July 19, 1932. C. H. GUNN 1,867,822

AIRPLANE PROPELLER

Filed Dec. 1, 1928

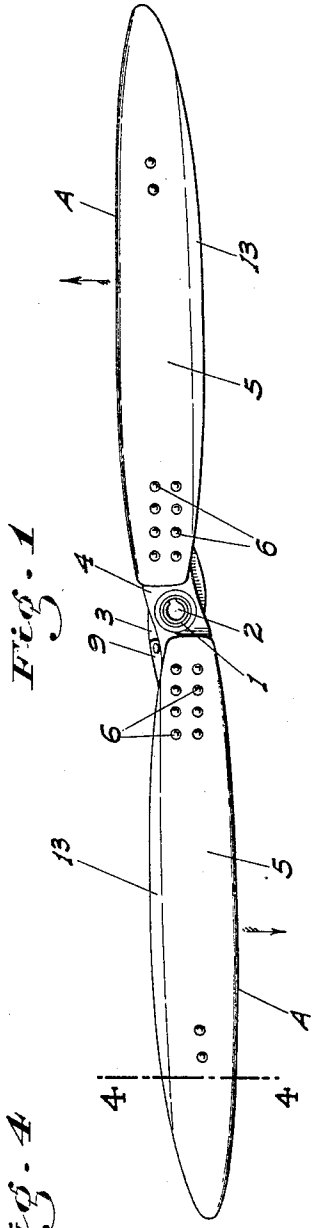


Fig. 1

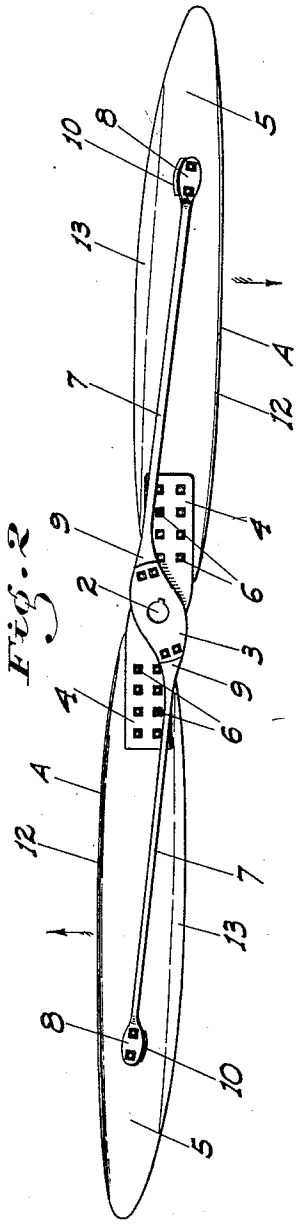


Fig. 2

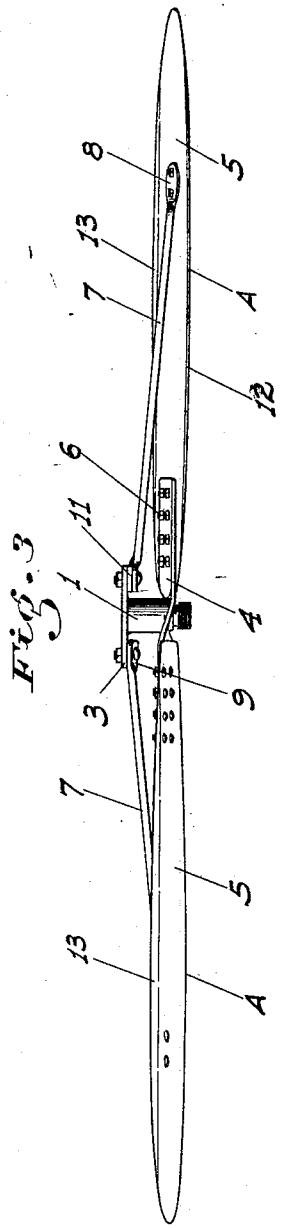


Fig. 3

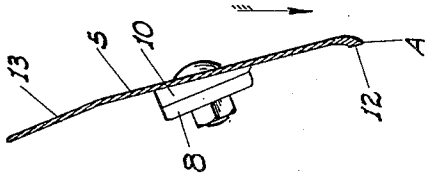


Fig. 4

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UNITED STATES PATENT OFFICE

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AIRPLANE PROPELLER

Application filed December 1, 1928. Serial No. 323,054.

This invention relates to propellers for airplanes and particularly represents improvements over the type of propeller shown in my co-pending application for patent Serial No. 213,280 filed August 16th, 1927.

The principal object of the present invention is to provide a propeller for the purpose which while of all metal construction and very strong, is still relatively light in weight; while the design of the blades themselves is such that the propeller is considerably more efficient than the usual form of blade as has been actually demonstrated by comparative tests.

A further object of the invention is to produce a simple and inexpensive device and yet one which will be exceedingly effective for the purpose for which it is designed.

These objects I accomplish by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawing similar characters of reference indicate corresponding parts in the several views:

Fig. 1 is a front elevation of my improved propeller.

Fig. 2 is a back elevation of the propeller.

Fig. 3 is a plan view of the same.

Fig. 4 is an enlarged cross section of a blade taken on the line 4—4 of Fig. 1.

Referring now more particularly to the characters of reference on the drawing the numeral 1 denotes the hub of the propeller, a metal member suitably bored and key-slotted as at 2 to receive the end of the drive shaft of the engine in the usual manner. Formed integral with the hub and projecting radially therefrom at one end are short opposed arms 3; said arms being flat and disposed with their flat faces in a common plane at right angles to the axis of the hub. From adjacent the opposite end of the hub other flat and longer arms 4 project in opposed relation to each other, said arms being set at opposed acute angles relative to the axis of the hub. The arms 4 are also disposed relative to the arms 3 so that corresponding arms are in circumferentially offset relation to each other as clearly shown in Fig. 2.

The propeller blades 5, of suitable size and peripheral contour are made of relatively thin metal of even thickness throughout, and are removably secured against the outer faces of the arms 4 by a number of bolts 6.

Brace rods 7 have pads 8 at one end bolted to the forward faces of the arms 3, and pads 9 on the other end to be bolted to the corresponding blades toward their outer ends. It will therefore be seen that the braces are disposed both at an acute angle to the back faces of the blades, as well as at an angle to the longitudinal plane of the blades, owing to the spacing of the arms lengthwise of the hub and the circumferentially offset arrangement of the arms 4 to which the blades are secured relative to the arms 3 to which the braces are secured. The blades are therefore rigidly held in two directions against possible deflection. To enable the tension between the blades and braces to be altered if desired, so as to twist the blades somewhat and stiffen the bracing action if necessary, I place wedge blocks 10 between the blades and the pads 8 of the braces, and similar but oppositely spaced blocks 11 between the pads 9 and the arms 3. These blocks are normally in place, and if removed and the parts again bolted together it will be evident that the blades will be placed under different torsional stresses than before, and the pitch of the blades intermediate their ends will also be altered somewhat owing to the difference in angular setting thus had between the pads of the braces and the parts they engage.

To further stiffen the blades and also to add to the efficiency thereof, the leading edge of each blade (which is substantially straight from end to end) is provided throughout its extent with a relatively small lip or flange 12 which is turned toward the back of the blade. The rear face of this lip is flat and parallel to the main face of the blade, and forms a sharp air cutting edge A with the curved outer surface of the blade along its leading edge.

The blade is also bent on a slight angle toward the back face thereof for practically its full length and some distance from the following edge to form a stiffening and air banking or deflecting flange 13 whose transverse

width is considerably greater than that of of the lip 12.

By reason of the cross sectional shape of the blades as well as the brace rod arrangement, it will be seen that the blades may be made quite thin and so will be relatively light, while having ample strength to resist distortion and buckling when in operation.

The main pitch of the blade, which is governed by the angle or pitch of the arms 4, is of course determined from the known speed of the engine in conjunction with the accepted mathematical formulæ, and the efficiency of the blades with such pitch is greatly enhanced by the peculiar cross sectional shape above described. The leading edge of each blade engages and cuts cleanly through the air at an angle to a vertical plane by reason of the sharp edge A; and this air passing by the flat surface of the flange or lip 12 will then rebound sharply against the back surface of the blade beyond the lip, which acts to provide a good frictional grip of the blade with the air and greatly increases its propulsive efficiency by lessening the slip. The backwardly angled flange 13, catching such air with the rotary advancing movement of the propeller has a tendency to bank this air and deflect the same rearwardly, also giving greater propulsive efficiency. Also this flange bending as it does away from the front face of the blade and consequently deflecting even further from a vertical plane than the main portion of the blade, offers practically no resistance to the air in front of the propeller and this feature also has its effect in increasing propeller efficiency.

As a result of this construction I have found from actual trials in the air that the efficiency of my blade over one of an ordinary type, used with the same engine and airplane, showed an increase of approximately 15%.

From the foregoing description it will be readily seen that I have produced such a device as substantially fulfills the objects of the invention as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention as defined by the appended claims.

Having thus described my invention what I claim as new and useful and desire to secure by Letters Patent is:

1. An airplane propeller comprising a hub, short diametrally opposed arms radiating from one end of the hub and rigid therewith, a pair of diametrally disposed arms projecting from the other end of the hub in circumferentially offset relation to the first arms and disposed at opposed acute angles relative to each other and to the axis of the hub, blades secured on and projecting from the last named arms, and tension braces between the adjacent faces of the first named arms and the blades toward their outer ends.

2. An airplane propeller comprising a hub, relatively thin blades projecting outwardly from one end of the hub at a predetermined pitch, brace rods secured to and projecting toward the adjacent faces of the blades from the opposite end of the hub, flat pads formed on the outer ends of the braces for flat abutting engagement with the adjacent faces of the blades, means to secure the pads and blades against each other, and wedge shaped elements placeable between the pads and blades with the temporary removal of the securing means whereby to increase the torsional stresses on the blades.

In testimony whereof I affix my signature.

CHARLES H. GUNN.