

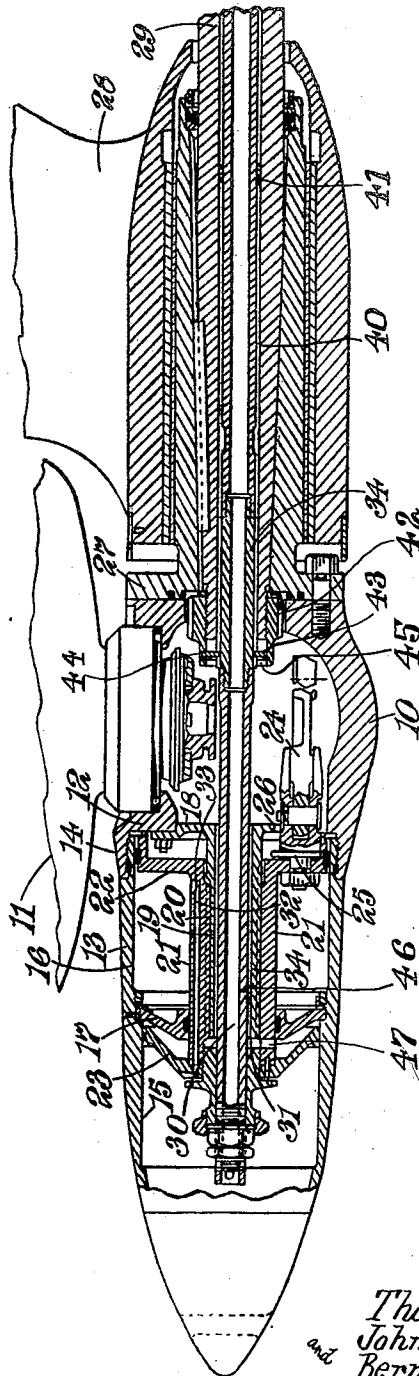
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T. E. GODDEN ET AL

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SCREW PROPELLER

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SCREW PROPELLER

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2 Claims. (Cl. 170—160.32)

1

This invention relates to screw-propellers of the hydraulically-operated variable-pitch type and is particularly, although not exclusively, suitable with propellers intended for marine propulsion.

In such variable-pitch propellers the blades are rotatably mounted in a small-diameter hub and pitch-changing movements are imparted to the blades by a hydraulic pitch-changing motor comprising a piston sliding within a cylinder which is formed as a faired rearward extension of the hub. If the dimensions of the hub and cylinder are to be kept small, the problem arises of obtaining sufficient power for effecting pitch-changing movements without using excessively high fluid-pressures, and an object of this invention is to provide a construction whereby this is achieved.

According to this invention, a pitch-changing motor for a variable-pitch screw-propeller comprises a plurality of hydraulic rams having their movable elements connected in tandem and to the blades. Preferably the two rams are situated adjacent one another in an extension of the propeller-hub.

According to another feature of this invention, the pitch-changing motor comprises two co-axial cylinders separated by a partition, a piston-carrying element extending through said partition and carrying two pistons, one in each cylinder, and means coupling them to the blades of the propeller. The said piston-carrying element may be formed with a passage or passages providing communication between the cylinders on the sides of their pistons remote from the hub.

According to another feature of this invention the said piston-carrying element is mounted to slide on a fixed tubular member, which member provides communication from the interior of the hub to the cylinder remote from the hub on the nearer side of its piston.

According to another feature of this invention, the piston which is more remote from the hub carries a tube extending through said piston-carrying element, and the hub into the driving shaft of the propeller for the supply of working fluid to the cylinders.

The accompanying drawing is a longitudinal sectional view of a pitch-changing motor according to the present invention, applied to a marine propeller.

The hub of the propeller 10 whereof one of the blades is shown at 11, has mounted upon its rear wall 12 the usual form of streamlined boss 13 extending aft from it, but this boss is, in the present

2

invention, hollow and forms two operating cylinders for a hydraulic pitch-changing motor. The boss 13 is preferably secured to the hub 10 by being screwed into a flange 14 thereof, and it is bored internally to provide two cylinders 15, 16, of which the cylinder 15 is somewhat smaller in diameter to be accommodated within the tapering outside formation of the boss.

Between the two cylinders there is provided a partition 17 which constitutes the rear end wall of the cylinder 16 and the forward end wall of the cylinder 15. On the end wall 12 of the hub, which is provided with a central aperture, there is mounted a bridge-piece 18 which carries, or has formed integrally with it, an extension or fixed cylindrical member 19 which is splined on its outer surface at 20 to receive a correspondingly splined piston-carrying element or sleeve 21. The piston-carrying element or sleeve 21 carries a piston 22 at its forward end, reciprocable in the cylinder 16, and a piston 23 at its rear end, reciprocable in the cylinder 15 so that these two pistons are rigidly connected together in tandem. The piston 22 is connected by links 24, to the root end of each blade within the hub 10 for the purpose of effecting their pitch-changing movements. The links 24 are pivoted to knuckle members 25 which extend through openings 26 in the bridge-piece 18 aforesaid.

The hub 10 is mounted by an adaptor 27, which is rotatable in the usual A-bracket 28 on the driving-shaft 29 for the propeller, and pressure-fluid is supplied to the hydraulic cylinders 15, 16 in the following manner.

Upon the rear piston 23, there is mounted a tube 30 which extends forward through the piston-carrying element 21, through the hub and into the propeller-shaft 29; this tube is conveniently made in sections screwed together to provide the necessary length, and one section of the tube at 34, adjacent the end of the propeller-shaft is splined thereto, so that when the propeller and hub are removed, the portion of the tube 30 which it encloses is also withdrawn and is not left projecting from the shaft. This avoids possible damage to the tube and facilitates the assembly; also the splined fitting of the part 34 prevents the various parts of the tube becoming unscrewed from one another.

The tube 30 extends into the propeller-shaft to a suitable point therein at which communication is made with it by a running joint for the supply of pressure-fluid; as the tube 30 is mounted on rear piston 23 (as shown in the drawing) it will be reciprocated with movements of piston

3

23 and the running joint referred to also allows for such axial movements of the tube. A second running joint is provided on shaft 29. The annular space 40 between shaft 29 and tube 30 communicates, at one end, with one of the running joints referred to and, at the other end, with hub 10. The tube 30 is supported within shaft 29 by a bearing 41 having passages which allow pressure fluid to flow past the bearing and along space 40. The shaft 29 receives a nut 42 which is locked against rotation, in well known manner, by a ring 43 which is toothed to engage the splines 34 and has a lug 44 to enter a groove in the nut. The ring is held with the lug 44 within the groove by a spring clip 45. The ring 43 has holes through it to allow the annular space 40 to communicate with the interior of hub 10.

The pressure fluid is controlled in conventional manner to pass either along tube 30 to the hydraulic cylinders 15, 16—at the same time the annular space 40 and hub 10 are connected to exhaust—or along space 40 to the interior of hub 10 and thence both through openings 26 to cylinder 16 and through an annular passage 46 to cylinder 15—at the same time the tube 30 is connected to exhaust. The passage of pressure fluid to, and from, the tandem cylinders is controlled in any convenient manner, either manually or automatically as may be desired such mechanism being well known in connection with variable-pitch airscrews.

The tube 30 does not communicate directly with cylinder 16 but, as will be seen in the drawing, the tube opens to the rear side of piston 23, and communication is provided therefrom to the rear side of piston 22 by passages 32, formed in the piston-carrying element 21, and openings 33.

Direct communication takes place between the interior of hub 10 and cylinder 16 through openings 26. The interior of the hub 10 communicates with cylinder 15 by passage 46 and radial ports 31 and 47. The latter is a fixed size but as the piston 23 moves rearwardly, taking tube 30 with it while member 19 remains stationary, the port 31 is elongated and communication between the passage 46 and the forward side of piston 23 is thereby maintained throughout the full stroke of said piston in both directions. Normally the pistons 22, 23 are more centrally located in their cylinders than has been shown in the drawing in which case, for movements in one direction, the port 31 is reduced in size to the minimum shown in the drawing and, for movements in the other direction, the port is enlarged.

In the operation of this mechanism, pitch-changing movements of the blades 11 of the propeller are effected in one direction by supplying pressure-fluid to the interior of the tube 30 and connecting the annular space around it to exhaust. Pressure-fluid thereby passes to the rear side of the piston 23 in the cylinder 15 and thence to the rear side of the piston 22 in the cylinder 16 so that the piston is moved forward. For adjustment of the pitch in the opposite direction, the interior of the tube 30 is connected to drain and pressure-fluid is supplied to the annular space around the tube 30 within the shaft 29 which communicates by the interior of the hub 10 and the passages 26 with the forward side of the piston 22, and by the interior of the splined tube 19 with the forward side of the piston 23 so that the pistons are moved rearwardly.

It will be seen that this invention provides a

4

complete pitch-changing mechanism which is totally enclosed within the usual fairing of the propeller boss and in which the effective piston-area is nearly double that which is available with the usual arrangement of single hydraulic ram, so that ample power is rendered available for pitch-changing purposes without the use of excessively high fluid-pressures, and without the use of an undesirably large piston in the propeller boss.

We claim:

1. For use with a rotary propeller hub, the interior of which is selectively connectible with a source of active fluid supply and with exhaust, and angularly adjustable blades, a boss connected with said hub and having an external taper formed progressively away from the hub, cylinders of differential diameters in said boss with the large diameter cylinder next the hub, a partition between said cylinders, pistons reciprocating in said cylinders, a piston-carrying element rigidly connecting said pistons and slidable through said partition, a tube extending through said element with one end selectively connectible with a source of active fluid supply and with exhaust and the other end opening to the smaller diameter cylinder on the side of its piston away from said hub and a fixed member having a cylindrical portion which surrounds and is spaced from said tube to form an inner annular passage which places the smaller diameter cylinder on the side of its piston nearer to said hub in communication with the interior of the hub, said fixed member having a hole for establishing communication between the larger diameter cylinder on the side of its piston nearer to the hub and the interior thereof and said cylindrical portion being nested within, and spaced from, said piston-carrying element to form an outer annular passage which places in communication the smaller and larger diameter cylinders on the side of their pistons away from said hub.

2. The combination of claim 1 characterized by the fact that the rear wall of the propeller hub provides means for detachably connecting the boss and also for detachably connecting a bridge-piece which carries the cylindrical portion of the fixed member.

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Certificate of Correction

Patent No. 2,501,720

March 28, 1950

THOMAS EDWARD GODDEN ET AL.

It is hereby certified that errors appear in the above numbered patent requiring correction as follows:

In the grant, line 16, strike out "December 24, 1963" and insert instead *January 24, 1963*; in the heading to the printed specification, line 8, foreign filing date, for "December 24, 1943" read *January 24, 1943*; line 10, for "December 24, 1963" read *January 24, 1963*;

and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of July, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.