The present invention relates to propellers wherein the pitch of the blades may be varied. More specifically the invention pertains to a propeller having gears associated therewith for changing the pitch of the blades from a driving position to a neutral position and to a braking position even though the propeller shaft is adapted to be driven in only one direction.

One of the objects of the invention is to provide a support for the rotatable blades that is particularly simple and of rugged construction which will prevent possible damage of the propeller as a result of centrifugal forces set up during high rotating speeds.

The propeller hereinafter described is designed principally for use in connection with airplanes. However, the propeller is equally adaptable to the propulsion of boats and ships. Further objects and features of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawings and the following description wherein several exemplary embodiments of the invention are disclosed.

In the drawings:

Figure 1 is a side elevational view wherein the upper half is shown in section through the longitudinal axis of the driving shaft.

Fig. 2 is a sectional view with parts broken away of the upper portion of the propeller of Fig. 1 taken from a direction at right angles to that of the view in Fig. 1.

Fig. 3 is a plan view showing one of the propeller blades in section and the exterior of the casing covering the pitch varying mechanism.

Fig. 4 is a diagram indicating the positions to which the blades may be moved.

Fig. 5 is a view principally in section illustrating a modification of the blade mounting shown in Fig. 1 and the means for actuating blade rotating gears.

Fig. 6 is a cross sectional view taken on the line VE—VI of Fig. 5.

While the propeller arrangement illustrated in the drawings and hereinafter described concerns a propeller having two blades it is understood that the pitch varying mechanism can be adapted to a propeller having a greater number of blades.

With reference to Fig. 4 the neutral or no-pitch position is indicated by the line OA. The driving position is indicated by the line OB while the braking or reversed pitch position is indicated by the line OD.

Referring particularly to Figs. 1 and 2 there is illustrated at 1 a driving shaft which extends from a prime mover (not shown). On the shaft 1 a sleeve 2 is mounted for axial displacement. That is to say, the sleeve 2 can be moved longitudinally of the shaft and the sleeve is adapted to be moved by a collar 41 having an annular groove 8 therein.

A beveled gear wheel 5 is rotatably mounted on the shaft 1 and fixed thereon against axial movement by means of the casing 7 and an annular flange 8a on the shaft 1. Another beveled gear 4 is mounted to be rotatable on the sleeve 2 and prevented from moving axially by means of the casing 7. Each of the gear wheels 4 and 5 is provided with sectors having gear teeth 33 and 34 and these teeth mesh with the gear teeth of the beveled gears 10 and 11.

The casing 7 is formed of two parts and adapted to be clamped together by means of the bolts 32 to provide hub sockets for the propeller blades 8 and 9. The inner ends of the propeller blades are provided with annular grooves 33 into which are fitted ribs 34 carried by each half sleeve 7a and 7b. Each propeller blade is additionally secured in the casing by means of a thrust bearing 36 and a nut 37 which is utilized to secure the beveled gears 10 and 11 to the respective inner ends of the blades.

The gear teeth 33 and 34 of the gear wheels 4 and 9 engage the teeth of the beveled gears 10 and 11 at diametrically opposite points so that by turning the gear 4 for example the blades 8 and 9 will be rotated about their axes to vary the pitch of the blades. The blades 8 and 9 may be rotated in one direction throughout the respective blades by turning the beveled gear 5 in the same direction. The rotation of the gear wheels 4 and 5 is accomplished by means of the member 3 which is secured to the slidable sleeve 2. The member 3 consists of projections which are adapted to engage the axially extending teeth 4n and 9a of the gear wheels 4 and 5 respectively.

The interior of the sleeve 2 is provided with grooves 38 as shown particularly in Fig. 2. The grooves 38 extend in an angular direction with respect to the axis of the shaft 1 and these grooves are engaged by pins 39 fixed to the driving shaft.
Thus when the sleeve 2 is moved in an axial direction by means of the collar 41 the projections of the member 3 will be moved into engagement with either the teeth 4a or 5a of the gear wheels 4 and 5 and after such engagement the gear 5 wheel may be actuated to vary the pitch of the blades 8 and 9 according to the developed length of the teeth sectors one of which is shown in Fig. 2.

The propeller blades 8 and 9 are driven by the shaft 1 through the sleeve 2 and the teeth 4a or 5a since the pins 39 engage the sleeve 2. Thus either the gear wheel 4 or 5 transmits motion to the propeller blades after the sectors having gear teeth 30 and 31 have turned the gears 10 and 11 to the full extent of the gear teeth 30 and 31. In other words the gear teeth carried by the gears 4 and 5 extend only over a portion of the circumference of each gear wheel as shown in Fig. 2 and when the end of these gear sectors is reached rotation of the gears 10 and 11 and rotation of the propeller blades around the axis thereof cease and the blades 8 and 9 are bodily whirled by the energy imparted to the shaft 1.

A modification of the pitch varying mechanism is illustrated in Fig. 5 wherein the gears 40 and 50 are similar to the gears 4 and 5 except that the gear teeth at the hubs thereof are similar to a ring gear and adapted to be engaged by the radial projections a and b carried by the sleeve 2. In this modification the inner end of the blade 8a is threaded into a tubular extension 44 of the beveled gear 10a and the blade 8a is further prevented from axial movement with respect to the beveled gear 10a by means of a washer 42 and a nut 43. Thus by turning the gear wheel 10a the sleeve 44 will turn in the two halves 7c and 7d of the casing. The sleeve 44 is provided with a projection 46 which is adapted to move in a circumferentially extending groove 47.

The projections a and b may be regarded as the teeth of a gear wheel rigidly fixed to the sleeve 2. The projections a and b slope in opposite axial directions so that on longitudinal displacement of the sleeve 2 these projections will engage the teeth 48 carried by the gear wheels 40 and 50. The sleeve 4 is fixed against rotation with respect to the shaft 1 by any suitable conventional means (not shown) and upon axial movement thereof will cause the propeller blade 8a to be rotated about its axis so as to vary the pitch thereof.

The propeller blades in Fig. 5 are also driven by the shaft 1 through the sleeve 2 and the projections a or b since the sleeve is arranged for axial movement only on the shaft 1. Rotation of the sleeve 2 is thus transmitted to the propeller hub by the gears 40 or 50 and the projection 46 engaging one end of the circumferentially arranged groove 47.

Any mechanism may be provided for shifting the collars 41 of Figs. 1 and 5 and a suitable arrangement is illustrated in Fig. 5 wherein the arms 23 extend into the groove 6. These arms are adapted to be moved by the pistons 22 which are adapted to be reciprocated in the cylinders 21 by means of fluid pressure which may be directed into the pipe 51 and exhausted through the pipe 52. The fluid pressure moving in such a direction will cause the sleeve 2 to be shifted to the left and when an opposite pitch of the propeller blades is desired the direction of the fluid may be reversed so as to enter the pipe 52 under pressure which will cause the pistons 22 to be moved to the right and the fluid may then escape through the pipe 51. The socket portion 1d of the casing may be provided with an annular extension 20 so as to provide a brake drum for the propeller. However, this feature forms no part of the invention.

While the invention has been described with reference to the specific embodiments shown in the drawings it is apparent that modifications may be made thereto by those skilled in the art. Such modifications may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

What I claim is:

1. In a variable pitch propeller, a shaft for driving the propeller, a hub-like casing mounted on the shaft, a propeller blade mounted with one end in the hub-like casing for rotation about the axis thereof, a beveled gear arranged in the casing adapted to rotate the blade about the axis thereof, a pair of beveled gears meshing with said first gear at diametrically opposite points, said last mentioned gears being mounted to turn about said shaft and each having teeth adjacent the hub portions thereof, means intermediate said last mentioned gears movably axially with respect to said shaft for selectively engaging the hub teeth of either of said pair of gears, means for transmitting rotary motion of said shaft to said axially movable means, means associated with said first mentioned means adapted to rotate one of the gears of said pair upon engagement thereof during the axial movement of said first mentioned means whereby the propeller blade is rotated about the axis thereof and means limiting the rotation of the first mentioned beveled gear.

2. In a variable pitch propeller, a shaft for driving the propeller, a hub-like casing mounted on the shaft, a propeller blade mounted with one end in the hub-like casing for rotation about the axis thereof, a beveled gear arranged in the casing adapted to rotate the blade about the axis thereof, a pair of beveled gears meshing with said first gear at diametrically opposite points, said last mentioned gears being mounted to turn about said shaft and each having teeth adjacent the hub portions thereof, means intermediate said last mentioned gears movably axially with respect to said shaft for selectively engaging the hub teeth of either of said pair of gears, means for transmitting rotary motion of said shaft to said axially movable means, means associated with said first mentioned means adapted to rotate one of the gears of said pair upon engagement thereof during the axial movement of said first mentioned means whereby the propeller blade is rotated about the axis thereof and means limiting the rotation of the first mentioned beveled gear.

3. In a variable pitch propeller, a shaft for driving the propeller, a hub-like casing mounted on the shaft, a propeller blade mounted with one end in the hub-like casing for rotation about the axis thereof, a beveled gear arranged in the casing adapted to rotate the blade about the axis thereof, a pair of beveled gears meshing with said first gear at diametrically opposite points, said last mentioned gears being mounted to turn about said shaft and each having teeth adjacent the hub portions thereof, means intermediate said last mentioned gears movably axially with respect to said shaft for selectively engaging the hub teeth of either of said pair of gears, means for preventing rotation of said means with respect to said shaft, a set of radial projections
carried by the first mentioned means extending in a longitudinal angular direction with respect to the shaft, another set of radial projections carried by said first mentioned means extending in an opposite angular direction with respect to the shaft, whereby said projections engage the teeth of one gear of each pair upon axial movement of said first mentioned means to rotate said propeller blade about the axis thereof, a projection moved by the first gear, and means carried by the casing limiting the movement of said projection.

Camille Hautier.

REFERENCES CITED

The following references are of record in the file of this patent:

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,719,953</td>
<td>Wiegand</td>
<td>July 9, 1929</td>
</tr>
<tr>
<td>1,765,091</td>
<td>Morris</td>
<td>June 17, 1930</td>
</tr>
<tr>
<td>1,929,435</td>
<td>McCollough</td>
<td>Oct. 10, 1933</td>
</tr>
<tr>
<td>1,982,284</td>
<td>Briner</td>
<td>Nov. 27, 1934</td>
</tr>
<tr>
<td>2,026,443</td>
<td>McDougall</td>
<td>Jan. 21, 1935</td>
</tr>
</tbody>
</table>

FOREIGN PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Country</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>136,003</td>
<td>Great Britain</td>
<td>Dec. 11, 1919</td>
</tr>
<tr>
<td>343,831</td>
<td>Great Britain</td>
<td>Feb. 26, 1931</td>
</tr>
<tr>
<td>772,115</td>
<td>France</td>
<td>Aug. 6, 1934</td>
</tr>
</tbody>
</table>