Nov. 9, 1965 S. M. CURIONI 3,216,507

ADJUSTABLE PITCH PROPELLER

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Fig. 1

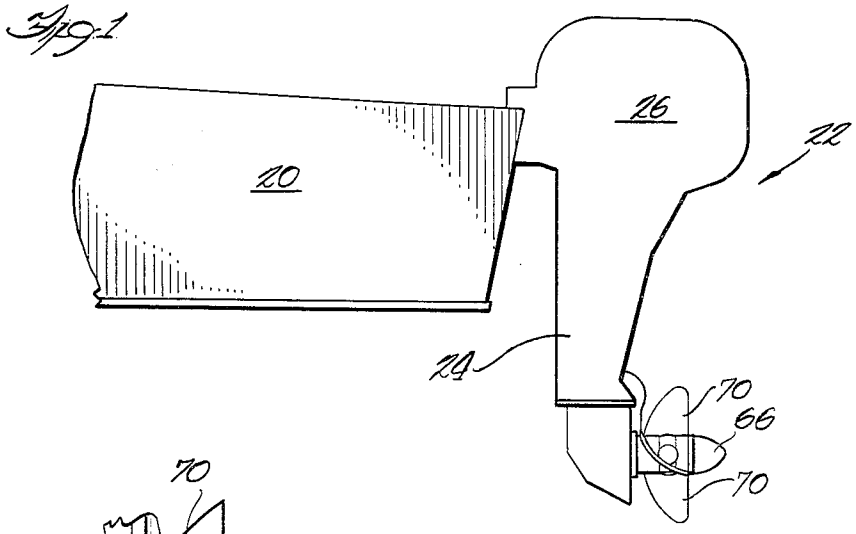


Fig. 3

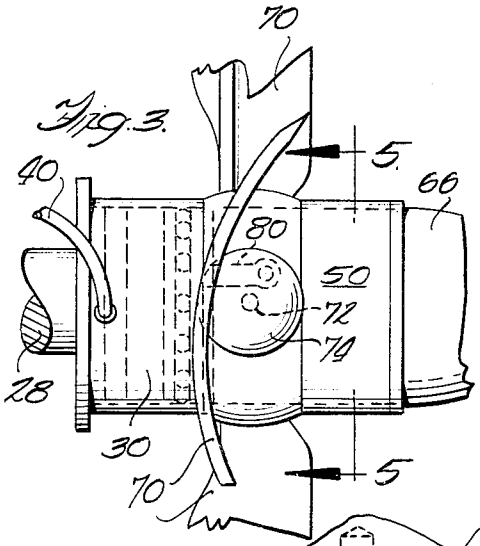


Fig. 4

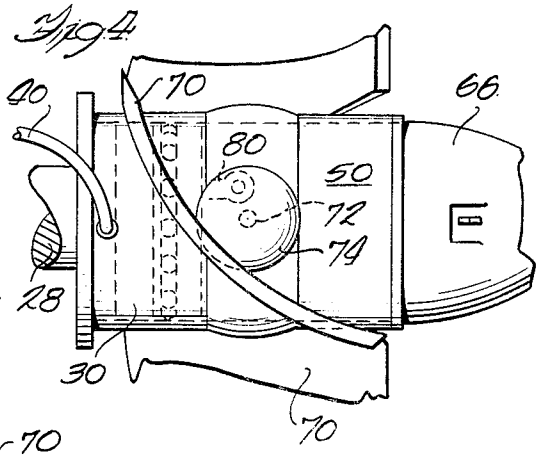
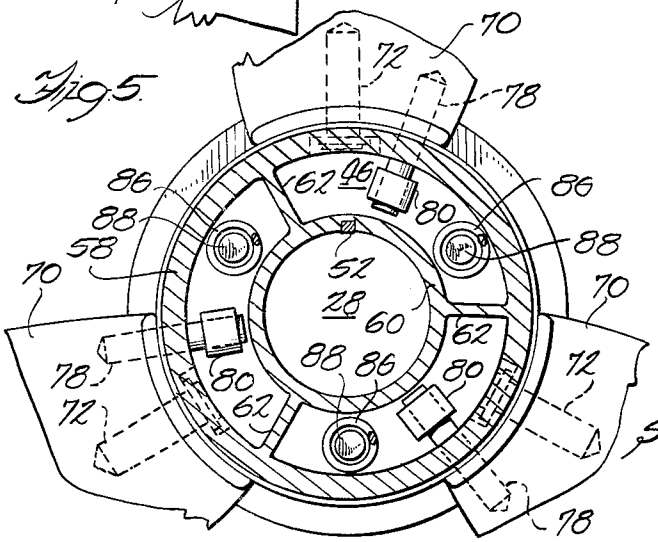


Fig. 5



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Fig. 2.

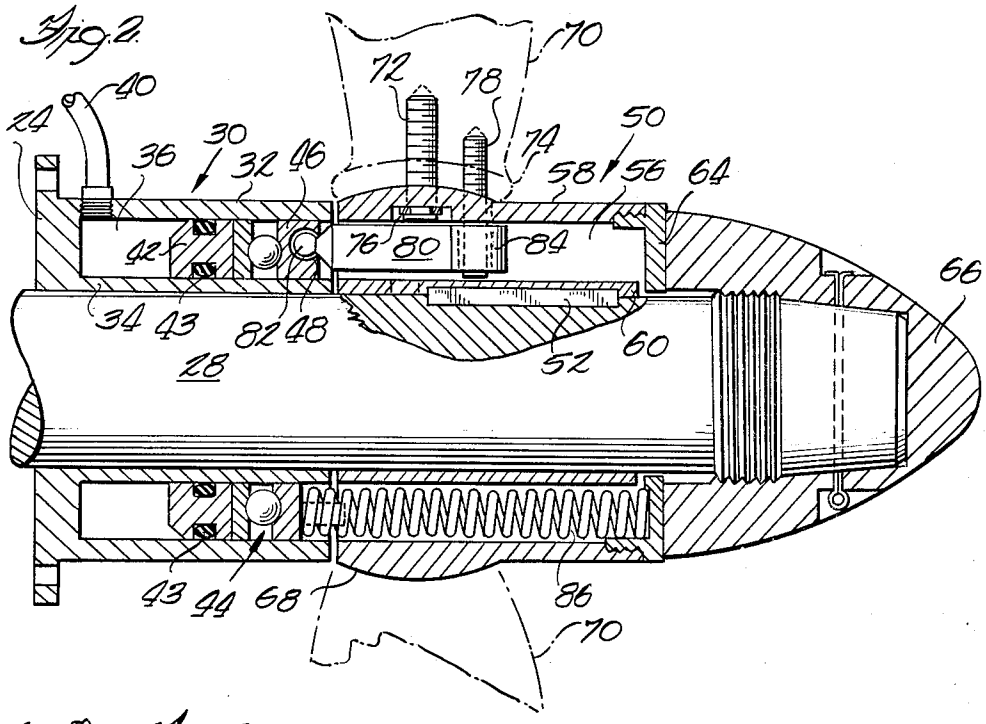


Fig. 6.

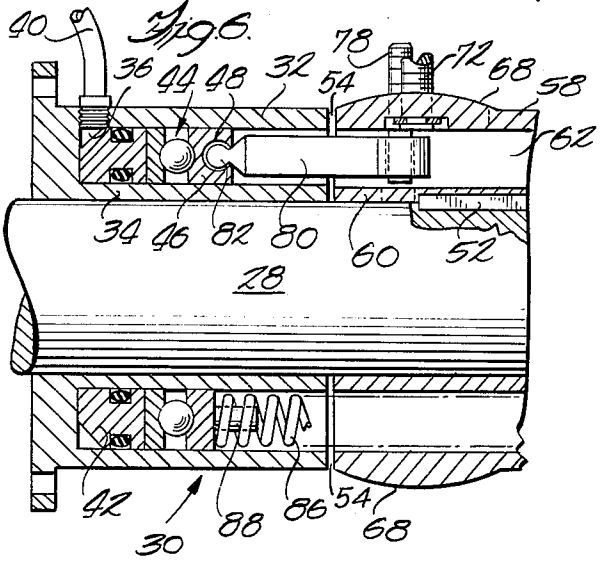
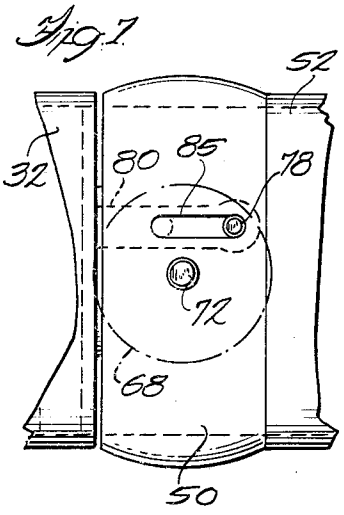


Fig. 7.



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ADJUSTABLE PITCH PROPELLER

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This invention relates to propeller devices and more particularly to adjustable pitch blade propellers for use on boat outboard motors.

It has long been known that propeller blades for driving a vehicle through a fluid should have a low pitch for providing maximum force to the vehicle for acceleration. At high vehicle speeds, however, the blade pitch should be increased to reduce engine r.m.p. while maintaining the vehicle speed. It is apparent, then, that the pitch of the propeller blades need be varied in relation to the vehicle motion and therefore must be controllable through suitable mechanism while the craft is in motion, preferably from a location remote from the engine, such as near the operator.

Variable pitch propellers for aircraft and certain marine vessels, while known in the art, have generally been complex and consequently expensive mechanisms. Such devices, therefore, are not suitable for application to outboard engine marine vehicles because of prohibitive cost, weight and reliability.

Accordingly, it is an object of the present invention to provide an adjustable pitch propeller apparatus for use on boat outboard motors which may be used to change the blade pitch according to the varying boat speed and load.

It is another object of the present invention to provide an adjustable pitch propeller apparatus for an outboard motor the blade position being hydraulically controlled from a remote location.

It is still another object of the present invention to provide an adjustable pitch propeller apparatus for an outboard motor in which the control arm for the blade position is biased to maintain a low blade pitch position.

For a better understanding of the invention, together with other and further objects thereof, reference should now be made to the following detailed description which is to be read in conjunction with the accompanying drawings in which:

FIGURE 1 is an elevational view of a boat stern having an outboard motor attached thereto for use with a variable pitch propeller apparatus;

FIGURE 2 is a sectional elevation view of a variable pitch propeller apparatus;

FIGURE 3 is a plan view of the variable pitch propeller apparatus of FIGURES 1 and 2 shown in a low-pitch position;

FIGURE 4 is a plan view of the variable pitch propeller apparatus of FIGURES 1 and 2 shown in a high-pitch position;

FIGURE 5 is a sectional end view of a variable pitch propeller apparatus;

FIGURE 6 is a sectional elevation view of a portion of the variable pitch propeller apparatus shown in FIGURE 2 in the high-pitch position; and

FIGURE 7 is a plan view of the variable pitch propeller apparatus showing in detail the control elements.

Referring now to FIGURE 1, there is shown a boat stern **20** to which is mounted an outboard motor **22**. A housing **24** depends from the engine housing **26** and contains a vertically disposed first drive shaft (not shown) which engages a horizontally disposed second drive shaft **28**. The latter shaft extends into a fixed housing **30** connected to the depending housing **24** and is rotatable therein. As seen best in FIGURE 2, the fixed housing **30** comprises an outer wall **32** and an inner wall **34** defining an annular space **36**. A hydraulic or fluid line **40** is

connected to the outer wall **32** for pressurizing the space **36** upon actuation of a hydraulic piston control device (not shown) remotely mounted from the engine such as near the boat operator. A piston **42** having sealing rings **43** is disposed in annular space **36** and adapted to slide rearwardly, upon application of hydraulic pressure, against a thrust bearing **44**. The thrust bearing has a rear or outer race **46** defining a plurality of sockets **48**.

Rearwardly adjacent the fixed housing **30** is a rotatable housing **50** which is connected to shaft **28** through key **52** for rotation. A space **54** may be sealed to prevent water from entering the chamber **56** by suitable means well known in the art. The housing **50** has an outer wall **58** and an inner wall **60** connected by members **62**. A sealing plate **64** is threaded into the aft end of outer wall **58**, and a hub **66** is threaded on the end of drive shaft **28** to secure the rotatable housing **50** in place. The housing **50** forms a convex spherical bearing surface **68**. Blades **70** are secured to housing **50** by studs **72**. The studs **72** are mounted in base **74** of the blades and are rotatably secured in the housing **50** by a snap ring **76**. The under surface of base **74** is formed as a concave spherical bearing surface for mating with the spherical bearing surface **68** formed by the rotatable housing. The blades **70** rotate about the studs **72**. Studs **78** are secured in base **74** at a spaced apart location from the studs **72**.

Control arms **80** each have a ball **82** which engages one of the sockets **48** and are disposed in chamber **56** for slidable translation therein. The rearward end of each control arm **80** has an opening **84**. The housing **50** has slots **85**, as seen in FIGURE 7, through which pass studs **72** which engage the openings **84** in control arms **80**.

A plurality of compression springs **86** are disposed in chamber **56**, each spring being mounted on one end over a guide pin **88**.

The variable pitch propeller apparatus is set in the low-pitch position, as shown in FIGURES 2 and 3 for accelerating the boat. In this position, hydraulic pressure applied to annular space **36** displaces piston **42** and control arms **80** overcoming the bias of spring **86** and thereby rotating blades **70**. When the boat reaches cruising speed, the operator may relieve the hydraulic pressure so that spring **86** forces piston **42** forwardly and the blades **70** are rotated into a high-pitch position as shown in FIGURES 4 and 6.

While a particular embodiment of the present invention has been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects. Accordingly, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

I claim:

1. An adjustable pitch propeller apparatus for attachment to the drive shaft of a boat motor comprising:

(a) a first fixed annular wall surrounding a drive shaft of a boat motor,

(b) a second fixed annular wall spaced apart from said first wall and forming an annular hydraulic chamber therebetween,

(c) an annular piston slidably disposed in said hydraulic chamber,

(d) an annular thrust bearing slidably disposed in said hydraulic chamber adjacent said piston, said bearing having a plurality of sockets formed in one race,

(e) a rotatble housing surrounding said drive shaft adjacent said first and second fixed annular walls,

(f) a plurality of radially extending adjustable pitch propeller blades rotatably mounted on said rotatable housing,

(g) a plurality of control arms slidably disposed within

said rotatable housing and between said first and second walls, one end of each of said control arms having a ball engaging one of said sockets formed in said thrust bearing race,

(h) a plurality of pins, one of said pins mounted in each of said blades at a spaced apart location from said rotatable mountings, each of said pins depending into said rotatable housing and engaging the other end of each of said control arms, whereby translation of said control arms rotates said propeller blades so as to change the pitch of the blades,

(i) means interconnecting said rotatable housing and the drive shaft, and

(j) resilient means for biasing said annular piston.

2. An adjustable pitch propeller apparatus for attachment to the drive shaft of a boat motor comprising:

(a) a fixed housing defining an annular hydraulic chamber and having a bore coaxial with said chamber and extending through said housing for receiving a drive shaft of a boat motor.

(b) an annular piston slidably disposed in said hydraulic chamber,

(c) an annular thrust bearing slidably disposed in said hydraulic chamber adjacent said piston, said bearing having a plurality of sockets formed in one race,

(d) a rotatable housing having a bore therethrough, coaxially aligned with the bore of said fixed housing for receiving the drive shaft,

(e) said rotatable housing forming a convex spherical bearing surface,

(f) a plurality of radially extending adjustable pitch propeller blades, each of said propeller blades having a base,

(g) said adjustable pitch propeller blade bases having concave spherical bearing undersurfaces, each of said blade bases rotatably mounted on said rotatable housing and engaging said convex spherical bearing surface formed by said rotatable housing,

(h) a plurality of control arms disposed within said rotatable housing and said fixed housing annular chamber, one end of each of said control arms having a ball engaging one of said thrust bearing sockets,

(i) a plurality of pins, each of said pins depending from said propeller blade bases at a spaced-apart location from said rotatable mounting, each of said pins engaging the other end of one of said control arms,

(j) means for interconnecting said rotatable housing with the drive shaft of a boat motor, and

(k) resilient means for biasing said annular piston.

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