

Jan. 18, 1966

D. L. MILLER ET AL

3,229,772

AUTOMATIC VARIABLE PITCH PROPELLER FOR SMALL BOATS

Filed Sept. 22, 1964

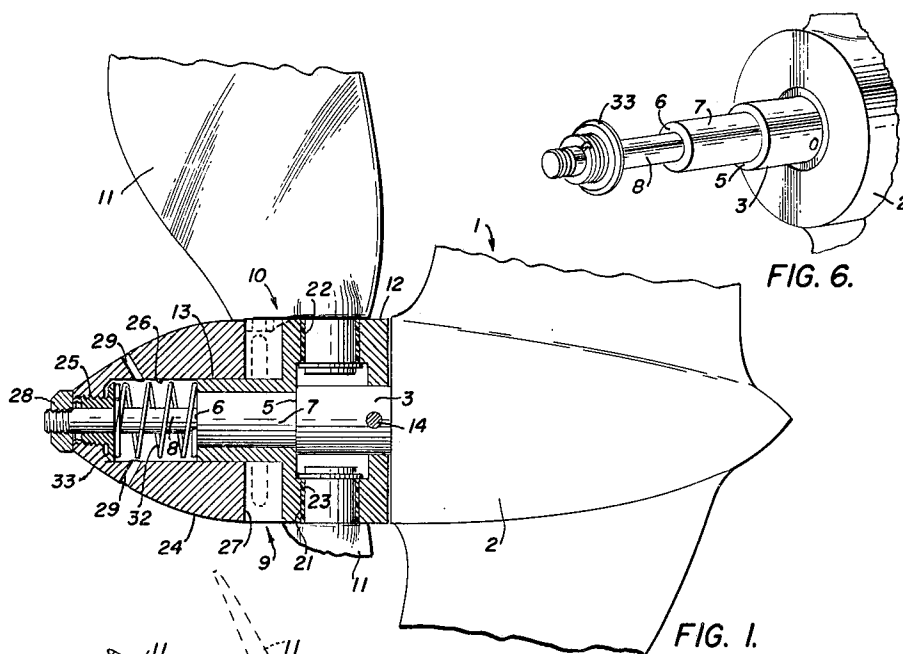


FIG. 6.

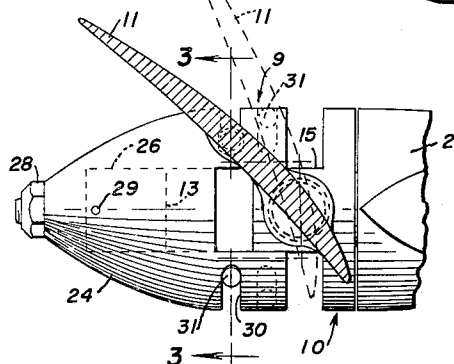


FIG. 2.

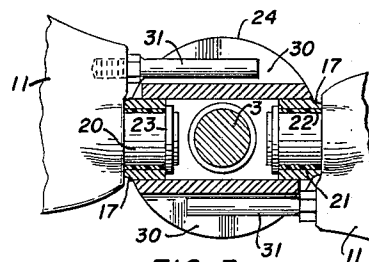


FIG. 3.

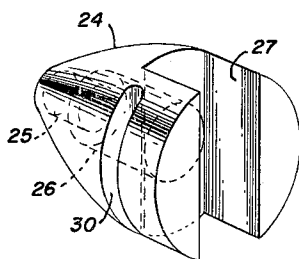


FIG. 4.

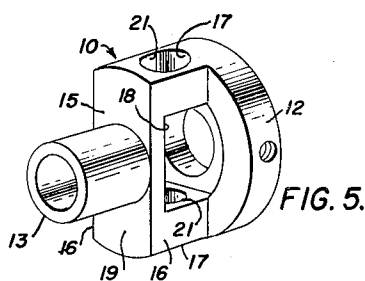


FIG. 5.

DONALD L. MILLER
LAWRENCE W. VINTHER
INVENTORS

BY *James P. ...*

ATTORNEY

1

2

3,229,772

AUTOMATIC VARIABLE PITCH PROPELLER FOR SMALL BOATS

Donald L. Miller, 321 Bedford Court E., Hurst, Tex.,
and Lawrence W. Vinther, 10420 Gooding Drive,
Dallas, Tex.

Filed Sept. 22, 1964, Ser. No. 398,362
2 Claims. (Cl. 170-160.53)

This invention relates to an automatic variable pitch propeller for small boats, and it concerns more particularly automatically operable means, responsive to the speed of a boat, for application to the lower drive portion of an outboard engine, or alternatively, to outboard drive means for an inboard engine having like structure, whereby the pitch of the propeller blades may be varied automatically according to the speed of the boat while the boat is in operation.

The automatic variable pitch propeller of this invention is characterized by its versatility, whereby the same propeller is adapted for a variety of uses requiring different ratios of engine speed to the speed of the boat. Depending on the use for which the boat is intended, as well as other considerations, including the design of the boat hull and the size of the engine, it is customary to select a propeller having blades of the desired pitch from a selection which may comprise as many as five fixed blade propellers having blades of different pitch.

The automatic variable pitch propeller of the invention is further characterized by its simplicity, and is readily applicable to existing engines without substantial modification thereof.

An advantageous feature of the invention is that the blades of the propeller are separable whereby any one of them may be replaced if it should become damaged without replacing the whole propeller.

The invention is particularly useful in water skiing, in which from one to four persons on skis are towed behind a boat, and in which the pitch of the propeller blades advantageously may be adjusted while the boat is in operation to provide the power needed to get the boat in motion against the resistance of the skis and to get the skis out of the water and in planing position, and thereafter to provide the speed which is needed to keep the skis afloat after the boat is in motion.

In speed boats for use in racing, the pitch of the propeller blades likewise advantageously may be adjusted while the boat is in operation to provide the power which is needed initially to get the boat in motion and in planing position, and thereafter to provide the high ratio of boat speed to the speed of the engine which is needed after the boat is in motion.

When using the boat for fishing, the pitch of the propeller blades advantageously may be adjusted while the boat is in operation to provide the power which is needed initially to get the boat in motion and in planing position, and thereafter to provide the high ratio of boat speed to the speed of the engine which is needed to get to the fishing site.

While the automatic variable pitch propeller of the invention, when set for automatic operation to vary the pitch of the propeller blades according to the speed of the boat as above described, is not suitable for trolling, the invention contemplates that by making a slight adjustment, using a wrench as hereinafter described, the propeller may be set for a non-automatic operation in which the pitch of the propeller blades may be adjusted to provide the high ratio of engine speed to the speed of the boat which is needed for trolling.

In our Patent No. 3,148,735, dated September 15, 1964, we have shown and described hydraulically operable

means, adapted to be controlled manually from inside a boat, for application to the lower drive portion of an outboard engine, or alternatively, to outboard drive means for an inboard engine having like structure, for varying the pitch of the propeller blades while the boat is in operation.

The invention will be readily understood by referring to the following description and the accompanying drawing, in which:

FIG. 1 is a fragmentary elevational view, partly in section taken on a median line, showing the lower drive portion of an outboard engine having the invention incorporated therein and showing the propeller blades in one of their adjusted positions;

FIG. 2 is a fragmentary top plan view showing the rearward portion of the apparatus illustrated in FIG. 1, and showing in broken lines one of the propeller blades in another of its adjusted positions;

FIG. 3 is a sectional elevational view taken on the line 3-3 of FIG. 2;

FIG. 4 is a perspective view showing in its detached position the blade adjusting member, illustrated in FIGS. 1 to 3, as seen from the top, front, and one side thereof;

FIG. 5 is a perspective view showing in its detached position the central hub of the propeller, illustrated in FIGS. 1 to 3, as seen from the top, back, and one side thereof; and

FIG. 6 is a perspective view showing fragmentarily a rearward portion of the engine housing in association with a progressively reduced rearward end portion of the propeller shaft, which extends rearwardly beyond the housing for attachment of the propeller thereto, and the spring adjusting member received on said rearward end portion of the propeller shaft, as illustrated in FIG. 1, as seen from the top, back, and one side thereof.

Referring to the drawing, the numeral 1 designates generally the lower drive portion of an outboard engine, which includes a housing, indicated generally by the numeral 2, and a horizontally extending propeller shaft 3 which is rotatable about its axis and is driven in the usual manner.

The propeller shaft 3 is journaled in bearings 4 positioned forwardly and rearwardly of the housing 2, and extends rearwardly beyond the housing 2 for engagement by a propeller assembly as hereinafter described.

In accordance with the invention the propeller shaft 3, which is in other respects similar to propeller shafts which are commonly employed for the purpose described in reduced stepwise rearwardly of the housing 2 to form rearwardly facing shoulders 5, 6 defining portions 7, 8 of progressively reduced diameter.

A propeller, indicated generally by the numeral 9, has a central hub 10 which is connected to the propeller shaft 3 rearwardly of the housing 2 and is rotatable therewith, and a plurality of blades 11 which are connected to the hub 10 and are rotatable therewith, the blades 11 being adjustable rotatively about a radial axis to vary their pitch as hereinafter described.

The hub 10 has opposite end portions 12, 13 which are generally cylindrical and which are of relatively greater and lesser diameter, respectively. The larger end portion 12, which is positioned forwardly, immediately adjacent the housing 2, has an inside diameter corresponding to the maximum diameter of the propeller shaft 3, to which it is connected by shear pins 14. The smaller end portion 13, which is positioned rearwardly, has an inside diameter corresponding to the diameter of the portion 7 of the propeller shaft 3.

The opposite end portions 12, 13 of the hub 10 are connected by a relatively narrow, "U" shaped intermediate portion 15 which with the rearward end portion 13 forms

a tongue-like rearward extension of the forward end portion 12.

The intermediate portion 15 has a transverse dimension in one direction corresponding to the diameter of the forward end portion 12, and has planar surfaces 16, 16 on two opposite sides thereof which are spaced apart a distance corresponding to the outside diameter of the rearward end portion 13.

The intermediate portion 15 has legs 17, 17 which are connected to the forward end portion 12 and which extend along opposite sides of the propeller shaft 3, in spaced apart relation thereto, and has forwardly and rearwardly facing planar surfaces 18, 19 on opposite sides of a middle portion thereof extending transversely between the legs 17 at the juncture of the intermediate portion 15 with the rearward portion 13. The intermediate portion 15 has a central opening in said middle portion thereof which coincides with the inside of the rearward portion 13, and the planar surface 18, which faces forwardly, abuts the rearwardly facing shoulder 5 of the propeller shaft 3.

The rearward end portion 13 of the hub 10 terminates flush with the rearwardly facing shoulder 6 of the propeller shaft 3 and forms with the shoulder 6 a spring seat for use as hereinafter described.

Each of the blades 11 has an integral stub shaft 20 thereon which is passed through an opening 21 therefor which extends radially through one of the legs 17 of the intermediate portion 15 of the hub 10 and is journaled in a cylindrical Teflon bearing 22 therefor received in the opening 21 whereby the blade 11 is adjustable rotatively about a radial axis.

A snap ring 23, which is received in a corresponding groove therefor in the stub shaft 20, in abutting engagement with the adjacent end of the bearing 22, secures the blade 11 against displacement from the hub 10.

A blade adjusting member 24, which is generally conical and has a series of connecting, axially aligned passages as hereinafter described extending longitudinally through it, loosely surrounds the propeller shaft 3, rearwardly of the hub 10, with its larger end positioned forwardly.

The blade adjusting member 24 has a threaded opening 25 therein beginning at its rearward end which loosely surrounds the portion 8 of the propeller shaft 3, and has a central passage 26 communicating with the opening 25 having a diameter corresponding substantially to the outside diameter of the rearward portion 13 of the hub 10. A transverse groove 27, which has a width corresponding to the width of the intermediate portion 15 of the hub 10 and which communicates with the passage 26, extends across the forward end of the blade adjusting member 24, which is planar.

The blade adjusting member 24 is received telescopically on the tongue-like rearwardly extending portions of the hub 10 comprising the rearward portion 13 and the intermediate portion 15. The length of the passage 26 is greater than the length of the rearward portion 13 which is received therein, and the depth of the groove 27 is greater than the length of the intermediate portion 15 which is received therein, whereby the blade adjusting member 24 is adjustable longitudinally relative to the hub 10 within predetermined limits, and in operation is movable reciprocally relative thereto a distance which may be of the order of about 1/4 inch, for example.

The blade adjusting member 24 is secured between the hub 10 and a nut 28 which is applied to the rearward end of the propeller shaft 3, which is threaded. A lock nut (not shown) advantageously may be provided, and an annular Teflon bearing (not shown) preferably is received on the propeller shaft 3 between the nut 28 and the adjacent end of the blade adjusting member 24 so that the propeller shaft 3 is rotatable independently of the blade adjusting member 24.

The passage 26 advantageously may be lined with an annular Teflon bearing (not shown) to facilitate reciprocal

movement of the rearward portion 13 of the hub 10 relative thereto.

The blade adjusting member 24 has water courses 29 therein through which water may flow in opposite directions in response to reciprocal movement of the blade adjusting member 24 relative to the hub 10.

The blade adjusting member 24 has a pair of discontinuous peripheral grooves 30 near its forward end, on opposite sides of the groove 27, and each of the blades 11 has a pin 31 removably connected, as by threads, to a trailing edge portion thereof, relative to the direction of movement of the boat, positioned eccentrically of the stub shaft 20 and extending substantially parallel thereto, in sliding engagement with one of the grooves 30 whereby the blades 11 are adjustable rotatively about a radial axis in response to longitudinal movement of the blade adjusting member 24 in either direction relative to the hub 10, and conversely, the blade adjusting member 24 is adjustable longitudinally within predetermined limits relative to the hub 10 in response to rotative movement of the blades 11 in either direction about a radial axis as hereinafter described.

A compression spring 32, which is received in the passage 26 rearwardly of the rearward portion 13 of the hub 10, acts on the spring seat formed by the rear end of the rearward portion 13 and the rearwardly facing shoulder 6 on the propeller shaft 3, and on a spring seat 33 which is secured by threads in the threaded opening 25, to urge the blade adjusting member 24 in a rearward direction relative to the hub 10.

In operation, the blades 11 are rotated about a radial axis in response to the action of the spring 32 to a position, as shown in solid lines in FIG. 2, in which their pitch is characterized by a relatively acute angle between the plane of the blade 11 and the axis of the propeller shaft 3, which is the position best suited to produce more speed and less power at a given throttle setting.

The blades 11 are rotated about a radial axis, against the resistance of the spring 32, from the position shown in solid lines in FIG. 2 to the position shown in broken lines, which is the position best suited to produce more power and less speed at a given throttle setting, in response to resistance of the water to rotative movement of the blades 11 about the axis of the propeller shaft 3 during forward movement of the boat, as upon initial movement of the boat or when moving at slow speeds. Upon rearward movement of the boat the rotative position of the blades 11 remains as shown in solid lines in FIG. 2.

The rotative movement of the blades 11 about a radial axis in response to resistance of the water to rotative movement of the blades 11 about the axis of the propeller shaft 3, as above described, is balanced against the resistance of the water to movement of the boat in a forward direction, which results in rotative movement of the blades 11 about a radial axis in an opposite direction, whereby the blades approach the position shown in solid lines in FIG. 2 as the speed of the boat is increased.

The invention may be modified in various ways without departing from the spirit and scope thereof.

The spring seat 33 is adjustable, as by means of a wrench, to thereby control the action of the spring 32 and its resistance to rotative movement of the blades 11 about a radial axis.

We claim:

1. An automatic variable pitch propeller for an engine driven boat having outboard drive means consisting substantially in its entirety of, in combination with a propeller shaft extending horizontally, rearwardly of a boat, the combination of a central hub having means connecting it to said propeller shaft and rotatable therewith, a plurality of propeller blades extending radially outwardly from said central hub, said blades each having a leading edge and a trailing edge relative to the direction of rotation of the propeller and the direction of movement of the boat in a forward direction, and said blades each having means

5

pivotally connecting it near its leading edge to said central hub for rotative adjustment about a radial axis, whereby said blades are movable rotatively about their axes in the direction of their minimum pitch positions by resistance of the water to rotative movement of the propeller, and are movable rotatively about their axes in the direction of their maximum pitch positions by resistance of the water to movement of the boat in a forward direction, and said blades each having an integral projecting element extending substantially parallel to said axis, in spaced apart relation thereto, near said trailing edge, operable to turn the blade about said axis, a blade adjusting member loosely surrounding said propeller shaft and having means loosely connecting it thereto for reciprocal longitudinal movement relative thereto, and extending radially outwardly therefrom, rearwardly of said central hub, said blade adjusting member having means for abutting engagement with the integral projecting elements of said blades whereby said blades are adjustable rotatively about their axes in response to reciprocal movement of said blade adjusting member, against the resistance of the water as above described, and conversely, said blade adjusting member is adjustable longitudinally relative to said propeller shaft in response to rotative movement of said blades about their axes, and yieldable means acting on said central hub and said blade adjusting member to urge

6

them apart to thereby bias said blade adjusting member in a rearward direction relative to said propeller shaft, whereby said blades are movable rotatively about their axes in the direction of their maximum pitch positions.

2. The structure of claim 1, said yieldable means comprising a compression spring positioned between said central hub and said blade adjusting member and having an adjustable seat whereby the spring may be partially compressed independently of the relative positions of said central hub and said blade adjusting member.

References Cited by the Examiner

UNITED STATES PATENTS

457,513	8/1891	Littlejohn	-----	170—160.47	X
2,099,922	11/1937	Bellman	-----	170—160.51	
2,383,440	8/1945	Baxter	-----	170—160.47	X
2,638,171	5/1953	Foss	-----	170—160.51	
2,742,097	4/1956	Gaston	-----	170—160.54	
2,988,156	6/1961	Coleman	-----	170—160.53	
3,145,780	8/1964	Kean	-----	170—160.51	X
3,148,735	9/1964	Miller et al.	----	170—160.47	X

SAMUEL LEVINE, *Primary Examiner.*

JULIUS, E. WEST, *Examiner.*

E. A. POWELL, JR., *Assistant Examiner.*