Oct. 11, 1960 E. W. DALEY 2,955,659

VARIABLE PITCH PROPELLER

Filed Nov. 20, 1958

2 Sheets-Sheet 1

FIG. 2.

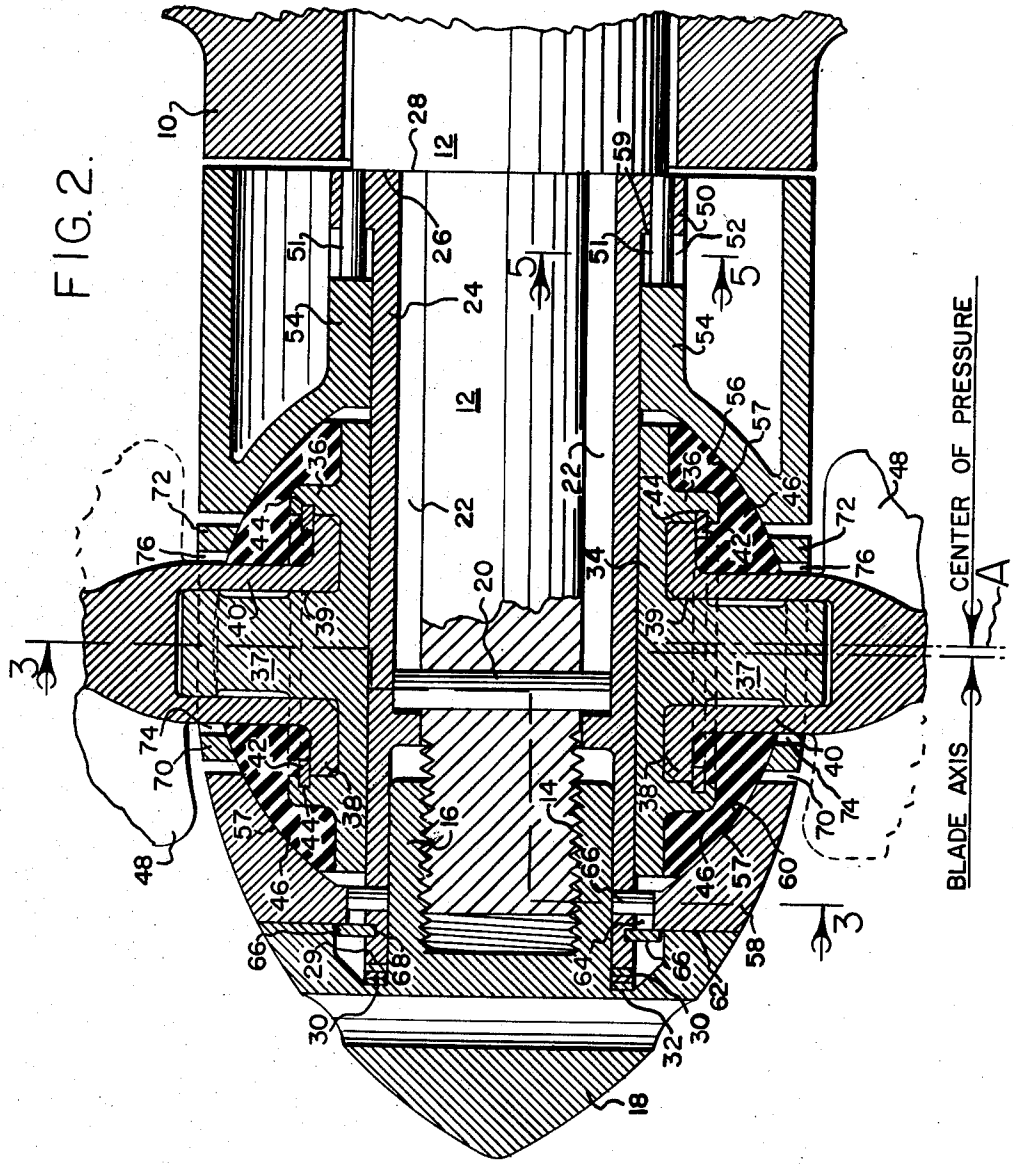

FIG. 1.

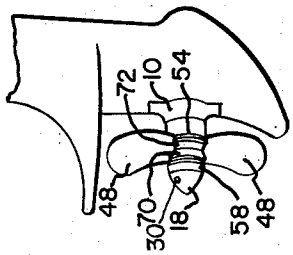

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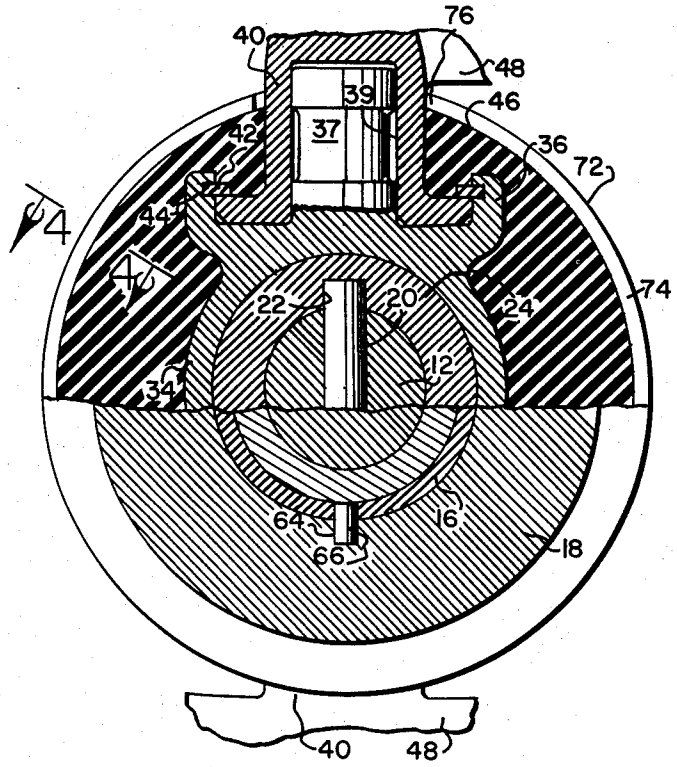
FIG. 3.



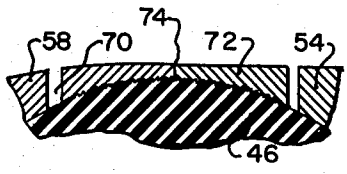
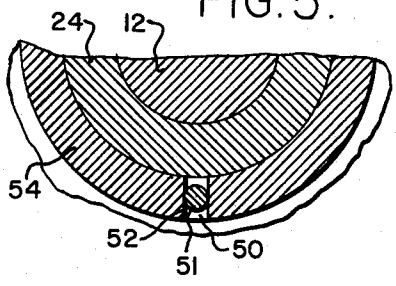


FIG. 4.

FIG. 5.



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VARIABLE PITCH PROPELLER

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9 Claims. (Cl. 170—135.75)

This invention relates to a variable pitch propeller, and more particularly to a variable pitch propeller for use in connection with the drive shafts of boat motors.

Sportsmen have generally used boat motors for various purposes including high speed travel on the water, and sometimes require the operation of a boat at low speed for trolling purposes when fishing. Furthermore, boat motors equipped with conventional propellers and which are sufficiently powerful to propel a boat at high speed have been unsuitable for use at a lower speed compatible with trolling.

The most common boat motor is known as the outboard motor which is detachable from a boat, and these motors are necessarily small and compact so that they may be readily handled, and in most instances it is not feasible to provide variable speed transmissions in such motors in order to accomplish satisfactory low and high speed operations of a boat by a single motor. Throttle controls of most boat motors permit the engine speed to be reduced considerably, but this generally causes stalling of the motor due to high pitch of the propeller connected therewith and such a combination thus becomes quite unsatisfactory to a fisherman, who, when trolling must continually attend the boat motor in order to keep it in operation.

When a boat motor is provided with a low pitch propeller suitable for low speed trolling operations, the motor must operate at extremely high speed in order to move the boat at an appreciable speed when the sportsman is going to and from a desired location. This low pitch propeller arrangement works a hardship upon the motor and also forces the sportsman to travel to and from his favorite fishing spot at a very low speed.

Accordingly, it is the object of the present invention to provide a variable pitch propeller which may readily be secured to a conventional boat motor drive shaft and which will permit satisfactory operation of a boat at low and high speeds with normal operation of the motor.

Another object of the invention is to provide a variable pitch propeller which is responsive to horsepower output of the motor automatically to change the pitch of the propeller blades whereby traction of the blades in water is increased in accordance with the horsepower output of the motor.

Another object of the invention is to provide a variable pitch propeller which may readily and easily be installed to replace a conventional propeller on the drive shaft of a conventional boat motor.

Another object of the invention is to provide a variable pitch propeller wherein resilient means tends to resist a change in pitch of the propeller blades and wherein the configuration of the blades is so arranged that their centers of pressure are offset relative to their pivotal axes whereby an increase of pressure on the blades causes them to pivot to a higher pitch angle with respect to their drive shaft axis.

Another object of the invention is to provide a variable pitch propeller having a novel resilient bushing which

is bonded to propeller blade shanks and a propeller blade hub whereby the blade shanks may rotate against the resilient resistance of the bushings in order to permit a pitch change of the propeller blades, and whereby the bushing serves as a friction clutch to permit slippage of the blades relative to the drive shaft when they contact a solid object.

Another object of the invention is to provide a variable pitch propeller having very compact and simple mechanism which readily replaces that of the conventional boat propeller.

Another object of the invention is to provide a variable pitch propeller having a combination of mechanism which may be used in operations other than boat propulsion, as for example, aircraft of various kinds.

Further objects and advantages of the invention may be apparent from the following specification, appended claims and the accompanying drawings in which:

Fig. 1 is a fragmentary side elevational view of an outboard motor showing a variable pitch propeller in accordance with the present invention in connection therewith.

Fig. 2 is a fragmentary axial sectional view of a variable pitch propeller in accordance with the present invention.

Fig. 3 is a fragmentary sectional view taken from the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary sectional view taken from the line 4—4 of Fig. 3, and

Fig. 5 is a fragmentary sectional view taken from the line 5—5 of Fig. 2.

As shown in Fig. 2 of the drawings, the conventional outboard motor frame 10 surrounds the motor drive shaft 12 which is provided with an extended externally screw threaded portion 14 which is engaged by an internally screw threaded sleeve 16 of a spinner nut 18 which holds the variable pitch propeller of the present invention on the motor shaft 12. The shaft 12 is provided with a conventional shear pin 20 which projects from the center thereof and into a slot 22 of a hollow shaft 24. This hollow shaft 24 at one end 26 is abutted to a shoulder 28 of the shaft 12. The opposite end 29 of the hollow shaft 24 is engaged by shims 30 which are interposed between the shaft end 29 and a recessed shoulder 32 of the spinner nut 18.

Rotatably mounted on the hollow shaft 24 is a blade hub 34. This blade hub 34 is a hollow cylindrical member having a plurality of blade shaft retaining cups 36 projecting substantially at right angles to the axis of the motor shaft 12. These cups 36 form annular sockets for annular flanges 38 of propeller blade shank 40. The annular flanges 38 are retained in the annular cups 36 by snap rings 42 fitted in grooves 44 internally of the cups 36. Thus the propeller blade shank 40 is permitted to rotate freely relative to the propeller blade hub 34.

Centrally of each cup 36 the hub 34 is provided with an integral trunnion 37 which projects into a bore 39 centrally of each blade shank 40 thereby structurally supporting the same on the hub 34.

It will be noted that an annular resilient rubberlike bushing 46 is bonded to the propeller blade shank 40 and the outer structure of the propeller blade hub 34 so that this resilient bushing 46 tends to hold the shanks 40 in a predetermined position with respect to the longitudinal axis of the drive shaft 12. Propeller blades 48 are carried by the shanks 40 and are disposed at a low pitch angle with respect to the axis of the shaft 12 and are normally held at such a low pitch angle by the resilient bushing 46. The blades 48 each have a center of pressure which is offset laterally and forwardly of their pivotal axes whereby an increase of horse power applied to

the blades 48 will tend to cause them to pivot against resilient resistance of the bushing 46 into a higher pitch angle with respect to the axis of the shaft 12.

The term "center of pressure" as used herein defines a configuration of the blades whereby the mean concentration of force on the blades is disposed at a location laterally of the pivotal axis of the blades whereby an increase of force applied to the blades will cause them to pivot about their axes into an increasing pitch angle with respect to the axis of the drive shaft 12.

The term "resilient bushing," as used herein, defines a bushing of rubber or any other suitable rubberlike material.

The hollow shaft 24 is provided with an enlarged diameter flange 50 having pins 51 secured therein. These pins 51 are engaged in slots 52 of a clutch member 54 which is provided with a spherical clutch surface 56 which engages a spherical outer surface 57 of the resilient rubberlike bushing 46. It will be noted that the clutch member 54 is abutted to a shoulder 59 of the annular flange 50 and the clutch member 54 is thus fixed axially of the drive shaft 12.

The second clutch member 58 is provided with an inner spherical surface 60 which engages the outer spherical surface 57 of the resilient rubberlike bushing 46 in opposition to the spherical surface 56 of the clutch member 54. The clutch member 58 is held against the bushing 46 by means of the spinner nut 18. This nut is provided with an annular surface 62 which engages a similar surface on the end of the clutch member 58. This clutch member 58 is provided with slots 64 which engage pins 66 projecting from the hollow shaft 24 in which the pins 66 are secured. Thus the pins 51 and 66 drive the clutch members 54 and 58 which in turn drive the resilient bushing 46 and the propeller blade hub 34.

A snap ring 67 is engaged in an annular groove 68 in periphery of the hollow shaft 24 and this snap ring 67 retains the clutch member 58 and the hub 34 on the shaft 24 when the spinner nut 18 is disengaged from the shaft 12. Thus all the mechanism of the present variable pitch propeller is held in assembly so that it may readily be installed on the shaft 12 as will be hereinafter described.

Disposed between the clutch members 54 and 58 and surrounding the middle portions of resilient bushing 46 is a metal structure composed of 2 retainer rings 70 and 72. These retainer rings 70 and 72 are abutted at 74 or as shown in Fig. 4 of the drawings. These rings form a protective covering for the resilient bushing 46 between the clutch members 54 and 58.

It will be noted that the ring 70 is slightly spaced from the clutch member 58 and the ring 72 is slightly spaced from the clutch member 54 permitting removal of some of the shims 30 so that the spinner nut 18 may be axially tightened to cause additional compression or frictional engagement of the resilient bushing 46 between the spherical surfaces 56 and 60 of the clutch members 54 and 58. This mechanism provides adjustment of the frictional clutch surfaces so that efficient driving of the propeller blades may be attained and also permits the clutch surfaces to slip if the blades 48 engage a solid object such as a rock or other obstruction below the surface of the water.

As shown in Fig. 2 of the drawings, these rings 70 and 72 are provided with semicircular cut out portions 74 and 76 respectively which receive the blade shanks 40. These rings 70 and 72 are bonded to the resilient bushing 46 and are thus held securely in the position as shown in Fig. 4 of the drawings.

Operation of the variable pitch propeller in accordance with the present invention is substantially as follows:

When installing the present variable pitch propeller on a conventional motor shaft 12, the hollow shaft 24 is first slid over the shaft 12 while the slot 22 is aligned with and receives the shear pin 20. The snap ring 67 holds the variable pitch propeller mechanism in assembly and the desired number of shims 30 are included in the assembly by placing them in surrounding relation with the sleeve 16 of the spinner nut 18 whereupon these shims subsequently are engaged between the surface 32 of the spinner nut 18 and the end 29 of the hollow shaft 24. The aggregate of these shims 30 determines the pressure of the clutch members 54 and 58 on the spherical surface 57 of the bushing 46 whereby this bushing may slip with a predetermined amount of resistance applied to the blades 48 during rotation of the shaft 12. Said resistance will be predetermined in accordance with the shear strength of the shear pin 20. Thus the clutch will be adjusted so that it will not slip under normal load but will only slip when the blades of the propeller engage an obstruction under the water.

When a small amount of power is applied to the propeller and the engine is idling freely the normal low pitch of the blades 48 is maintained by the resilient bushing 46 which resists a pitch change due to its resilient character. Thus the motor may run freely at low throttle and maintain sufficient r.p.m.'s so that it does not stall. The low pitch of the propeller blades being such as to permit the boat to move forwardly at a low speed.

When the engine throttle is opened and the engine delivers a considerable amount of horse power, force of the water acting at the mean center of pressure of the blades laterally of the pivotal axes of the blades, causes them to pivot against resilient resistance of the resilient bushing 46 to increase the blade pitch angle with respect to the axis of the shaft 12. The increased pitch of the blades absorbs the increased horse power output of the engine and provides increased forward traction of the propeller in the water to hereby move the boat forward at high speed with a reasonable engine speed.

From the foregoing it will be obvious to those skilled in the art that the present variable pitch propeller when connected to a powerful outboard motor will permit the operator of the motor to run a boat at a low forward speed for various purposes such as trolling and in addition will permit the operator to move a boat through the water at high speed, all of which is automatically permitted by the variable pitch propeller of the present invention.

Various modifications of the present invention may be resorted to in a manner limited only by just interpretation of the following claims.

I claim:

1. In a variable pitch propeller a hollow shaft; first means for securing said hollow shaft on a drive shaft; a blade hub means rotatably mounted on said hollow shaft; a plurality of propeller blades pivotally connected to said hub on axes at an angle to the axis of said hollow shaft; a bushing of resilient material secured to and resiliently interconnecting said propeller blades and said hub means, and a clutch member carried by said hollow shaft and frictionally engaging said bushing to drive it and said blades; said blades structurally shaped to have centers of pressure disposed laterally of their pivotal axes.

2. In a variable pitch propeller a hollow shaft; first means for securing said hollow shaft on a drive shaft; a blade hub means rotatably mounted on said hollow shaft; a plurality of propeller blades pivotally connected to said hub on axes at an angle to the axis of said hollow shaft; a bushing of resilient material secured to and resiliently interconnecting said propeller blades and said hub means, and a clutch member carried by said hollow shaft and frictionally engaging said bushing to drive it and said blades; said blades structurally shaped to have centers of pressure disposed laterally of their pivotal axes, said centers of pressure being normally forward of the pivotal axes of said blades whereby increasing force applied to said blades causes them to pivot to an increasing pitch angle with respect to the axis of said hollow shaft.

3. In a variable pitch propeller a hollow shaft; first

means for securing said hollow shaft on a drive shaft; a blade hub means rotatably mounted on said hollow shaft; a plurality of propeller blades pivotally connected to said hub on axes at an angle to the axis of said hollow shaft; a bushing of resilient material secured to and resiliently interconnecting said propeller blades and said hub means, and a clutch member carried by said hollow shaft and frictionally engaging said bushing to drive it and said blades; said blades structurally shaped to have centers of pressure disposed laterally of their pivotal axes; said first means including a spinner nut having screw threads engageable with said drive shaft and abutting said hollow shaft to hold it on said drive shaft and in engagement with a shoulder thereon.

4. In a variable pitch propeller a hollow shaft; first means for securing said hollow shaft on a drive shaft; a blade hub means rotatably mounted on said hollow shaft; a plurality of propeller blades pivotally connected to said hub on axes at an angle to the axis of said hollow shaft; a bushing of resilient material secured to and resiliently interconnecting said propeller blades and said hub means, and a clutch member carried by said hollow shaft and frictionally engaging said bushing to drive it and said blades; said blades structurally shaped to have centers of pressure disposed laterally of their pivotal axes; said first means including a spinner nut having screw threads engageable with said drive shaft and abutting said hollow shaft to hold it on said drive shaft and in engagement with a shoulder thereon, said spinner nut engaging said clutch member and holding it against said resilient bushing.

5. In a variable pitch propeller a hollow shaft; first means for securing said hollow shaft on a drive shaft; a blade hub means rotatably mounted on said hollow shaft; a plurality of propeller blades pivotally connected to said hub on axes at an angle to the axis of said hollow shaft; a bushing of resilient material secured to and resiliently interconnecting said propeller blades and said hub means, and a clutch member carried by said hollow shaft and frictionally engaging said bushing to drive it and said blades; said blades structurally shaped to have centers of pressure disposed laterally of their pivotal axes; said first means including a spinner nut having screw threads engageable with said drive shaft and abutting said hollow shaft to hold it on said drive shaft and in engagement with a shoulder thereon, said spinner nut engaging said clutch member and holding it against said resilient bushing; removable shims between said spinner nut and said hollow shaft permitting adjustment of said nut relative to said clutch member to thereby adjust frictional engagement of said clutch member with said resilient bushing.

6. In a variable pitch propeller a hollow shaft; first means for securing said hollow shaft on a drive shaft; a blade hub means rotatably mounted on said hollow shaft; a plurality of propeller blades pivotally connected to said hub on axes at an angle to the axis of said hollow shaft; a bushing of resilient material secured to and resiliently interconnecting said propeller blades and said hub means, and a clutch member carried by said hollow shaft and frictionally engaging said bushing to drive it and said blades; said blades structurally shaped to have centers of pressure disposed laterally of their pivotal axes; means for retaining said blade hub and said clutch member in assembly with said hollow shaft.

7. In a variable pitch propeller a shaft; a blade hub means rotatably mounted on said shaft; a plurality of propeller blades pivotally connected to said hub on axes at an angle to the axis of said shaft; a bushing of resilient material secured to and resiliently interconnecting said propeller blades and said hub means, and a clutch member carried by said shaft and frictionally engaging said bushing to drive it and said blades; said blades structurally shaped to have centers of pressure disposed laterally of their pivotal axes.

8. In a variable pitch propeller a shaft; a blade hub means rotatably mounted on said shaft; a plurality of propeller blades pivotally connected to said hub on axes at an angle to the axis of said shaft; a resilient means connecting said propeller blades and said hub means to permit variable pitch of said blades, and a clutch means disposed frictionally to connect said shaft in driving relation with said blade hub; said blades structurally shaped to have centers of pressure disposed laterally of their pivotal axes.

9. In a variable pitch propeller the combination of: a hollow shaft; first means for securing said hollow shaft on a drive shaft; a blade hub means rotatably mounted on said hollow shaft; a plurality of propeller blades pivotally connected to said hub on axes at an angle to the axis of said hollow shaft; a resilient rubberlike structure bonded around and connecting said hub and portions of said propeller blades; a clutch member frictionally engaging said resilient structure, and connected to said hollow shaft, said blades having mean centers of pressure disposed laterally of their pivotal axes.

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