

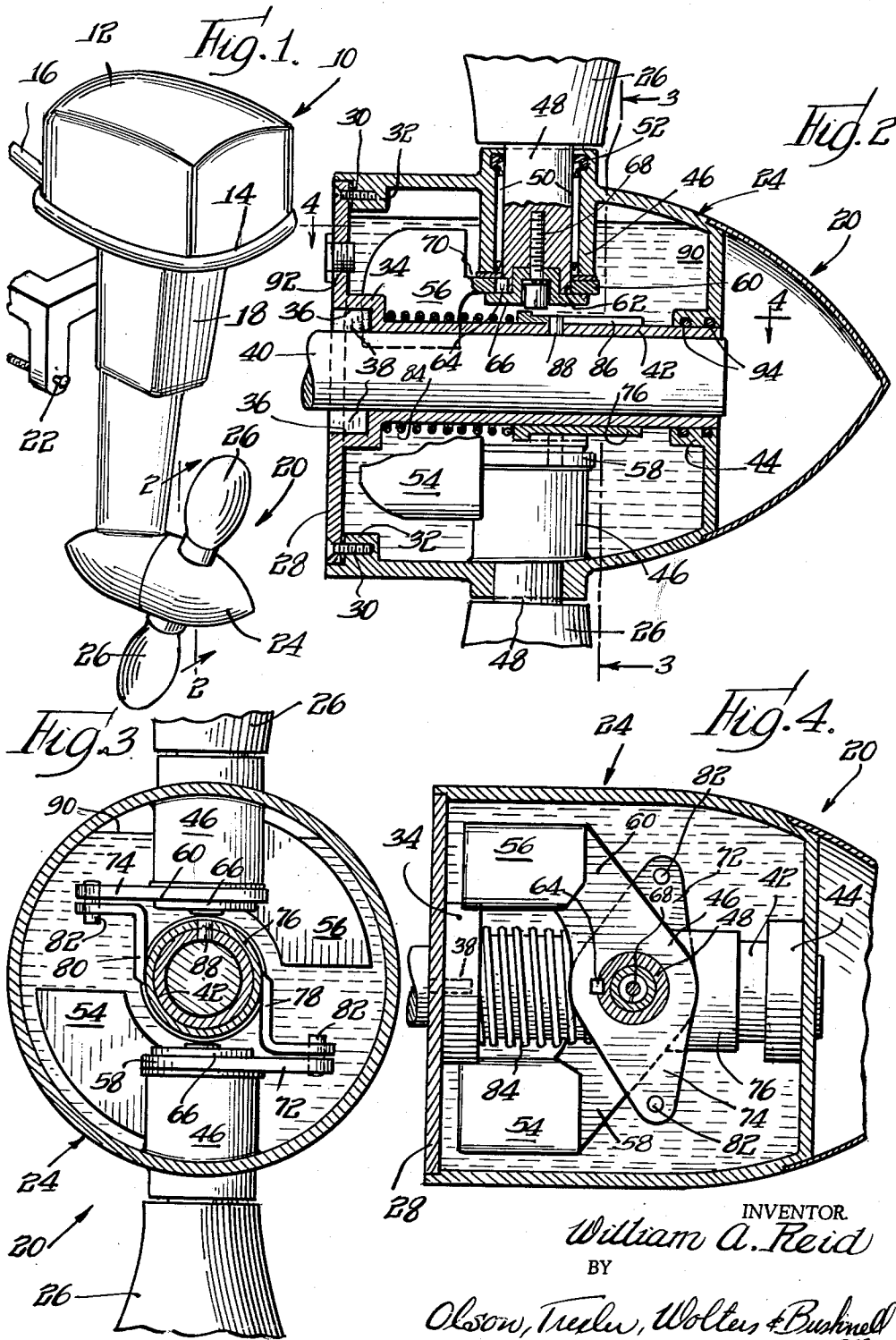
April 13, 1965

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3,177,948

VARIABLE PITCH PROPELLER

Filed Oct. 1, 1962



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3,177,948

VARIABLE PITCH PROPELLER

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Filed Oct. 1, 1962, Ser. No. 227,447

1 Claim. (Cl. 170-160.18)

This invention relates generally to systems of providing motive power for small boats and more particularly to a variable pitch propeller for use in such systems.

In the past, it has been common practice for fishermen to equip their boats with two separate power systems, a conventional, gasoline-powered outboard motor for rapid transportation of the boat from one location to another and an electrically operated trolling motor for low speed propulsion of the boat over the actual fishing waters. It is a well-known fact that operation of a conventional outboard motor at trolling speeds is generally unsatisfactory due to inadequate purging of the cylinders and resultant fouling of valve components and spark plugs. This situation has led to the introduction and use of the auxiliary trolling motor. However, the heavy, gasoline-powered outboard motor must be removed and replaced with the smaller trolling motor at the fishing waters; and it is generally recognized that this is a cumbersome and dangerous task.

Therefore, an important object of the invention is to provide a variable pitch propeller which is automatically feathered upon reducing its speed of rotation whereby to permit propulsion of the boat at trolling speeds while powering the gasoline motor at a rate which insures clean and efficient operation.

A more general object of the invention is to provide a new and improved variable pitch propeller arrangement.

Another object of the invention is to provide a variable pitch propeller arrangement which assures equal advance of the individual propeller blades.

Still another object of the invention is to provide a variable pitch propeller arrangement in which the variation in the pitch of the blades is achieved in a smooth and positive manner.

A further object of the invention is to provide a variable pitch propeller arrangement in which damping means are incorporated to prevent abrupt and excessive changes in the pitch of the propeller blades.

These and other objects and features of the invention will become more apparent from a reading of the following descriptions.

A variable pitch propeller arrangement in accord with the invention includes a hub, propeller blades that are journaled to the hub for rotation about axes that are disposed perpendicularly to the hub axis, weights individually coupled to the propeller blades in order to rotate the blades in response to rotation of the hub, and means biasing the blades against the action of the weights.

In order that the principles of the invention may be readily understood, a single embodiment thereof, but to which the application is not to be restricted however, is shown in the accompanying drawing wherein:

FIG. 1 is a perspective view of a gasoline-powered outboard motor equipped with a variable pitch propeller that is constructed in accordance with the invention;

FIG. 2 is an enlarged, side elevational view in cross-section taken substantially along the line 2-2 of FIG. 1;

FIG. 3 is an end elevational view in cross-section taken substantially along the line 3-3 of FIG. 2; and

FIG. 4 is a plan view in cross-section taken substantially along the line 4-4 of FIG. 2.

Referring now in detail to the drawing, specifically to FIG. 1, an outboard motor indicated generally by the numeral 10 will be seen to include a hood 12 which covers the major portions of a gasoline engine 14. A control handle 16 is provided for directing operation of the

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engine 14 and dirigible control of the boat being powered by the outboard motor. A leg 18 depends from the engine 14 to have a propeller arrangement 20 mounted to its nether end in drivable relationship with the engine 14.

A transom bracket 22 is connected to the leg 18 intermediate the ends thereof for use in mounting the outboard motor 10 to a boat which it is desired to propel. The propeller arrangement 20 includes a conical hub 24 and two or more blades 26. The hub 24 is adapted to be rotated about its longitudinal axis which is disposed substantially horizontally, and the blades 26, being fabricated with fixed curvature or pitch, are journaled to the hub 24 for rotation about axes that are disposed perpendicularly to the axis of the hub. Turning to a consideration of FIGS. 2-4, the hub 24 will be seen fashioned as a substantially hollow member which is closed off by means of a plate 28, the shanks of screws 30 passing through bores in the plate 28 threadedly to engage bosses 32 formed adjacent the terminal periphery of hub 24. The plate 28 is formed with a perforated, central boss 34 which extends into the hollow hub 24 and which has diametric slots 36 for receiving sheer pins 38 in coupling the hub 24 to a drive shaft 40. Advantageously, the central boss 34 merges into a sleeve 42, sleeve 42 extending longitudinally through the hub 24 to engage and be received in the central bore of a boss 44 formed in the fore end of the hub.

The hub 24 is also fashioned with radial sleeves 46 which rotatably receive the shafts 48 of propeller blades 26. Needle bearings 50 and oil seal 52 are employed in mounting the shafts 48 in the radial sleeves 46, as is best shown in FIG. 2.

In compliance with the invention, relative massive members or weights are individually coupled to each of the blades 26 to rotate the blades in response to rotation of the hub 24. Specifically, weights 54 and 56 are disposed within the hub 24 spaced apart from the walls thereof for free radial movement therein. The weights 54 and 56 are fashioned with relatively lightweight, integral flanges 58 and 60 respectively, and these flanges are employed in coupling the weights 54 and 56 individually to the blades 26 spaced therefrom. Advantageously, the weights and their integral flanges are fashioned from a suitable metal such as low carbon steel. As is best shown in FIG. 2, the flange 60 is fashioned with a central aperture 62 that receives the end of propeller shaft 48. A square key 64 non-rotatably joins the flange 60 to the shaft 48, and a recessed washer 66 is fastened to the shaft 48 by a socket-head set screw 68, the annular flange of washer 66 confining flange 60 against axial movement relative to the shaft 48. Advantageously, a thrust washer 70 is interposed between the flange 60 and the end of sleeve 46. Weight 54 is rotatably mounted to the other shaft 48 in a similar manner.

Being thus mounted to the blades 26 for rotation about the axes of the shafts thereof, the weights 54 and 56 are able to respond to the centrifugal force developed by rotation of the hub 24, this response taking the form of radially outward movement of the weights. In compliance with a feature of the invention, this potential movement of the weights 54 and 56 is controlled by biasing means acting to restrain the blades 26 against the action of the weights. Therefore, the flanges 58 and 60 are fashioned with arm extensions 72 and 74 respectively; and these arms extend radially away from the respective weight as shown in FIG. 3. The arm extensions 72 and 74 are coupled to a sleeve 76 that is slidably mounted on the sleeve 42. More specifically, L-shaped links 78 and 80 are secured to the sleeve 76 by weldments or other suitable means; and pivot pins 82 are employed in swingably coupling link 78 with arm extension 72 and link 80 with arm extension 74. A compression spring 84 is dis-

posed over sleeve 42 between the boss 34 and one end of the sleeve 76 in order to bias sleeve 76 toward the fore end of hub 24 and in order to bias the blades 26 into a feathered condition. As is shown in FIG. 2, the sleeve 76 is provided with an axial slot 86 and a stop pin 88 is fastened radially to the sleeve 42 whereby to limit the movement of sleeve 76 toward the fore end of the hub.

In accordance with another feature of the invention, means are provided for damping the movement of the weights 54 and 56. In the illustrated embodiment, this damping means comprises a quantity 90 of viscous lubricating oil filled into the hub 24 through a plugged aperture 92 in plate 28. The hub is advantageously filled to approximately three-fourths capacity with the damping fluid, and when the damping fluid takes the specific form of lubricating oil as disclosed immediately hereinabove, lubrication of the moving parts is additionally achieved. In order to seal the hub and contain the damping fluid, suitable seals are provided at all points of potential egress. For example, O-rings 94 are situated in annular grooves formed in the boss 44 surrounding the sleeve 42.

Having thus described one embodiment of the invention, it is important now to state how the illustrated embodiment operates.

When the propeller arrangement 20 is rotated at a speed such that the centrifugal force acting on weights 54 and 56 is insufficient to overcome the force of spring 84, the parts will be disposed in the positions shown in FIGS. 2-4. This is associated with the feathered or trolling configuration of the propeller blades 26. The parts are also disposed in this position when the propeller arrangement is at rest. It will be observed that the force of spring 84 holds the weights 54 and 56 relatively closely to the sleeve 42 in this position.

When the speed of rotation of the propeller arrangement is increased to a value where centrifugal force, acting on the weights 54 and 56, begins to overcome the force of spring 84, the weights will tend to move radially outwardly relative to the axis of shaft 40. This radial outward movement of the weights is realized as a rotation of the corresponding flanges 58 and 60 about the axes of the corresponding propeller blades 26. Due to the connection of the flanges to the respective propeller shafts, a rotation of the blades results, the blades assuming a more steeply pitched angle whereby to apply a more aggressive driving force to the surrounding watery medium.

The radially outward movement of the weights, in addition, causes the corresponding arm extensions to rotate about the axes of the propeller blades; and this movement of the arm extensions is transmitted to the sleeve 76 by the pins 82 and the links 78 and 80. A compression of the spring thus takes place when the centrifugal force acting on the weights is sufficient to overcome the force of the spring. Similarly, when the centrifugal force is diminished, as for example upon throttling of the engine 14, the spring 84 once again becomes the controlling element whereby to urge the sleeve 86 to the end of its travel. The links 78 and 80 and the pins 82 transfer this latter movement to rotation of the arm extensions 72 and 74 whereby to reset the weights 54 and 56 in close proximity to the sleeve 76 as shown in the figures.

A concomitant rotation of the blades 26 to their feathered position results.

The movements of weights 54 and 56 are smoothed by the damping action of the quantity 90 of the damping fluid; and in addition to this damping action, it should be observed that the disclosed arrangement insures equal movements of the several propeller blades.

The specific example herein shown and described is to be considered as being primarily illustrative. Various changes in structure will, no doubt, occur to those skilled in the art; and these changes are to be understood as forming a part of this invention insofar as they fall within the true spirit and scope of the appended claim.

The invention is claimed as follows:

A variable pitch propeller arrangement for use with marine-type outboard motors, comprising: a hub mounted for rotation about an axis, said hub including a hollow body, an axial sleeve extending a substantial distance through the interior of said body, and a boss encircling said axial sleeve at one end thereof; a drive shaft in said sleeve non-rotatably interconnected to said hub; propeller blades journaled to said hub for rotation about axes that are disposed perpendicularly with respect to said hub axis; weights individually coupled to each of said blades inside said hub to rotate said blades about their respective axes in response to the speed of rotation of said hub; a moderately viscous fluid inside said hub body in contact with said weights to damp the movements thereof; and means biasing said blades against the action of said weights, including a movable sleeve telescopically mounted on said axial sleeve to slide reciprocally in the direction of said hub axis, a flange-like member fixed to each of said weights and including an arm portion which extends radially beyond the corresponding blade in a direction away from the weight, L-shaped links rigidly connected to said movable sleeve and individually pivotally mounted to the extremities of said arm portions, and a compression spring aligned with said movable sleeve in abutting relationship with one end thereof and acting between said movable sleeve and said boss to urge said weights in a direction generally toward said hub axis, said biasing means tending to preserve the rest position of said blades upon moderately low speed rotation of said hub whereby to maintain the trolling pitch of said blades, the centrifugal force acting on said weights upon rapid rotation of said hub being transmitted to said movable sleeve by said links and said flange-like members for overcoming the resistance of said spring whereby to rotate said blades about their respective axes and into high speed transport pitch.

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