Jan. 25, 1955 P. K. DEWHURST 2,700,359

OUTBOARD SUPPORT FOR STEERABLE PROPELLERS

Filed May 21, 1952 5 Sheets-Sheet 1

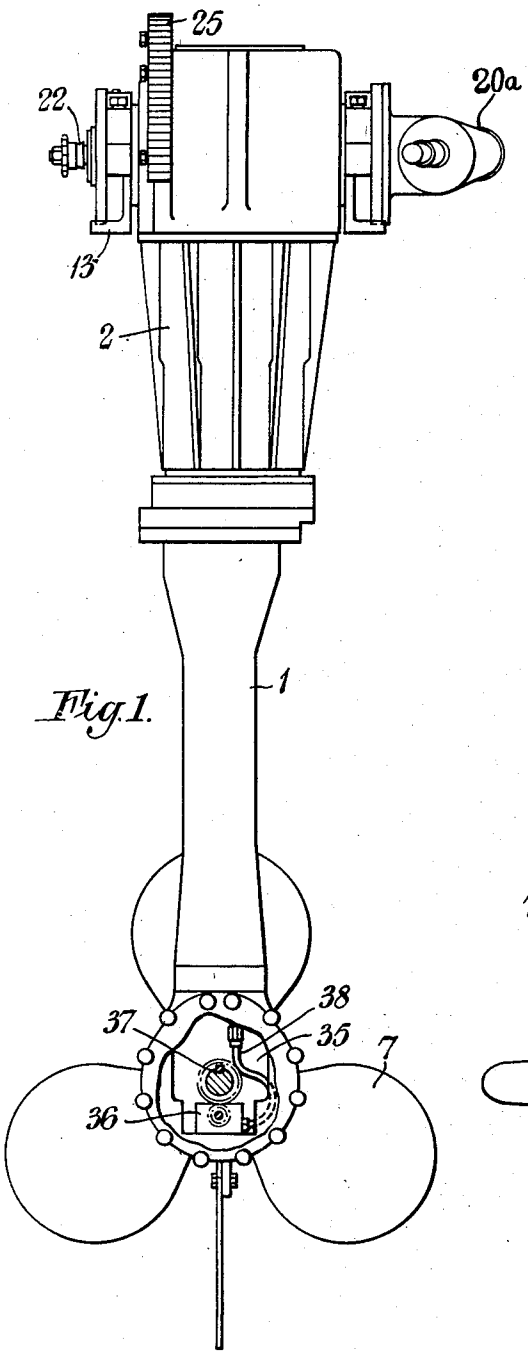


Fig. 1.

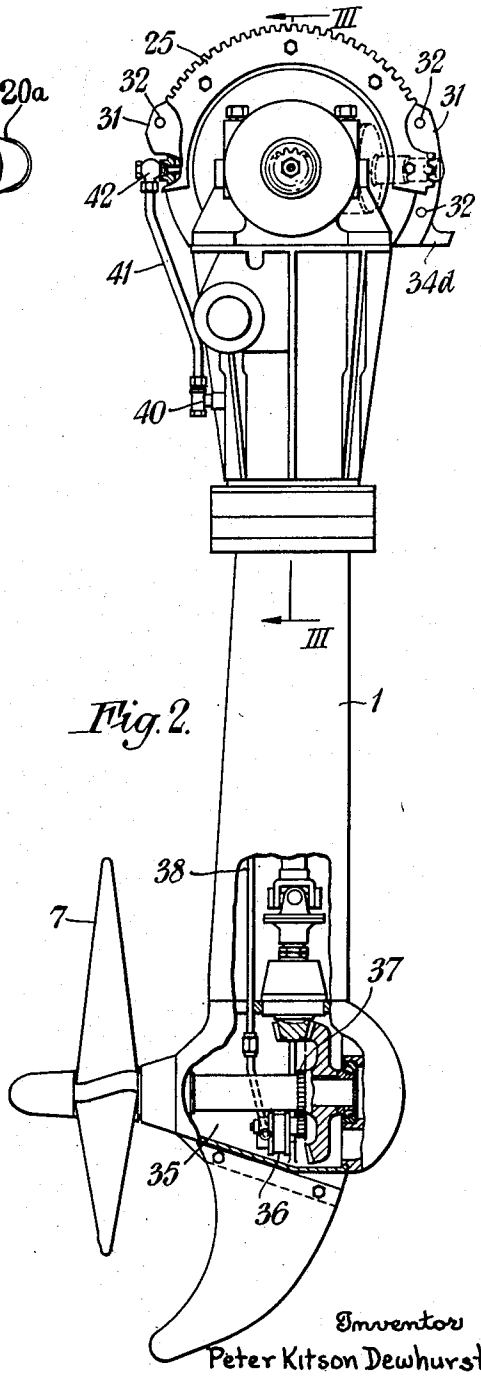


Fig. 2.

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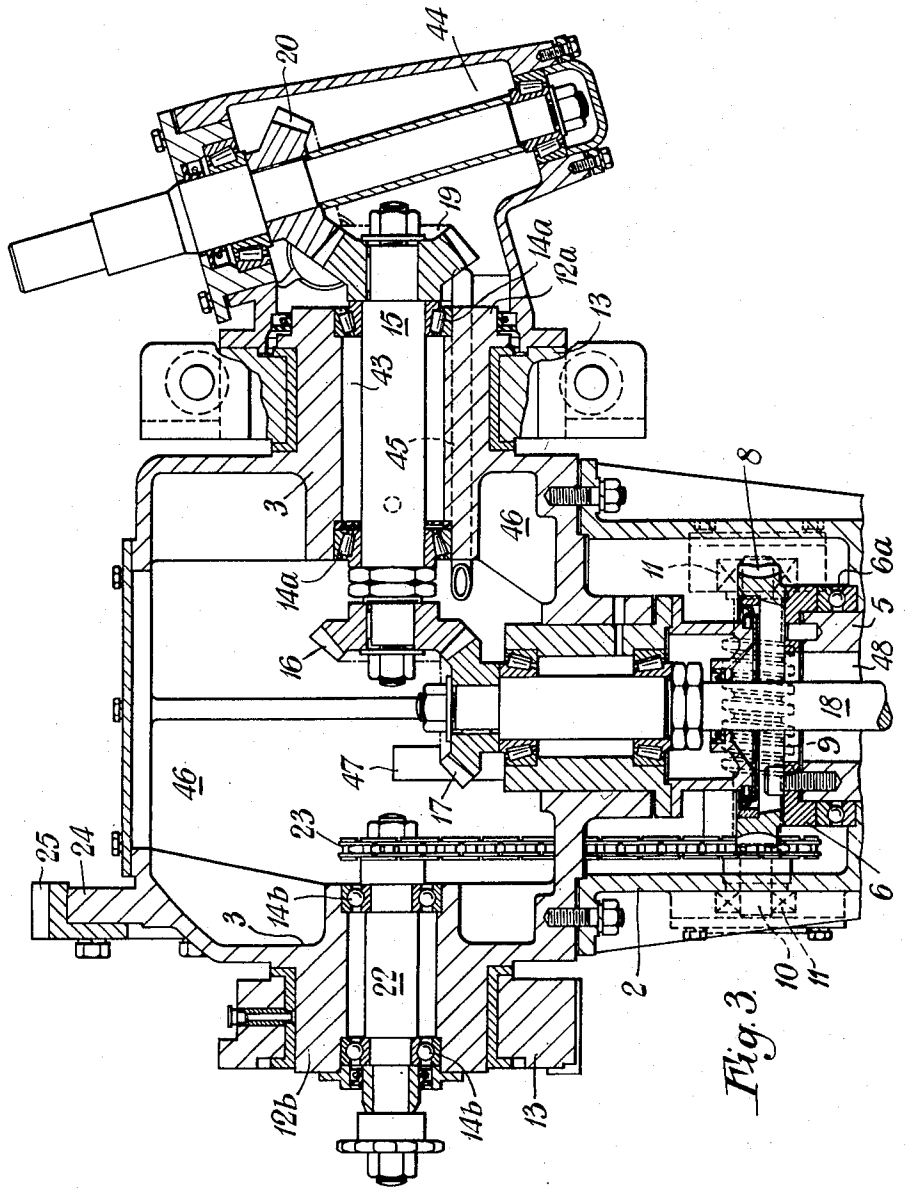


Fig. 3.

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OUTBOARD SUPPORT FOR STEERABLE PROPELLERS

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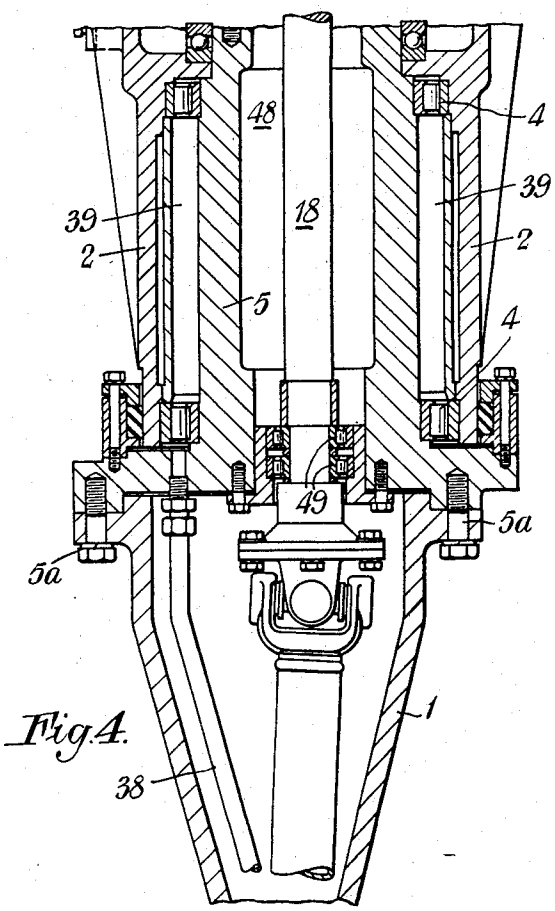


Fig. 4.

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OUTBOARD SUPPORT FOR STEERABLE PROPELLERS

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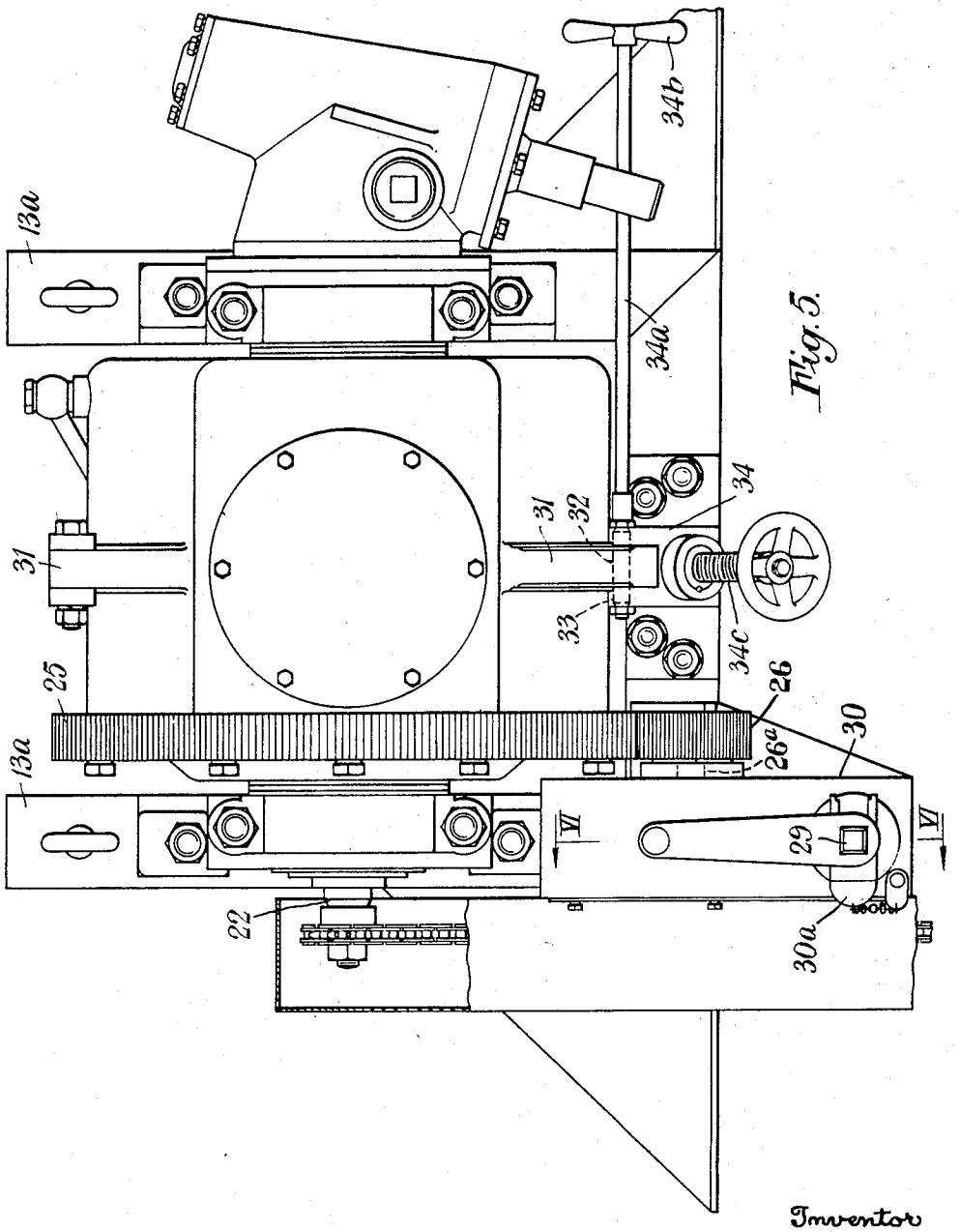


Fig. 5.

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OUTBOARD SUPPORT FOR STEERABLE PROPELLERS

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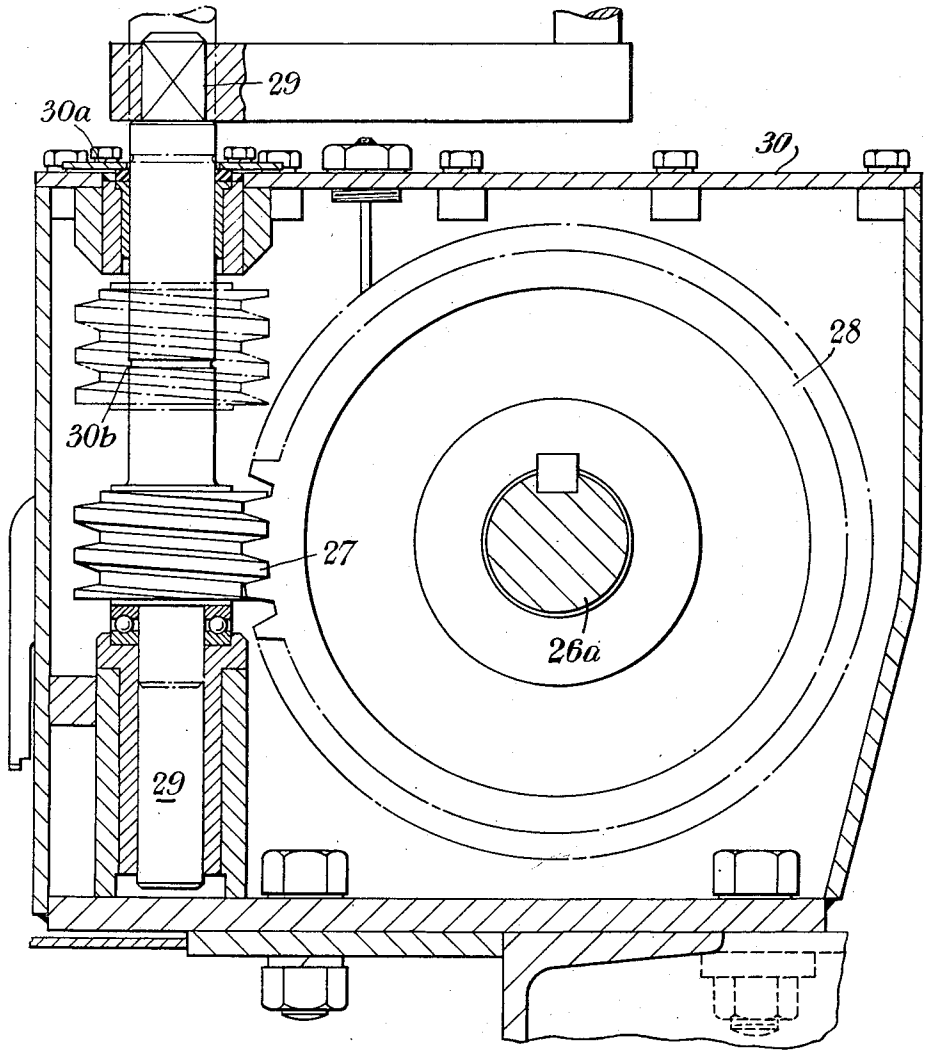


Fig. 6

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United States Patent Office 2,700,359 Patented Jan. 25, 1955

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OUTBOARD SUPPORT FOR STEERABLE PROPELLERS

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Application May 21, 1952, Serial No. 289,152

Claims priority, application Great Britain May 21, 1951

5 Claims. (Cl. 115—35)

This invention relates to outboard propeller mechanisms for barges and other vessels of the kind (hereinafter referred to as the kind described) in which the propeller is carried on a horizontal shaft, a driving shaft by which the propeller is rotated, the driving shaft being mounted so that it can swing upwards either to permit the propeller to clear obstructions in the water, or to raise the propeller entirely out of the water.

The driving shaft is usually enclosed in a hollow stem.

In outboard propeller mechanisms of the kind described as hitherto constructed, it has been customary to transmit the drive to the upper end of the vertical shaft through gearing on an intermediate cross-shaft mounted in bearings co-axially with the axis about which the stem can be swung and carried in a fixed frame about which the upper end of the stem or housing is journalled.

The driving shaft from the power unit which drives the intermediate cross shaft through bevel gearing, has hitherto been positioned so as to enter the upper end of the stem or housing at some point lying between the two bearings in which the upper end of the stem or housing is journalled. This construction has resulted in a relatively complex structure generally taking the form of a fork-shaped structure at the head of the stem, the limbs of the fork embracing the cross shaft and gearing, and since the depending stem must be capable of executing substantially 180° of swinging movement it has not been possible to brace the ends of the limbs of the fork since the main driving shaft from the power unit enters the fixed frame at a point between the limbs. The fork structure at the head of the depending stem has thus of necessity been of complicated design in order to obtain the necessary rigidity of parts, and has thus resulted in relatively high costs of construction and assembly.

In the known outboard propeller mechanisms of the kind described as hitherto constructed, it has also been customary to effect the raising and lowering swinging movements of the hollow stem through a gear train driving a toothed wheel or sector formed on or secured to a boss or trunnion on the upper end of the stem about which the pivotal movement is executed, the said boss or trunnion being carried by horizontally disposed pivots or bearings mounted on a main frame member of the mechanism on the vessel. In this arrangement one or more shear pins have been inserted between flange couplings in the gear train or mechanism for effecting the raising and lowering of the hollow stem in such a manner as to withstand the torque due to the normal operating thrust of the propeller but to fail in shear should an excessive torque be exerted on the hollow stem due to the stem's fouling, say, an underwater obstacle.

This construction suffers from certain disadvantages, notably the rendering inoperative of the raising and lowering mechanism after failure of the shear pin or pins, and also the need for the use of a high grade alloy steel sector and gears due to the small space normally available within the casing of the outboard mechanism and the consequent short face width of the rear teeth transmitting the raising or lowering thrusts.

It is an object of the present invention to provide a construction of outboard propeller mechanism of the kind described in which the structure at the head of the depending stem can be materially simplified.

In outboard propeller mechanisms of the kind described according to the present invention, the vertical driving shaft is mounted for swinging movement on a hollow trunnion and an input drive cross shaft coupled to the vertical driving shaft extends co-axially through the hollow trunnion to be coupled beyond the outer end of the trunnion to an external driving member.

Preferably the mechanism has means to move the vertical driving shaft about the hollow trunnion to effect the raising and lowering of the vertical driving shaft.

Advantageously the mechanism has a lubricating system comprising a pump mounted in a reservoir at the bottom of a hollow stem through which the driving shaft and the propeller shaft extend a pipe extending from said pump to the hollow trunnions, a connection from said trunnions to a box containing the driving gear for the vertical shaft, an overflow pipe in the box delivering to the reservoir.

One form of outboard propeller mechanism according to the invention will now be described by way of example and with reference to the accompanying drawings in which:

Fig. 1 is a rear view partly cut away of part of the outboard propeller mechanism in its lowered position;

Fig. 2 is a side view, partly cut away, of the mechanism shown in Fig. 1;

Figs. 3 and 4 are sectional views taken on the line III—III Fig. 2 but with the supporting framework removed;

Fig. 4 being a continuation of Fig. 3;

Fig. 5 is a plan view of mechanism as shown in Fig. 1, and

Fig. 6 is a view showing the releasable connection in the drive to the propeller raising and lowering mechanism on the line VI—VI Fig. 5.

Referring to the drawings a hollow depending stem **1** is rotatable about its vertical axis for steering the vessel and the head structure at the upper end of the stem **1** is of generally T-form in vertical cross-section having a substantially tubular vertical limb **2** and a cross limb **3**. The lower end of the vertical limb **2** constitutes the external housing for a pair of axially spaced roller bearings **4** whose inner races are locked on an upper spigot extension **5** of the depending stem **1**. This extension is fixed to the stem **1** by screws **5***a*. The spigot extension **5** also carries an annular plate **6** which is supported on a ball bearing carried by the limb **2** and thus a bearing supports the weight of the stem **1**. The propeller **7** together with gearing through which it is driven is carried at the lower end of the stem **1**. A worm wheel **8** fixed on the plate **6** is driven by a steering worm **9** mounted on a cross-shaft in bearings **11** in the vertical limb **2** of the head structure. Rotation of the worm **9** thus effects rotation of the stem **1** about its axis relative to the head structure and produces the required steering movements.

The ends of the relatively short cross limb **3** of the T constituting the head structure are formed by coaxial hollow trunnions **12***a*, **12***b* which are supported in a pair of aligned plummer blocks **13** bolted to the main frame **13***a* (Fig. 5) of the outboard mechanism. The outer housing of a ball or roller bearing **14***a* and **14***b* is carried at each end of each hollow trunnion. The inner races of one pair of these bearings are locked to an input drive cross-shaft **15** whose inner end carries a bevel pinion **16** meshing with a bevel gear **17** keyed on the upper end of a vertical driving shaft **18** for the propeller **7**. The outer end of the cross-shaft **15** projects beyond its trunnion **12***a* in which it is journalled and has keyed thereto a bevel or other gear **19** or one member of a coupling, the gear **20** or component of which meshes or co-operates therewith being driven by the power unit **20***a*. This power unit **20***a* may be offset from the fore-and-aft centre line of the outboard mechanism to drive the cross-shaft through the bevel gears **20**, **19** or it may be skewed with relation to the fore-and-aft centre line and similarly geared to the cross-shaft **15**. Alternatively, however, the power unit **20***a* may be mounted with its output shaft co-axially aligned with the cross-shaft **15** and connected thereto by a coupling. As will be understood, any other alternative form of drive to the cross-shaft **15** may be adapted to suit particular circumstances of the craft on which the outboard mechanism is to be mounted.

The hollow trunnion **12***b* on the opposite side of the vertical driving shaft **18** from the input drive cross-shaft

15 accommodates the bearings 14*b* for a steering counter-shaft 22 which is coupled by a chain and sprocket transmission 23 to the steering worm 9 within the head structure, the outer end of the counter-shaft being suitably connected to the steering mechanism (not shown), for example, by means of a further chain and sprocket drive.

The head structure terminates above the trunnions 12*a* and 12*b* between the plummer blocks 13 and is provided with a radial seating 24 to which is bolted a toothed segment 25. This segment 25 is connected to a gear 26 which is secured to a shaft 26*a* keyed to a gear 28 which, in turn, meshes with a worm 27. The worm wheel 27 is connected to the driving mechanism (not shown) for providing the power to move the head structure about the blocks 13 and thereby to raise and to lower the stem 1. As shown in Fig. 6 the worm 27 and gear 26 are located in the housing 30.

The worm 27 is mounted on a vertical shaft 29 capable of being slid axially so as to bring the worm into and out of mesh with the worm wheel 28. A releasable locking device comprising a plate 30*a* is provided for retaining the worm in its inoperative position by engaging an annular groove 30*b* in the shaft 29. When the worm 27 is locked in its inoperative position (shown in dotted lines in Fig. 6) the worm wheel 28 is free to rotate and hence if the stem strikes an underwater obstruction the thrust is not transmitted to the mechanism by which the stem is raised or lowered.

On the other hand if the worm 27 is inadvertently left in its operative position as shown in full lines in Figure 6 and the stem strikes an underwater obstruction the thrust is automatically transferred from the worm wheel 28 to the worm 27 to move the worm 27 with its shaft against gravity or spring pressure until the worm 27 disengages from the worm wheel 28, and the thrust is still not transmitted to the stem raising and lowering mechanism.

Adjacent the toothed segment 25 the head structure is provided with ribs 31 which project radially with respect to the axis of the cross-shaft for a short distance beyond the external surface of the head structure and are provided with locking holes 32 (Fig. 2 and Fig. 5) through any one of which may pass a shear pin 33 carried in a bracket 34 mounted on the outboard mechanism frame. The shear pins are moved into and out of the locking holes 32 by a rod 34*a* carrying a suitable head 43*b*. The holes define alternative positions of the depending stem 1, to allow the stem to be arranged at different inclinations for rise for example in shallow water. When the stem has been moved to its operative, or one of its operative, positions it is locked by means of the shear pin 33 and the worm 27 on the stem swinging mechanism is moved axially to disengage the worm wheel with which it co-operates. If now the lower end of the stem strikes an underwater obstruction while the vessel is under way, the shear pin 33 can break, allowing the stem to swing clear of the obstruction without imposing any strain on the swinging control mechanism. The latter may, therefore, be of a construction which is relatively light and which has only sufficient strength to effect the raising and lowering movements of the stem.

The threaded stem 34*c* screws into the fixed bracket 34 into contact with a stop 34*d* (Fig. 2) on the rib 31. Thus when the required locking hole 32 has been positioned and the shear pin inserted the stem 34*c* is screwed into contact with the stop 34*d*. Should the pin be skewed the stem 1 can afterwards be returned to position by moving it until the stem 34*c* re-engages the stop 34*d* when the hole 32 will be repositioned to enable a new shear pin to be inserted.

The oil system for lubricating the mechanism comprises a reservoir 35 for the oil provided at the lower end of the stem 1. The joints in the lower end are made fluid-tight. A pump 36, which is driven by gears 37 from the drive to the propeller 7 is arranged in this reservoir and a pipe 38 is connected to the outlet of the pump, the other end of this pipe 38 being connected to the lower end of the extension 5 of the stem 1 (Fig. 4). A port is arranged in this extension to effect communication from the pipe 38 to the space 39 between the vertical limb 2 and the extension 5 of the stem 1 past the lower bearings 4. A port indicated at 40 (Fig. 2) communicates with the space 39 and a pipe 41 extends from the port indicated at 40 through a port 42 in the casing of the head structure with the space 43 (Fig. 3) between the shaft 15 and the trunnion 12*a*.

The bearings 14*a* are arranged so that lubricating fluid can pass therethrough into the space 44 in which the gear 19 moves. A pipe 45 provides communication between the space 44 and the box 46 within the head structure. The head structure is fluid tight and a pipe 47 having its upper end within this box and about level with the shafts 15 and 22 communicates at its lower end with the chamber 48 in the extension 5 in which the shaft 18 rotates. It will be seen that as oil is pumped up into the box 46 when it reaches a level above the top of the pipe 47 it will lie in the space between the shaft 22 and the trunnion 12*b* and overflow into the pipe 47 and pass down into the chamber 48. This chamber 48 is in communication through slots in the bearing 49 for the shaft 18 with the reservoir 35.

When the drive is transmitted to the propeller the gears 37 are rotated to drive the pump 36 to pump oil through the pipes 38 and 41 to the space 43. From the space 43 the oil passes into the space 44 and from this space through the pipe 45 into the box 46. It will be seen that as the gears 19 and 20 rotate the oil will be moved around all the moving parts in the space 44 and in the box 46.

The oil then passes down the pipe 47 to the chamber 48, thereby lubricating the gear 8 and 9, into the chamber 48, thereby lubricating the bearing for the shaft 18 whence it returns to the reservoir 35.

The invention thus provides a simple and cheap construction of outboard propeller mechanism by reducing substantially the size and complexity of the head structure and by simplifying the lubrication of the working parts. The separation of the raising and lowering mechanism from the positive locking shear pin enables the former to be of materially lighter and simpler construction.

It will be understood that various modifications in design may be made to the mechanism without departing from the scope of the invention.

What I claim is:

1. Outboard propeller mechanism comprising a propeller shaft, a propeller carried on the propeller shaft, a driving shaft by which the propeller is rotated, a hollow trunnion to which the driving shaft is mounted for swinging movement, an input drive cross shaft coupled to the driving shaft and extending co-axially through the hollow trunnion to be coupled beyond the outer end of the trunnion driving member, means to move the driving shaft about the hollow trunnion to effect the raising and lowering of the said driving shaft, and a worm, and a worm wheel connected in the drive to raise and lower the driving shaft, the worm being movable to disengage the worm wheel to prevent transfer of thrust to the raising and lowering means when a force is exerted on the stem.

2. Outboard propeller mechanism comprising a hollow depending stem, a propeller shaft supported at the lower end of the hollow stem, a propeller mounted on the propeller shaft, a driving shaft by which the propeller is rotated, a hollow trunnion on which the depending stem is mounted for providing a swinging movement in the vertical plane, an input drive cross-shaft coupled to the drive shaft and extending through the hollow trunnion to be coupled beyond the outer end of the trunnion to an external driving member, a reservoir at the bottom of the stem, a pipe connection extending from the reservoir to the hollow trunnion, an overflow pipe adjacent the hollow trunnion, and connected to the reservoir and pump means to deliver lubricant from the reservoir to the hollow trunnion.

3. Outboard propeller mechanism comprising a hollow depending stem, a propeller shaft supported at the lower end of the depending stem, a propeller mounted on the propeller shaft, a driving shaft extending through the stem and by which the propeller is rotated, a pair of hollow trunnions on which the driving shaft is mounted for swinging movement, an input drive cross-shaft coupled to the driving shaft and extending coaxially through one hollow trunnion, an input drive cross-shaft for adjusting the propeller shaft about an axis of the driving shaft and extending through the other hollow trunnion, driving means for rotating the driving shaft, a reservoir for lubricant at the bottom of the stem, a pipe connection extending from the reservoir to a hollow trunnion,

an overflow pipe adjacent the hollow trunnion and connected to the reservoir, and pump means to deliver lubricant from the reservoir to the hollow trunnion and to the overflow pipe.

4. Outboard propeller mechanism comprising a head structure, a pair of coaxial hollow trunnions mounted in said head structure in spaced relation, a stem depending from said head structure and journaled for rotation about the vertical axis thereof, a propeller shaft extending downwardly in said stem, a propeller joined to said propeller shaft at the lower end thereof, means positioned within said head structure for driving said propeller shaft, said driving means including a drive shaft mounted in one of said trunnions and operatively connected to said propeller shaft, and means positioned within said head structure for rotating said stem, said rotating means including a drive shaft mounted in the other of said trunnions and operatively connected to said stem.

5. Outboard propeller mechanism comprising a head structure, a pair of coaxial hollow trunnions mounted in said head structure in spaced relation, a stem depending from said head structure and journaled for rotation about the vertical axis thereof, a propeller shaft extending downwardly in said stem, a propeller joined to said propeller shaft at the lower end thereof, means positioned within said head structure for driving said propeller shaft, said driving means including a drive shaft mounted in one of said trunnions and operatively connected to said propeller shaft, means positioned within said head structure for rotating said stem, said rotating means including a drive shaft mounted in the other of said trunnions and operatively connected to said stem, and means mounted on said head structure and operatively connected to said trunnions for moving said head structure to raise and lower said stem.

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