W. R. TURNBULL.

PROPELLER.

APPLICATION FILED MAR. 13, 1919.

1,427,178.

Patented Aug. 29, 1922.

2 SHEETS—SHEET 1.

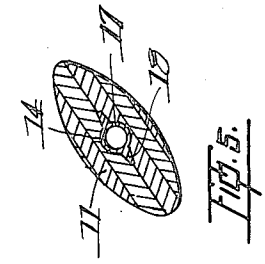


Fig. 5.

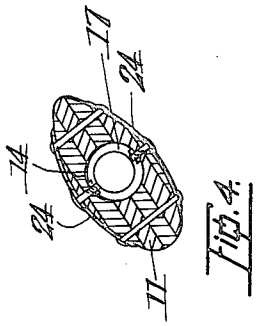


Fig. 4.

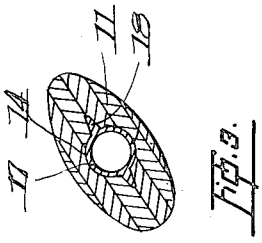


Fig. 3.

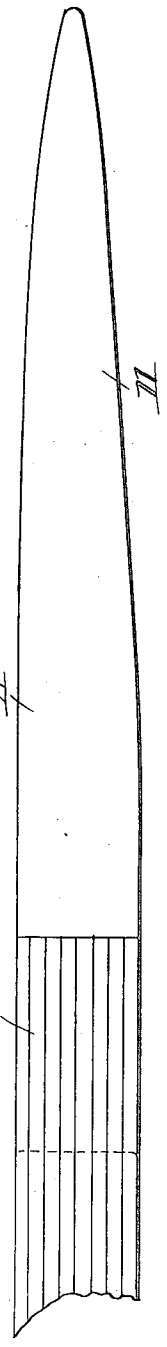


Fig. 2.

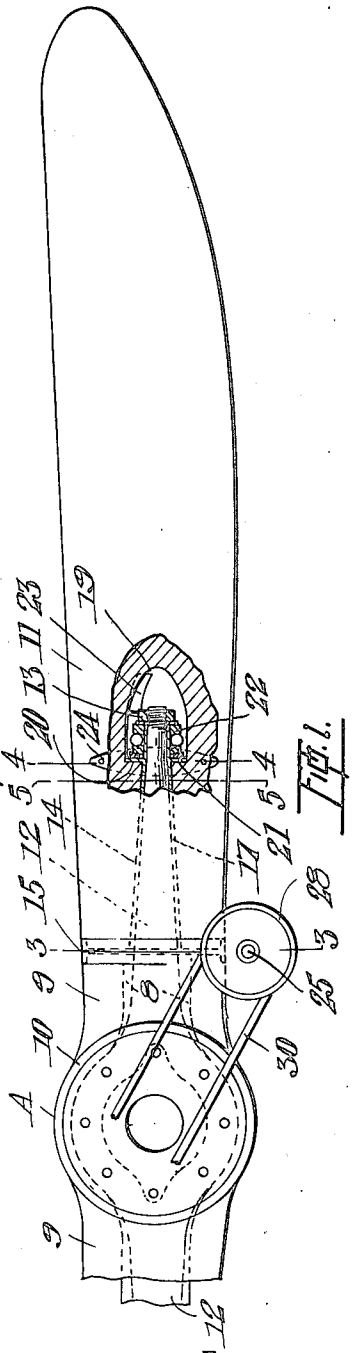


Fig. 1.

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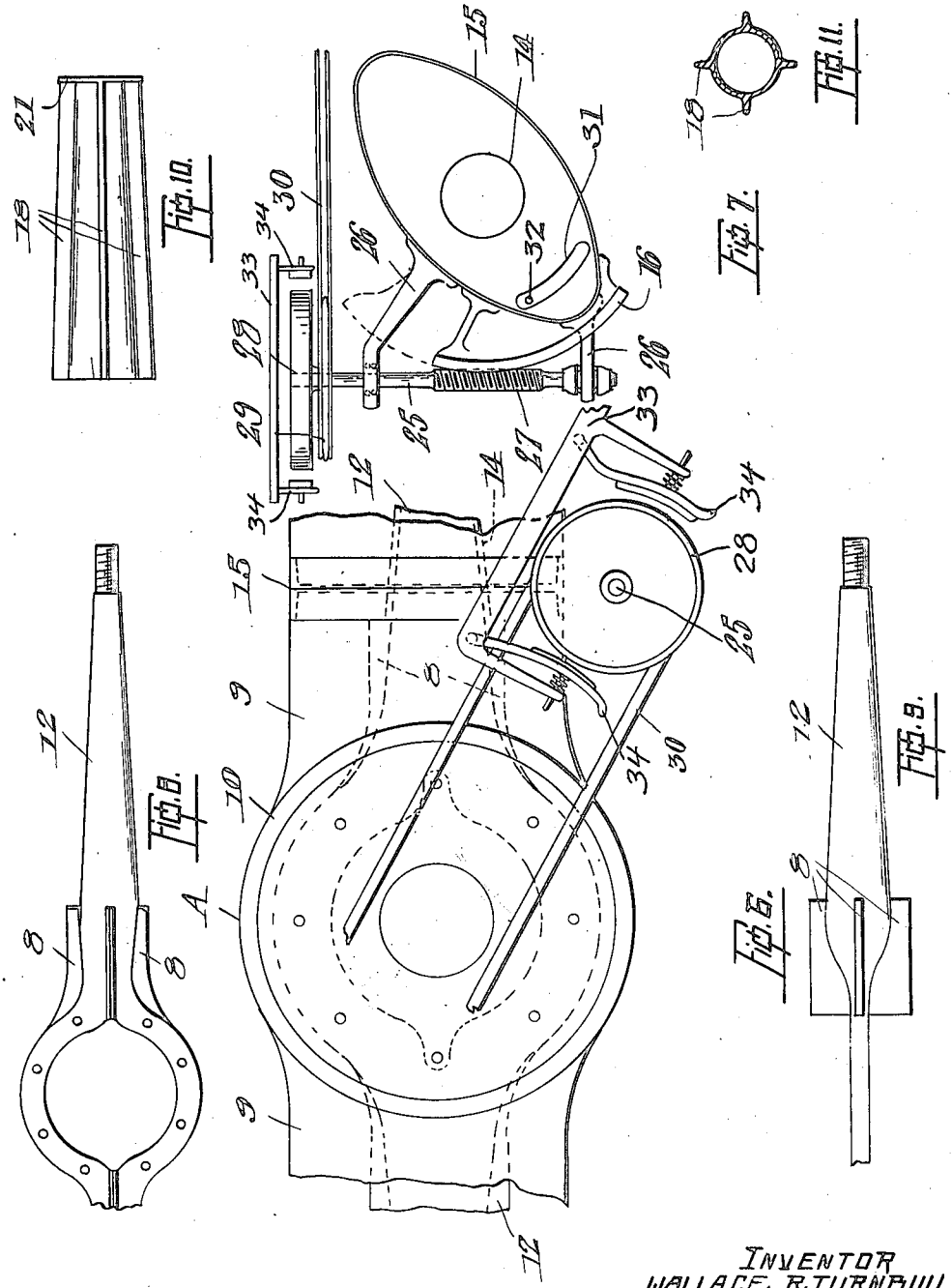
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UNITED STATES PATENT OFFICE.

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PROPELLER.

1,427,178. Specification of Letters Patent. Patented Aug. 29, 1922.

Application filed March 13, 1919. Serial No. 282,255.

To all whom it may concern:

Be it known that I, WALLACE RUPERT TURNBULL, a subject of the King of Great Britain, and resident of Rothesay, in the Province of New Brunswick, Dominion of Canada, have invented certain new and useful Improvements in Propellers, of which the following is a specification.

This invention relates to improvements in propellers adapted to use on air or other craft.

It is found that to obtain the greatest efficiency the pitch of the propeller blades requires to be adjusted according to the character of the flight being executed, for example the pitch is required to be different for climbing from what it is for flying straight ahead, and one of the objects of this invention is to facilitate varying the pitch of the blades during the operation of the propeller to suit the conditions of flying, and further by reversing the blades creating a braking effect which will enable a landing to be made in an extremely small area.

Further objects are to construct the propeller with detachable blades capable of rotating about their longitudinal axis and thus allow the pitch of the blade to be altered independently of the hub, and to so connect the blades to the hub that end and lateral displacement will be adequately taken care of, to facilitate assembling the propeller, and generally to enable the propeller to better perform the functions required of it.

Further objects are to provide means whereby the blade and its coacting spindle may be readily assembled, provision being made for the insertion of securing means into the interior of the blade after the blade has been positioned on the spindle, to secure the blade to the spindle.

According to the one feature of this invention there is provided with the hub swivelling means for connecting the blades to the hub, and worm and worm wheel mechanism whereby the blades may be rotated about their longitudinal axis to alter the pitch of the blade to suit the conditions under which the propeller is operated.

Another feature of this invention is to hold the blades against endwise displacement by suitable locking means, but at the same time leaving the blades free to swivel on their supporting spindle.

When the spindles are stationary relatively to the hub, they may extend right through the same, being interconnected by, or made integral with, the centre portion which is perforated to receive the propeller-shaft.

According to one method of carrying out this invention as applied to a two-blade propeller, the spindles for the blades are formed on the ends of a steel tie which extends through the wooden hub and is perforated at its centre to receive the propeller-shaft. The ends of the tie project radially from the hub and constitute the aforesaid spindles which are made conical, the larger diameter being nearest to the hub.

On each spindle a metal sleeve is mounted which is free to swivel thereon and this is held against endwise displacement by nuts at the ends of the spindles, thrust-bearings being placed between the sleeves and the nuts.

In the drawings:—

Figure 1 is a plan view of the hub and blade of the propeller, part of the blade being in section showing the means for connecting the blade to the hub.

Figure 2 is a fragmentary side view of the propeller blade and hub.

Figure 3 is a transverse section on the line 3—3 of Figure 1.

Figure 4 is a transverse section on the line 4—4 of Figure 1.

Figure 5 is a transverse section on the line 5—5 of Figure 1.

Figure 6 is an enlarged plan view of the hub of the propeller showing the location of the pitch varying mechanism.

Figure 7 is a side view of the pitch varying mechanism looking from the tip of blade towards the boss.

Figure 8 is a plan view of the tie and spindle showing the location of the radial vanes on that portion of the spindle which engages with the hub of the propeller.

Figure 9 is a plan view of the tie and spindle shown in Figure 8 and as seen when looking from above.

Figure 10 is a plan view of one form of sleeve utilized with the blade and formed with peripheral vanes and annular flange.

Figure 11 is a transverse section through the sleeve shown in Figure 10.

In the drawings, like characters of reference refer to like parts in all the figures.

Referring to the drawings, A represents the improved propeller comprising the hub 10 and blades 11 operatively connected

thereto, the hub being designed to be fitted to the propeller shaft of a prime mover of an aeroplane, boat or land vehicle.

In the embodiment illustrated the propeller is of the two blade type, and the hub 10 is formed with a pair of arms 9 designed to abut the inner ends of the propeller blades 11.

The arms 9 carry spindles 12 arranged diametrically opposite each other and tapering outwardly, and the outer or smaller end of the spindles are threaded and provided with nuts 13.

The spindles 12 may be secured to the hub in any suitable manner and by reference to the drawings a preferred method of securing the spindles to the boss is illustrated.

It will be seen that the central portion of the adjoining spindles constitutes a tie which is perforated to receive the propeller shaft and is secured to the boss 10 intermediate of the thickness thereof by bolts or other suitable fastening means, the spindles extending in alignment with the longitudinal axis of the arms 9 of the boss.

The spindles adjacent to the tie are formed with radial vanes 8 which engage the arms of the hub and evenly distribute any stress therethrough which may be set up by the uneven torque of the engine or from other causes.

The blades 11 of the propeller are provided with orifices 14 extending partially through the longitudinal axis thereof, these orifices being conical or tapering.

The ends of the blades adjacent to the arms 9 of the hub are reinforced by metal rings 15 which are provided with arcuate racks 16 by means of which the blades are rotated about their longitudinal axis in a manner to be made clear hereafter.

The orifices 14 are lined with metallic sleeves 17 which may be held against longitudinal displacement by the annular flange 21, and the sleeves are provided with radial vanes 18, so that any bending or crushing forces exerted on the blade will be uniformly distributed throughout the blade.

The orifices 14 each terminate in an enlarged cavity 19 which forms with the inner end of the orifice a suitable shoulder 20 with which the annular flange 21 of the sleeve 17 abuts.

On the smaller end of the sleeve 17 a thrust bearing 22 is provided, and is secured in place by a suitable washer and the nut 13, which is threaded on the end of the spindle.

A very important feature of my invention is the ease with which the blades 11 can be assembled on the spindles 12, and the thrust bearings 22 and nuts 13 positioned.

To facilitate securing the nut 13 and the various parts of the thrust bearing in position, the cavity 19 is provided with a radial elongated opening 23 extending through the lateral walls of the blades 11, and the nut and parts of the thrust bearing after being passed through the opening in a flat position tilted through a right angle when delivered to the cavity 19, so that they will engage with the threaded end of the spindle 12.

The blades 11 may be reinforced adjacent to the cavity 19 with plates 24, which embrace the outer faces of the blades and are suitably secured in position, so that there is no liability of the blades failing or becoming unduly weakened by the provision of the cavity 19 or opening 23 being provided therein.

The means that I employ for rotating the blades 11 on the spindles 12 consists of spindles 25 journalled in brackets 26 carried by the arms 9 of the hub, and the spindles are provided intermediate of their length with worms 27 designed to mesh with the arcuate racks 16. One end of each spindle 25 overhangs the brackets 26 and carries the friction disc 28 and adjacent to this friction disc a sprocket 29 is mounted.

It will be understood that each blade 11 carries an arcuate rack 16, and each arm 9 of the propeller carries a worm spindle 25, and these spindles 25, are connected by a chain 30 which engages with the sprockets 29.

It will thus be seen that when the friction disc 28 is rotated the motion is transmitted directly to one spindle 25 and through the chain drive 30 to the other spindle, so that both blades 11 of the propeller will be simultaneously rotated about their longitudinal axis to alter the pitch.

The means which I provide for intermittently rotating the friction disc 28 are shown in Fig. 1 and Fig. 6 by the arm 33 carrying brake-shoe 34, the arm 33 being supported by a part fixed relatively to the propeller, and which can be moved by the pilot of the airplane, or other vehicle, as required to bring one or other of the brake shoes against the friction discs or to free the shoes from the said discs.

The brake shoes are arranged to lie at opposite sides of the discs, and thus when one brake shoe is brought into operation the disc will be rotated in one direction by the movement of the propellor, and when the other brake shoe is brought into operation the disc will be made to rotate in the reverse direction.

It will be clear that by this means the pitch of the blades can be varied at will, and if desired the blades can even be brought into a reverse direction.

When the blades are reversed a strong breaking effect is obtained which will facilitate landing of an aeroplane in a restricted area, or stopping and reversing a boat or land vehicle.

The construction of the blades may be as in the manner employed in factories at the present time and the blades may be constructed of laminæ, glued or suitably secured together or in any other manner such as has been found effective in practice, but it will be evident that the positioning of the sleeve 17 in the orifice 14 will present no difficulty in the construction of the blades.

When a propellor of this description is in use and it is desired to alter the pitch of the same, the discs 28 will be intermittently rotated by the brake shoes, and the rotation will be transmitted to the worm-screws 25, so that both blades of the propeller will be simultaneously adjusted to the desired pitch, to suit the conditions of the flight. Any end thrust in the ends 11 due to centrifugal action will be taken care of by the thrust bearing 22.

As many changes could be made in the above construction and many apparently widely different embodiments of my invention within the spirit or scope thereof, it is intended that all matter contained in the accompanying specification and drawings, shall be interpreted as illustrative and not in a limiting sense.

What I claim as my invention is:

1. A propeller comprising a hub, tapered spindles carried by the hub, the said spindles being in radial alignment, blades rotatably mounted on the spindle and having radial recesses in which the spindles are mounted, means on the outer ends of the spindles for preventing endwise displacement of the blades, anti-friction means between the blade and the last said means for reducing friction, an arcuate rack, and means coacting with the rack for rotating the blades to alter the pitch of the propeller.

2. A propeller comprising a hub, tapered spindles attached to the hub and in radial alignment, blades having tapered orifices extending partially through their longitudinal axis, sleeves in the orifices rotatably engaging with the spindles, means on the outer tapered ends of the spindles for preventing longitudinal displacement of the blades, anti-friction means between the last said means and the blade, an arcuate rack, and means coacting with the rack for rotating the blades to alter the pitch of the propeller.

3. The propeller as claimed in claim 2, in which sleeves are mounted in the orifices of the blades and designed to engage with the spindle, and radially extending flanges integral with the sleeve and coacting with the blades designed to prevent rotation of the sleeve relatively to the blade.

4. A propeller comprising a hub, tapered spindles attached to the hub and in radial alignment, blades having tapered orifices extending partially through their longitudinal axis and terminating in an enlarged cavity in the blade, sleeves engaging the orifices provided with radial flanges co-acting with the shoulder formed between the orifices and the enlarged cavity, an orifice in the wall of the cavity, a thrust bearing between the sleeve and the end of the spindles engaging the shoulder and a nut on the ends of the spindles, the nut and bearing being designed to be inserted through the orifice into the cavity.

5. A propeller comprising a hub, tapered spindles carried by the hub and in axial alignment, blades mounted on the spindle, means for eliminating end movement of the blades, an arcuate rack carried by each blade, worm gears carried by the hub meshing with the said rack, chain and sprocket means connecting the worm gear of opposite blades, and means for rotating one of the sprocket gears to adjust the pitch of the blades during the rotation of the propeller.

6. The propeller claimed in claim 9, in which a friction disc is provided on one of the worm gears and movable brake shoes coacting with the friction disc whereby the worm gears may be rotated in either direction.

7. A propeller comprising a hub, tapered spindles attached to the hub and in radial alignment, blades having tapered orifices extending partially through their longitudinal axis, and terminating in an enlarged cavity in the blade, sleeves engaging the orifices provided with radial flanges coacting with a shoulder formed between the orifice and the enlarged cavity, a ball bearing engaging the shoulder, a nut on the end of the spindle coacting with the ball race, an arcuate rack carried by the blade, a worm gear carried by the hub and meshing with the rack, and means for rotating the worm.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

WALLACE RUPERT TURNBULL.

Witnesses:
F. M. MANUVELL,
ERNEST A. HAMILTON.