Aug. 23, 1960 H. H. SIMSHAUSER 2,949,966

VARIABLE PITCH BOAT PROPELLER

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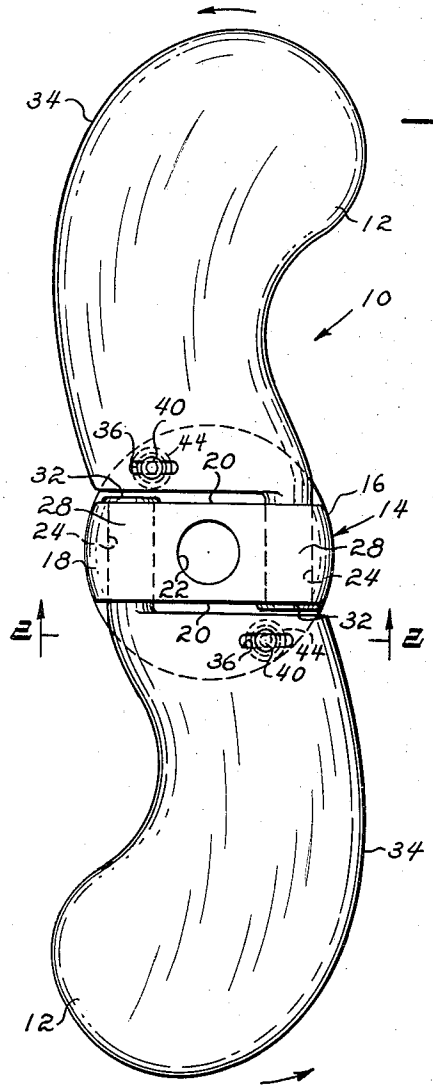
Fig. 1



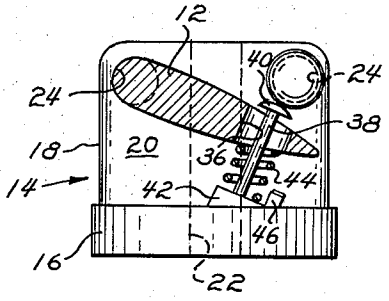


Fig. 2

Fig. 3

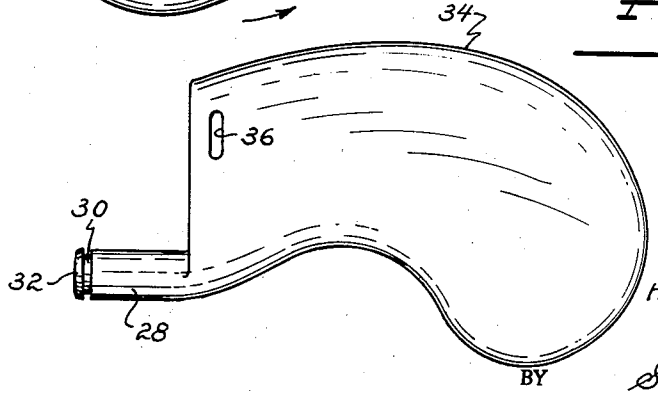


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Fig. 4

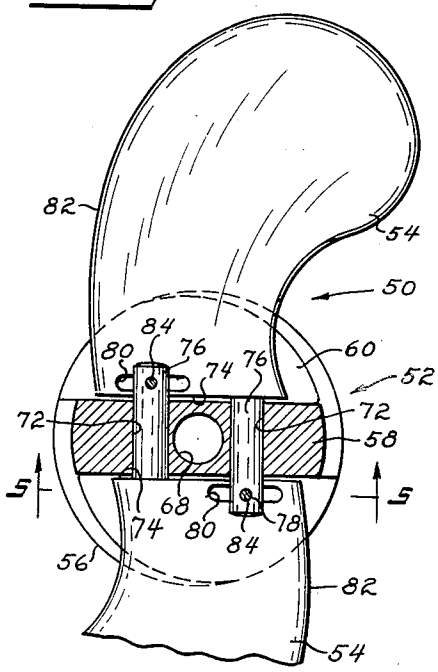


Fig. 6

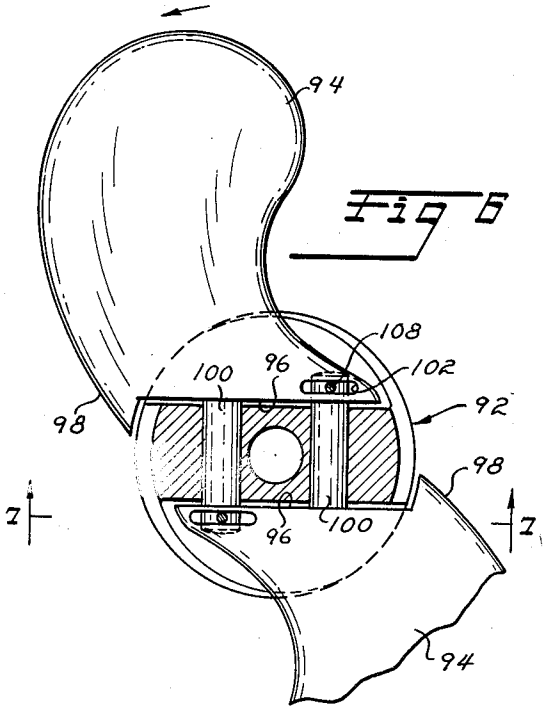


Fig. 5

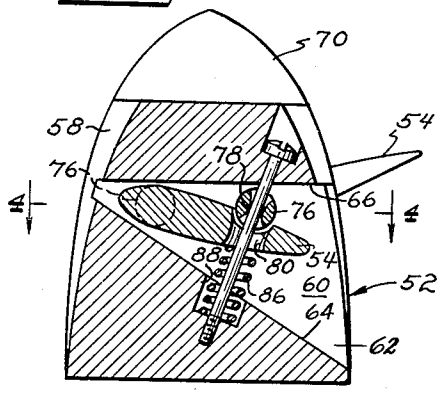
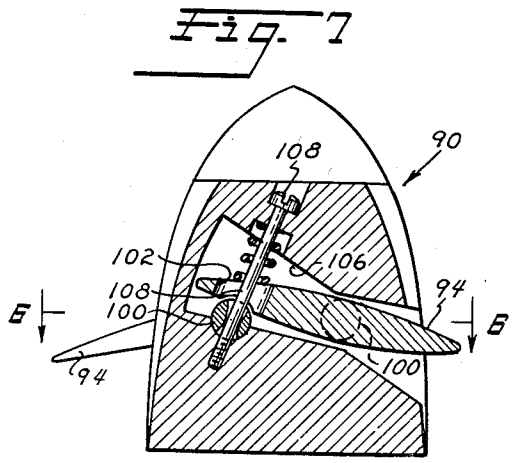


Fig. 7



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United States Patent Office 2,949,966
Patented Aug. 23, 1960

2,949,966

VARIABLE PITCH BOAT PROPELLER

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Filed Aug. 20, 1958, Ser. No. 756,131

1 Claim. (Cl. 170—160.51)

This invention relates to a boat propeller and more particularly to a two-speed variable pitch outboard motor propeller in which the propeller blades automatically shift from a low pitch position at slow boat speeds to a high pitch position at higher speeds for maximum efficiency of the propeller.

The use of outboard motors is becoming increasingly popular and there is great demand for a versatile motor capable of high cruising speeds and very slow speeds for trolling and maneuvering through crowded anchorages and around dock areas. Because practically all outboard motors are 2-cycle, it has not been possible to provide a powerful engine that will run at high speeds and yet throttle down to very low speeds for long periods as is required for trolling. This is due to the fact that the oil in the gasoline necessary for lubrication of the motor quickly fouls the spark plugs at low speeds.

In attempts to solve the above problem, various devices have been used to slow the boat speed while running the motor at a sufficiently high number of r.p.m. to prevent fouling of the spark plugs, the most common of these devices being trolling plates clamped on the back of the propeller to reduce its efficiency considerably. These plates are inconvenient to attach and detach as the occasion demands and are often lost or dropped overboard during installation.

Recently, some outboard motors have been provided with two-speed transmissions. While such devices are effective to allow the motor to run at a high enough number of r.p.m. to prevent fouling of the spark plugs without propelling the boat at a proportionate speed normally obtained at such r.p.m., these transmissions substantially increase the weight and cost of the motor.

With the foregoing considerations in view, an object of this invention is to provide a variable pitch boat propeller in which the propeller blades are in a low pitch position for slow boat speeds and automatically shift to a high pitch position for higher speeds, the pitch position being determined by water pressure on the propeller blades which is a function of the number of r.p.m. at which the propeller is rotated.

Another object of this invention is to provide a variable pitch boat propeller assembly in which the propeller blades shift automatically from a position of low pitch to high pitch and return when the number of r.p.m. of the assembly is above or below, respectively, a predetermined limit, the shifting to high pitch position being effected by increased water pressure on the propeller blades and the return to low pitch position being effected by spring means having a biasing force greater than the water pressure on said blades at a number of r.p.m. below said predetermined limit.

A further object of this invention is to provide a variable pitch boat propeller which may be made in any suitable size and number of propeller blades, and used with any engine for which such a size propeller is adapted.

Other objects and advantages of the invention will become apparent from the following detailed description and drawings, in which:

Fig. 1 is a rear elevational view of one embodiment of the variable pitch propeller assembly of this invention illustrating the trailing portion thereof;

Fig. 2 is a view, partially in section, taken along the line 2—2 of Fig. 1;

Fig. 3 is a side elevation of a propeller blade used in the assembly of this invention;

Fig. 4 is a rear elevational view, with parts shown in section for clarity, of another embodiment of this invention;

Fig. 5 is a view, partially in section, taken along the line 5—5 of Fig. 4;

Fig. 6 is a rear elevational view similar to Fig. 4, but showing still another embodiment of this invention; and

Fig. 7 is a view taken along the line 7—7 of Fig. 6.

It is of course well known that the forward thrust of a propeller is a function of the propeller pitch; i.e., the angle at which the propeller blades attack or pass through the water. In general, at a low or moderate number of r.p.m., a low pitch has low efficiency and results in a slow boat speed. Assuming for purposes of illustration, that the number of r.p.m. remains constant, increasing the blade pitch would result in an increase in boat speed until maximum efficiency of the propeller is reached. In this invention, the propeller blades shift automatically in accordance with the number of r.p.m. the propeller is rotated in the water to provide a low pitch at low or moderate engine speeds whereby the boat is propelled very slowly and a high pitch at cruising or top engine speeds where the propeller blades will be in position for maximum efficiency and therefore propel the boat accordingly. Thus, with such a propeller, a boat may be driven at a slow speed without slowing the engine to a point where it may stall or the spark plugs become fouled.

Referring now more specifically to the drawings, there is illustrated in Figs. 1 through 3 an embodiment of this invention in which a variable pitch boat propeller assembly indicated generally at 10 in Fig. 1 comprises a pair of opposed radially extending propeller blades 12 of identical configuration mounted for limited rotational or pivotal movement about a longitudinal axis thereof on a hub indicated generally at 14. The hub 14 comprises a cylindrical base 16 from which there axially extends a propeller blade mounting member 18 having opposed substantially flat parallel sides 20 substantially perpendicular to the adjacent end face of base 16. A centrally disposed bore 22 axially extends through the base 16 and mounting member 18 and is adapted to receive a propeller drive shaft (not shown). A pair of parallel bores 24 adapted to mount propeller blades 12 are provided through mounting member 18 at equally spaced points from opposite sides of bore 22 and have their respective longitudinal axes disposed in a plane substantially perpendicular to the longitudinal axis of bore 22.

The propeller blades 12 have a substantially flat transverse base 26 from which there extends at substantially right angles thereto a mounting stud 28 which is rotatably received in the respective bores 24. The ends of studs 28 have a reduced portion 30 which is swaged or upset after the studs are positioned to form a rivet like head 32 to lock the studs 28 in their respective bores 24. Of course other suitable locking means may be used if desired such as a cotter key or the like.

It is essential that the longitudinal axis of the mounting stud 28 on each propeller blade 12 be positioned so that a major portion or effective area of the propeller blade is disposed between a leading edge 34 thereof and the longitudinal axis of the stud, as will become apparent hereinafter. An elongated slot 36 is provided through

blade 12 adjacent and parallel to the base 26 and is disposed between leading edge 34 and the longitudinal axis of stud 28.

With propeller blades 12 mounted on hub 14 as shown in Fig. 1, a retaining pin 38, having a head 40, is inserted through respective slots 36 and threaded into bosses 42 rigid with the adjacent end face of base 16 on opposite sides of mounting member 18. A coil spring 44 is disposed around each pin 38 and is compressed between a forward side of the respective propeller blades 12 and bosses 42 to bias the propeller blade against the heads 40 of retaining pins 38. The heads 40 provide a stop for propeller blades 12 in their respective low pitch positions while projections 46 on bosses 42 provide stops for the propeller blades in their respective high pitch positions. The stop positions for the propeller blades may be varied as desired for maximum efficiency in accordance with such factors as the size and configuration of the blades, the size and displacement of the boat, and the power of the motor. This may be accomplished by placing washer shims (not shown) under the heads 40 or by adjusting the amount pins 38 are threaded into bosses 42 for the respective low pitch positions while the height of stop projections 46 may be varied for the respective high pitch positions.

In operation of the propeller assembly 10 of this invention, the coil springs 44 bias propeller blades 12 against the stops 40 thereby maintaining the low pitch position for the propeller blades. As the assembly 10 is rotated, water pressure on the aforedescribed major portion of propeller blades 12 disposed ahead of studs 28 increases as the number of r.p.m. of the assembly increases, and when the water pressure thereon is greater than the biasing force of springs 44, the propeller blades 12 snap or shift to their high pitch position against stop projections 46. The strength of coil springs 44 is correlated with a selected water pressure on the propeller blades 12 so that when the number of r.p.m. of the assembly 10 reaches about ¼ maximum engine speed, or any other suitable predetermined limit, water pressure on the major portion of blades 12 exceeds the biasing force of the springs and the blades are pivoted about their mounting studs 28 to their respective high pitch positions. When the engine is slowed to a number of r.p.m. below the predetermined limit, the biasing force of the spring overcomes or exceeds water pressure on the propeller blades and they are again snapped or shifted to their low pitch position. The strength of springs 44 of course may be selected so that the propeller blades 12 shift at substantially any desired predetermined r.p.m. within the operating range of the engine.

Referring now to Figs. 4 and 5, there is illustrated another embodiment of the invention in which a variable pitch propeller assembly indicated generally at 50 comprises a hub 52 having mounted thereon radially extending propeller blades 54 which pivot between positions of low pitch and high pitch in the same manner as described hereinbefore. The hub 52 comprises a substantially flat base 56 from which there axially extends a propeller mounting member 58 having formed therein opposed radially extending propeller blade mounting recesses 60 defined by a substantially flat bottom 62, a forward side 64 disposed in a vertical plane at an angle of about 30° with respect to the longitudinal axis of the hub, and a rear side 66 disposed in a vertical plane at substantially right angles to the longitudinal axis of the hub. A bore 68 formed along the central longitudinal axis of hub 52 extends through base 56 and propeller blade mounting member 58 and is adapted to receive a propeller drive shaft (not shown) on which there is threaded a cone nut 70 for securing the hub thereto. The mounting member 58 tapers toward its rear end where it has a circular cross-sectional configuration substantially the same as the base of cone nut 70 so that smooth continuous flow lines extend from the mounting member to the apex of

the cone. A pair of parallel bores 72 are equidistantly spaced from opposite sides of bore 68 with their longitudinal axes disposed in a plane intersecting the longitudinal axis of bore 68 at right angles and extend through propeller blade mounting member 58 into the opposed propeller blade mounting recesses 60 at substantially right angles to the bottoms 62 thereof.

The propeller blades 54 are of substantially the same construction as propeller blades 12 in Figs. 1–3 and have a substantially flat base 74 from which there extends at right angles thereto a mounting stud 76 adapted to extend through the bores 72 and an outer end portion thereof into the opposed propeller blade mounting recesses 60. A slot 78 is formed through a portion of the studs 76 that extends into each recess 60. An elongated slot 80 is formed through propeller blades 54 adjacent the base 74 and between a leading edge 82 of the propeller blade and the longitudinal axis of stud 76. The respective slots 78 and 80 are so positioned that when opposed blades are in mounted position, the slot 78 of each stud is aligned with the slot 80 of an opposed propeller blade so that a retaining pin 84 mounted in the propeller mounting member 58 in skewed relation to the longitudinal axis thereof and disposed across each propeller mounting recess 60 extends through the respective aligned slots 78 and 80. The slots 78 are of a flattened hourglass configuration so that retaining pins 84 will not prevent limited rotational movement of the respective studs 76 when blades 54 shift from one pitch position to another. A coil spring 86 is disposed over each retaining pin 84 and compressed between a forward side of each propeller blade 54 and the forward side 64 of each propeller blade mounting recess 60 to bias the respective propeller blades to their low pitch position against each stud 76. Each forward side 64 serves as a positive stop for the blades 54 in their high pitch position and has a spring well 88 therein for receiving an end of spring 86 and which also receives in a bore at the bottom thereof a threaded end of retaining pin 84. The depth of spring well 88 may be varied by shim washers (not shown), or the like, in accordance with the degree of compression desired on springs 86. The retaining pins 84 serve a multiple function by mounting the coil springs 86 and also locking the propeller blades in fixed radial relation to hub 52 by extending through one propeller blade and the mounting stud of the opposite propeller blade.

Operation of the variable pitch propeller assembly of this embodiment is identical with that illustrated and described in Figs. 1 through 3. The springs 86 hold the blades 54 in their respective low pitch positions until water pressure on a major attacking portion of the blades, resulting from rotation of the assembly, exceeds the biasing force of the springs and shifts the blades to their respective high pitch positions.

Referring now to Figs. 6 and 7, there is illustrated still another embodiment of this invention in which a variable pitch propeller blade assembly indicated generally at 90 comprises a hub 92 having mounted thereon propeller blades 94. The structure of the blades 94 in this embodiment is substantially the same as those in the assembly 50 illustrated in Figs. 4 and 5 except that a substantial portion of the body of each blade is offset from respective bases thereon indicated at 96 in a direction toward leading edges 98. It is thus possible to position the longitudinal axis of mounting studs indicated at 100 closed to leading edge 98 of the propeller blades and accordingly, an elongated slot 102 is positioned adjacent and parallel to base 96 between the longitudinal axis of stud 100 and the trailing edge of the blade instead of between the longitudinal axis of the stud and the leading edge of the blade as illustrated and described in the previous embodiments.

The configuration of the propeller mounting recesses indicated at 104 in Fig. 7 is tailored as illustrated so that

a rear side **106** thereof forms the stop for the propeller blades in their high pitch position. A forward side of blades **94** when in a low pitch position abuts against a portion of the studs **96** extending from the opposite propeller blade and into the respective recesses.

Retaining pins **108** are disposed on the opposite side of the longitudinal axis of hub **92** as compared with hub **52** in Figs. 4 and 5. Also, a coil spring **110** is compressed between the rear side **106** of propeller mounting recesses **104** and a rear side of propeller blades **94** instead of the respective forward sides as illustrated in Figs. 4 and 5.

The function and operation of the components in assembly **90** are the same as corresponding ones in assemblies **10** and **50** which were described in greater detail hereinbefore.

While all the embodiments of this invention thus far illustrated and described have pertained to a variable pitch propeller blade assembly in which two blades are used, it should be understood that the principles of this invention may be used in constructing a three or four blade propeller.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claim rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claim are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

A variable pitch water propeller assembly suitable for propelling boats, said assembly comprising a hub having spaced radially extending blade mounting recesses therein, a pair of bores extending through said hub from the bottom of one recess into the bottom of an opposed recess, a plurality of propeller blades mounted respectively in said recesses, each of said propeller blades having a base from which there axially extends a mounting stud, the mounting stud on the respective blades extending through a bore at the bottom of the recess in which the blade is mounted into an opposed recess, a major portion of said blades being disposed between leading edges thereof and their respective studs, an elongated slot in each of said blades adjacent the base thereof, a slot in each of said studs, the slot in said blades being substantially aligned with the slot in a stud extending into the recess, a retaining pin extending transversely of said recesses through said aligned slots, said blades being pivotally movable about their respective mounting studs between positions of low pitch and high pitch, and spring means biasing said blades toward their respective low pitch positions, said spring means exerting a sufficient biasing force to hold said blades in their respective low pitch positions when said propeller assembly is operatively rotated at a number of r.p.m. below a predetermined limit, operative rotation of said propeller assembly above said predetermined limit creating a water pressure on said blades sufficient to pivot them to their respective high pitch positions against the opposing biasing force of said spring means and hold them in said high pitch positions while water pressure on the blades is greater than the biasing force of said spring means.

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