed for ascending, i. e. for attaining a tractive effort of as great magnitude as possible. The air propeller according to the invention may be considered as representing the combination of two such different types of air propellers i. e. as representing an air propeller having two inlet edges *a*, *i* and one outlet edge *b*, whilst at the same time the starting angle of the first, for practical reasons, preferably narrow, part *f* of the pressure surface of the air propeller is made larger than that of the second, preferably also narrow, part *g* of the pressure surface of the air propeller.

From the embodiment shown in Fig. 1 it also appears that in the case of air propellers dimensioned for the same performance and number of revolutions per minute the frontal resistance of the propeller A according to the invention, which resistance is proportional to the length *m*, is lower than the frontal resistance of the ordinary type of propeller B, which is proportional to the length *n*.

Finally it should be mentioned that the dividing line *i* between the two parts *f* and *g* of different angle of the delivery surface should, as shown on Fig. 2, be chosen so as to make the surface *f* larger than the surface *g*.

Having described my invention and set forth its merits, what I claim and desire to secure by Letters Patent is:—

1. An airplane propeller for aircraft, having the pressure side of each blade which extends from the leading edge, formed at the intersection of a cross-sectional plane transversely through the same with two planes respectively disposed at an angle to each other, of which two planes that adjacent to the leading edge is disposed at a greater angle to the direction of rotation than that adjacent to the trailing edge, while the greater portion of the suction side of the propeller from the trailing edge transversely inward is practically parallel with the plane of the pressure side adjacent to the leading edge.

2. An airplane propeller according to claim 1, wherein the relative transverse widths of the two angular planes of the pressure side are different and the point of intersection of the two planes is spaced from the leading edge a sufficient distance to make the plane adjacent to said leading edge greater throughout its entire length than the plane adjacent to the trailing edge.

3. An airplane propeller according to claim 1, wherein the portion of the suction side of the propeller which is practically parallel with the plane of the pressure side adjacent to the leading edge, is gradually curved smoothly downward toward the leading edge to present a full curve, so that in cross section the blade has a substantial thickness and consequently great strength as well as superior aerodynamic properties.

4. A screw propeller for aircraft, having the pressure side of each blade which extends from the leading edge, formed at the intersection of a cross-sectional plane transversely through the same with two planes respectively disposed at an angle to each other, of which two planes that adjacent to the leading edge is disposed at a greater angle to the direction of rotation than that adjacent to the trailing edge, while the point of intersection of the two angular planes is spaced from the leading edge a sufficient distance to make the plane adjacent to said leading edge greater throughout its entire length than the plane adjacent to the trailing edge.

5. An airplane propeller according to claim 4, wherein the intersection of the two angular planes forms a substantially straight line throughout its entire length and is disposed substantially at right angles with the axis of the propeller shaft and is practically parallel with and spaced rearwardly from the individual longitudinal axis of the blade while the leading and trailing edges are curved convexly in opposite directions so that said intersecting angular planes are both widest at their intermediate portions.

JOSEPH TOTH.