June 27, 1933. R. O. MATTSON 1,915,685

SCREW PROPELLER

Filed March 10, 1930

Fig. 1

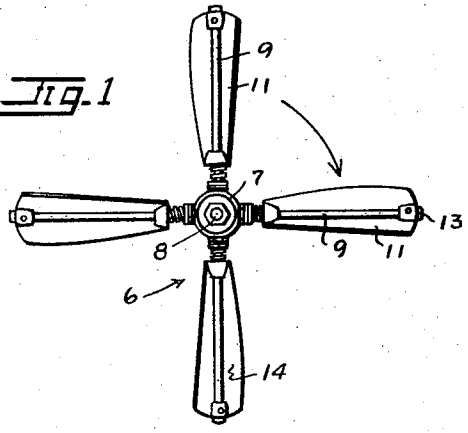


Fig. 2

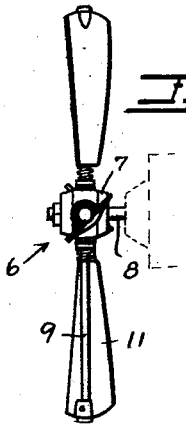


Fig. 3

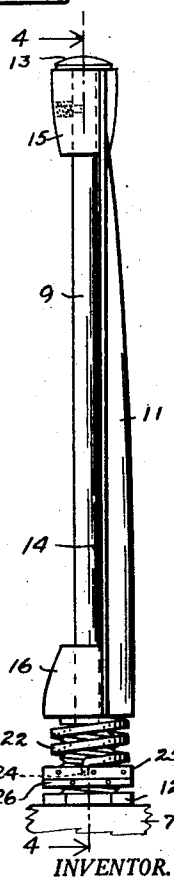
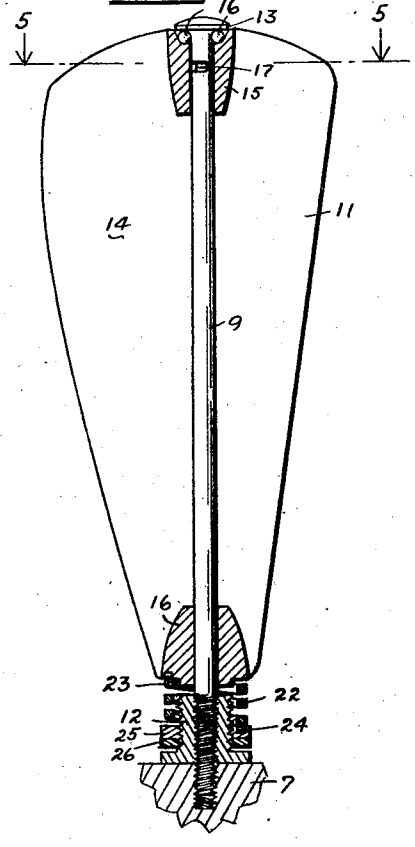


Fig. 4



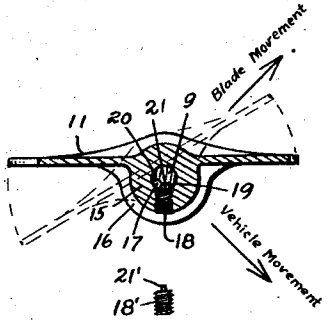


Fig. 5

INVENTOR.
Robert O. Mattson
BY
M. C. Frank
ATTORNEY.

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UNITED STATES PATENT OFFICE

ROBERT O. MATTSON, OF OAKLAND, CALIFORNIA

SCREW PROPELLER

Application filed March 10, 1930. Serial No. 434,524.

The invention relates to a method of controlling the pitch of a screw propeller blade and to a blade structure and mounting for effecting said control.

An object of the invention is to provide a device for so controlling the pitch of a propeller blade as to prevent the creation of an excessive tractive reaction thereagainst.

Another object is to provide an automatically operating control of the class described.

A further object is to provide the means of my invention in a blade structure which may be substituted for present propeller blades.

Yet another object is to provide in the structure for certain required preliminary adjustments as to maximum allowable pitch and the allowed range of automatic pitch variation.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth or be apparent in the following description of a typical embodiment of the invention which is illustrated in the accompanying drawing, in which:—

Figure 1 is a front face view of a propeller embodying the invention.

Figure 2 is a side view of the propeller and a supporting drive shaft therefor.

Figure 3 is an enlarged front edge view of a propeller blade and its mounting on the propeller hub, the hub being shown fragmentarily.

Figure 4 is a section at 4—4 in Figure 3.

Figure 5 is a section of the blade at 5—5 in Figure 4.

As particularly illustrated, the present invention is embodied in the structure of a propeller 6 comprising a hub 7 for mounting on a power operated shaft 8, arms 9 fixed to the hub 7 to form radial extensions thereof, and blades 11 mounted on the arms 9 for a limited swivelled movement thereabout. As particularly shown, the arms 9 are separate elements and their inner ends are arranged for threaded engagement in radial sockets provided in the hub. A collar 12 is mounted on each arm 9 at the base thereof; as shown, the collar 12 threadedly engages the arm end outwardly of the hub and is arranged for abutment against the hub as a lock nut for fixing the arm in the hub; the present arrangement is seen to provide for a rotative adjustment of the arm in the hub, which adjustment is desirable, as will hereinafter be brought out.

The outer end of each arm 9 is provided with a laterally extending head 13 between which and the collar 12 the blade 11 is mounted in swivelled engagement with the arm. As particularly illustrated, the blade 11 has a relatively flat forward face 14 and is provided with transverse extensions or bosses 15 and 16 protruding from said face at the outer and inner blade ends respectively, said bosses having mutually aligned bores for the rotative reception of the arm 9 therethrough. While such is not shown, it is to be understood that for a relatively thick blade, an arm-receiving longitudinal bore might be provided through and entirely within the blade. Preferably, and as particularly brought out in Figure 4, the opposed head and blade portions are formed to provide a raceway for ball bearings 16 whereby to minimize frictional resistance to the turning of the blade on its arm, it being obvious that a strong centrifugal force will constantly urge the blade against the head while the propeller is rotating.

Means are provided for limiting the swivelled movement of each blade 11 about the arm 9 which carries it. As particularly shown in Figure 5, such means comprises the provision of a segmental and circumferential slot 17 in the arm 9 opposite the boss 15 and into which a set screw 18 mounted in said boss is arranged to extend as a stop for engaging the opposite slot ends 19 and 20. With the stop end 21 of the set screw 18 of a given size, the angular spacing of the slot ends 19 and 20 is seen to determine the maximum swivelled movement of the blade about the arm. Should it be desired to change the range of angular adjustment, a substitute set screw may be used, the latter having a larger or smaller stop end as may be desired. A substitute set screw 18′ is shown in Figure 5 wherein the stop end 21′ thereof is smaller

than the end 21 of the screw 18; when the screw 18' is used, a greater swivelling range is permitted than when the screw 18 is used.

Means are provided for yieldingly urging the blade to retain a limiting position wherein the working pitch thereof is a desired maximum. When the blade is disposed as desired, the stop screw 18 is arranged to engage an appropriate end of the slot 17; in the present disclosure, the slot end 19 is arranged to be so engaged that a permitted rotation of the blade moves the stop pin toward the other slot end 20 and decreases the pitch of the blade. It is noted that adjusted disposal of the slot end 19 as required to provide for the desired maximum pitch of the blade is provided by the hereinbefore described fixed mounting of the arm 9 in the hub by the use of the collar 12 as a lock nut. As particularly shown, the means provided for urging said blade to maintain its position of maximum pitch comprises an helical torsion spring 22 disposed to generally encircle the collar 12 and having one end thereof fixed to the inner blade end and the other end fixed to the collar whereby a displacement of the blade from its position of maximum pitch is resiliently resisted.

For securing the spring ends as required, said ends are extended axially of the spring for respective engagement in a socket 23 provided in the opposed blade and in a socket 24 provided on an annulus 25 on the collar 12, said spring being compressedly engaged between said blade end and annulus for retaining the blade ends in said sockets. To permit adjustment of the torsional resistance of the spring 22 to a swivelled displacement of the blade, the annulus 25 is threaded on the collar 12 and a lock ring or annulus 26 is also mounted on said collar as a means to secure the annulus 25 in its adjusted position. Desirably, the springs 22 of the propeller 6 would be alike and would be adjusted to offer a like resistance to a rotation of the blades from their positions of maximum pitch.

It will now be noted that the tractive reaction against a blade is arranged to be utilized to effect a displacement thereof from its position of maximum pitch when a desired draft, or traction, maximum is exerted by the propeller. To this end, the blades 11 are so designed that the tractive reaction thereagainst is arranged to urge their rotation to positions of lowered pitch and against the resistance of the springs 22, the torsional urge thus created prevailing if and when the tractive reaction exceeds a desired value. In the present propeller, the desired effect is accomplished by providing a greater blade surface behind the pivotal axis of the blade than ahead of it, the type of the blade determining the exact proportions. Since the net torsional or twisting effect on the blade is the difference between rotative urges in opposite directions, a minimum difference may be provided for in designing the blade. In an airfoil blade, the aforesaid relation may not be necessary to insure a torsional urge to decrease the blade pitch as desired, it being generally essential only that said torsional urge be created by the propeller draft reaction and increase with said reaction.

It will now be clear that with a spring 22 set for a given resistance and the propeller in rotation whereby the effective torsion on a blade tends to urge it to a position of less than normal pitch, if the traction, and therefore said reaction, be increased, a point will be reached when the torsion will overcome the resistance of the springs 22 and the blade will assume a position of decreased pitch, limited only by the range of adjustment permitted by the stop slot 17. Since the resistance of the spring 22 increases with its degree of distortion, a fully minimized pitch setting may not be reached.

Propellers embodying the novel features now set forth may be designed for the propulsion of both air and water vehicles. In any case, should an excessive draft or traction be urged on the propeller by a driving mechanism, the effect thereof to decrease the propeller blade pitch prevents a slowing down or drag on the driving means, and may result in an increased rotative speed for the propeller, whereby a maximum application of the available power is maintained. It will thus be clear that the present device operates as a resilient shock absorbing means for the blades, prevents the imposition of an excessive traction on the propeller, and automatically provides for a continued operation of a driving means at an efficient speed thereof.

From the foregoing description taken in connection with the accompanying drawing, the advantages of the construction and method of operation will be readily understood by those skilled in the art to which the invention appertains, and while I have described the principle of operation, together with the device which I now consider to be the best embodiment thereof, I desire to have it understood that the device shown is merely illustrative, and that such changes may be made, when desired, as fall within the scope of the appended claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent of the United States the following:

1. In a screw propeller, a hub, an arm threadedly secured to and extending radially from said hub, a blade swivelled on said arm for rotation between positions of maximum and minimum pitch, said blade having an annular groove at its outer end surrounding the arm, a head on the outer end of the

arm, ball bearings between said groove and head, yielding means constantly urging said blade to retain its said position of maximum pitch, and means operative in accordance with the draft of the propeller to urge a rotation of said blade about said arm to its said position of minimum pitch.

2. In a screw propeller, a hub, arms extending radially from the hub, a blade mounted to swivel upon said arm, said arm having a segmental slot formed therein and a pin carried by the blade and extending into said slot to limit swivelling movement of said blade to positions of maximum and minimum pitch, means to cause the blade to swivel under predetermined operating conditions, head members on the outer ends of said arms and antifriction thrust bearings interposed between the blades and said head members.

3. In a screw propeller, a hub, radial arms threadedly secured to the hub, a threaded collar on each arm adapted to be screwed against the hub to serve as a lock-nut for said arms, a blade swivelled on each arm for rotation between positions of maximum and minimum pitch, a ring threadedly mounted on the exterior of said collar, a spring surrounding the arm and fixed to said ring and blade, a second threaded ring for locking said first ring in position, head members on the outer ends of said arms and anti-friction thrust bearings interposed between said head members and the outer ends of the blades.

In testimony whereof, I affix my signature.

ROBERT O. MATTSON.