June 23, 1953 G. WOOD 2,642,946

REVERSIBLE PROPELLER

Filed July 30, 1947 5 Sheets-Sheet 1

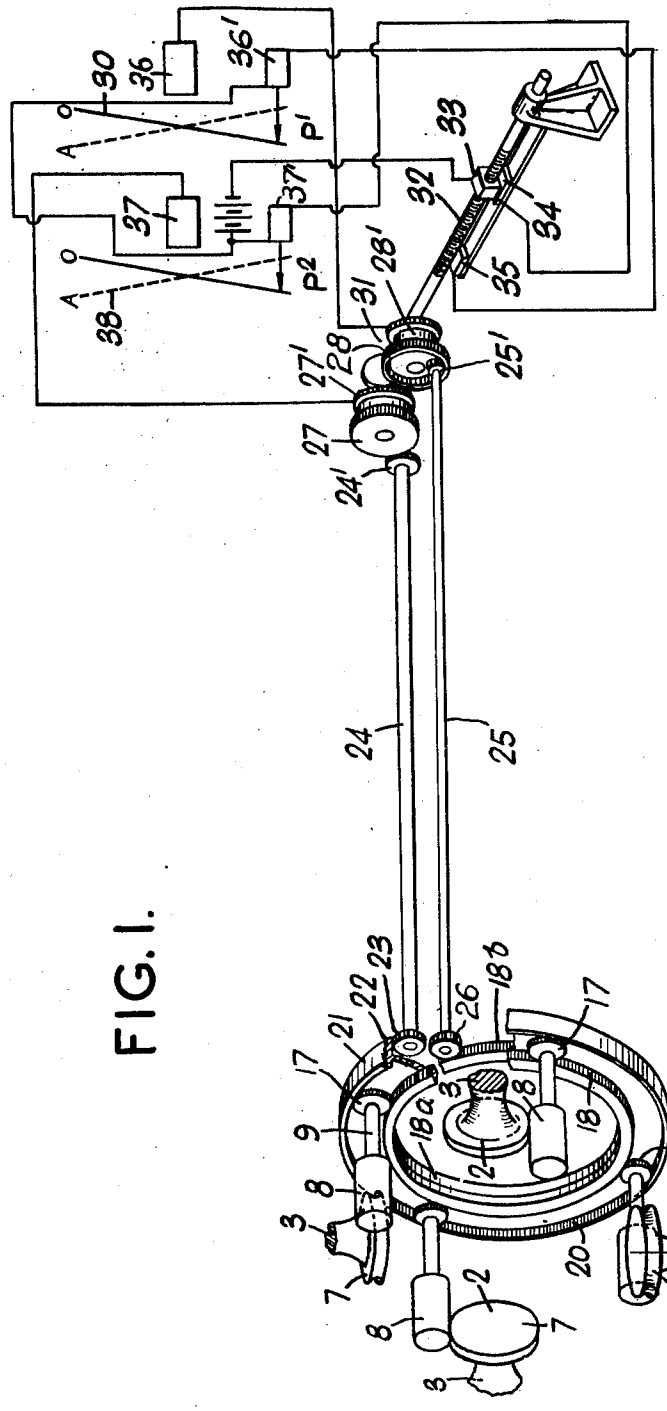


FIG. I.

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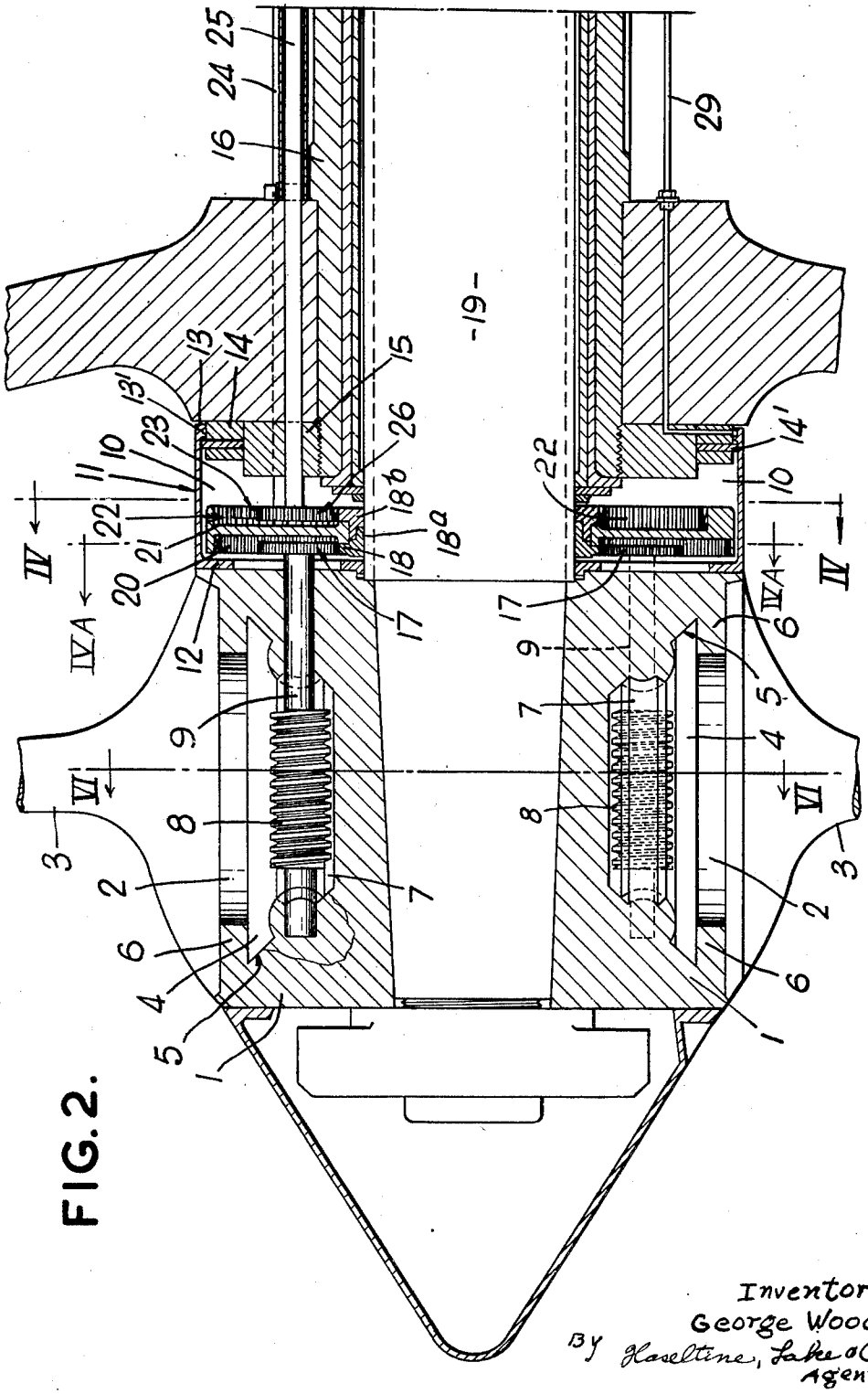


FIG. 2.

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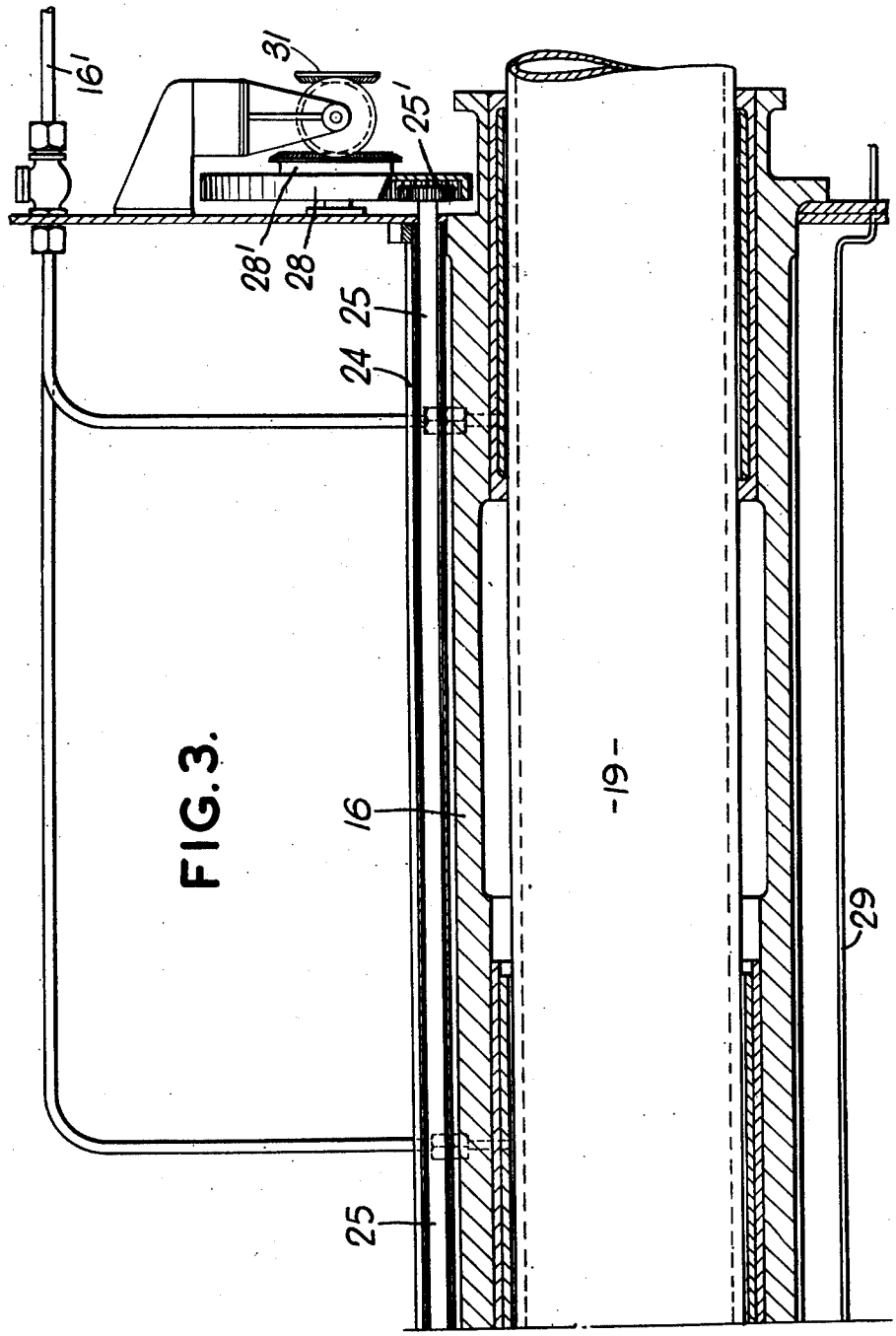


FIG. 3.

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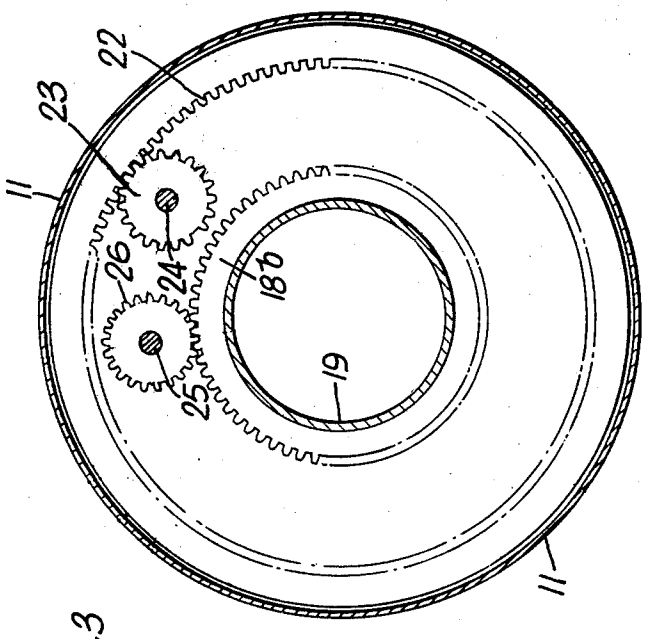


FIG. 4

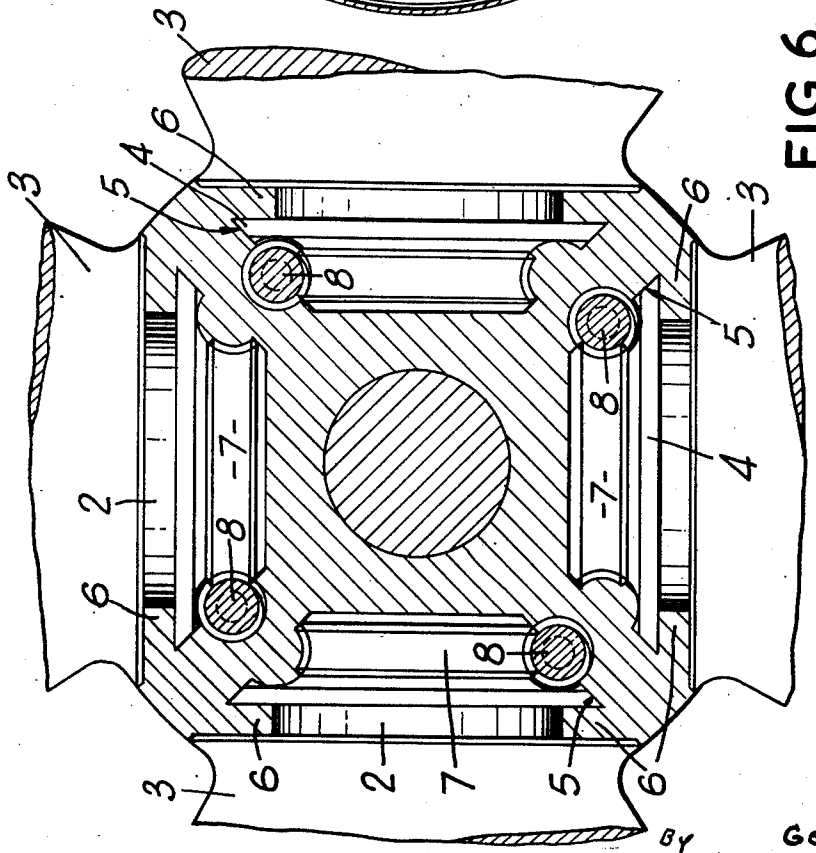


FIG. 6.

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REVERSIBLE PROPELLER

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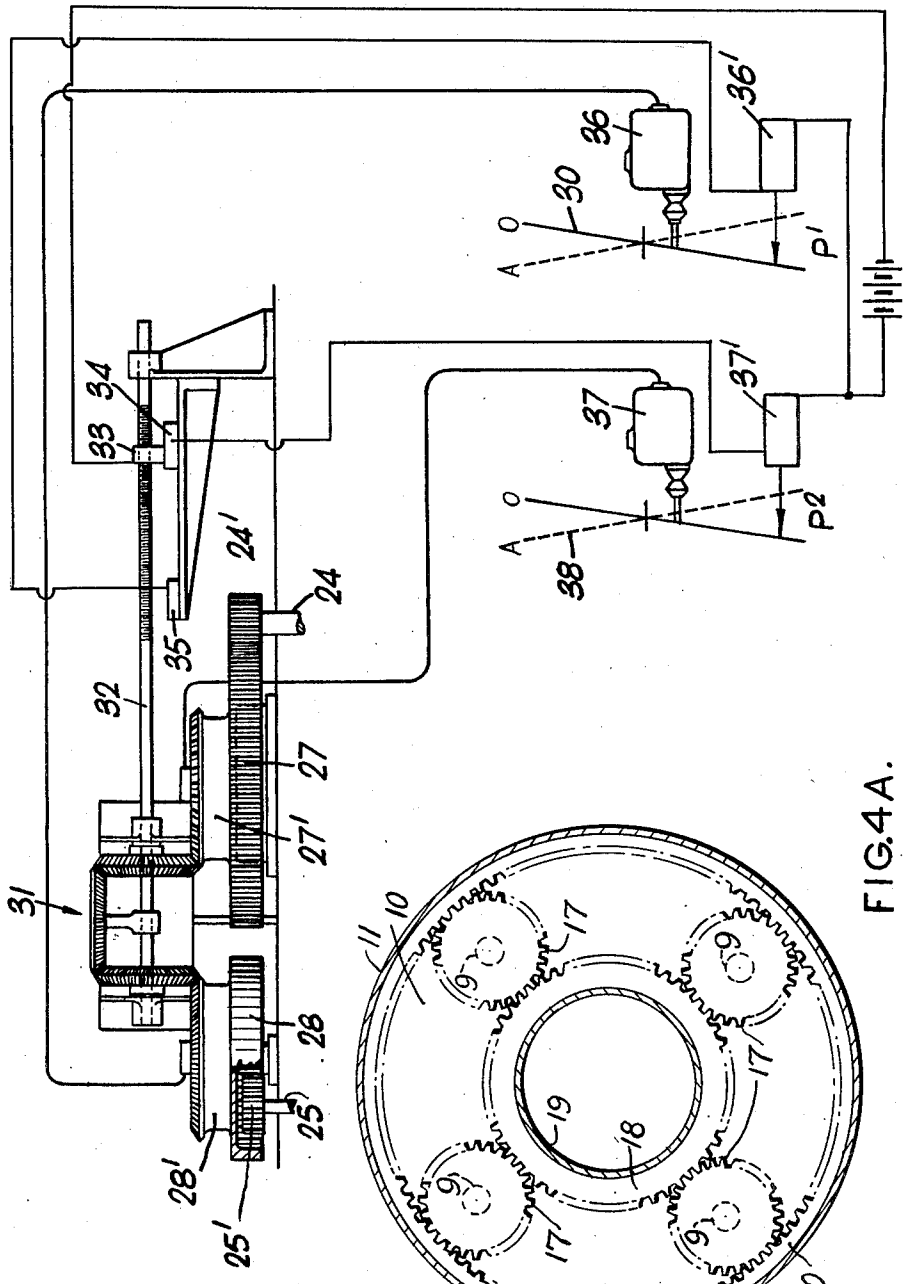


FIG. 5.

FIG. 4A.

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UNITED STATES PATENT OFFICE

2,642,946

REVERSIBLE PROPELLER

George Wood, London, England, assignor to Vickers-Armstrongs Limited, London, England, a company of Great Britain

Application July 30, 1947, Serial No. 764,644
In Great Britain July 18, 1946

Section 1, Public Law 690, August 8, 1946
Patent expires July 18, 1966

2 Claims. (Cl. 170—160.29)

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This invention relates to reversible propellers for the propulsion of ships, and has for its object to provide a remote control means for readily setting the pitch of the blade of a ship's propeller from normal or ahead position to a reverse or astern position.

According to this invention the boss or hub of a ship's propeller has the blades connected thereto in such manner that their pitch can be changed from normal ahead to astern whilst maintaining a uniform direction of rotation of the propeller shaft, remote control means being provided adapted to co-operate with the propeller shaft to transmit to the blades simultaneously a change in pitch or direction of inclination relatively to the boss or hub.

In the preferred form of the present invention, the blade roots of the propeller are geared to driving members in the hub structure, gearing being provided for transmitting the rotation of the propeller hub or shaft to said driving members, said gearing including gear elements normally free to idle but being combined therewith remote control means for bringing the gear elements relatively into the positive or live condition to transmit the rotation of the propeller shaft to said driving members for moving the propeller blades about their root axes from the ahead to the astern position or vice versa according to the setting of the remote control means.

In order that the invention may be clearly understood and readily carried into effect drawings are appended hereto illustrating an embodiment thereof, and wherein,

Figure 1 is a diagrammatic view in perspective showing the general layout of the blade reversing means,

Figure 2 is a longitudinal sectional view of the propeller hub and adjacent end of the stern tube,

Figure 3 is a section in prolongation of Figure 2 showing the location of the controlling mechanism for controlling the reversing gear of the propeller blades,

Figure 4 is a transverse sectional view taken on the line IV—IV of Figure 2,

Fig. 4A is a transverse sectional view taken on the line IVA—IVA of Fig. 2,

Figure 5 is a plan view of the controlling mechanism shown in Figure 3, and

Figure 6 is a section on the line VI—VI of Figure 2.

Referring to the drawings, the periphery of the hub 1 of the propeller is recessed to accommodate the roots 2 of the propeller blades 3, such roots being rotatable about axes normal to

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the axis of the hub and relatively to the hub, the peripheries of such roots being formed with annular flanges 4 with truncated conical peripheries 5 seating in correspondingly shaped recesses in the hub 1 and the hub having annular shoulders 6 seating in corresponding recesses in the peripheries of the roots 2 to restrain the individual blades from displacement axially relatively to the hub or boss. To enable this latter form of assembly to be effected, the hub is built up of segments corresponding to the number of blades and suitably joined together in planes containing the axes of the roots 2. The arrangement is such that each of the blades 3 is supported for rotation between positions to ahead and astern screw respectively, and for this purpose each root is formed at its inner end with a peripheral worm wheel 7, and the propeller hub or boss is shaped internally to accommodate a number of axially directed worms 8 corresponding to the number of blades, each of these worms meshing with one of the aforesaid worm wheels 7 and having a forwardly prolonged stem 9 forming a spindle journalled in the leading part of the hub and projecting forwardly into an annular chamber 10 immediately in advance of the hub or boss. This chamber is preferably the interior of a housing in the form of a ring 11 acting as a rope guard, for which purpose the ring is formed with a trailing annular flange 12 fixed to the front annular face of the hub and with a relatively narrow front flange 13 having a lubricating groove 13' accommodating a U-shaped leather running on a co-operating ring 14 carried upon a collar 15 fixed to the trailing end of the stern tube 16. A sealing ring 14' is also provided with suitable locating means to ensure adequate sealing of the chamber 10.

The chamber 10 contained within the rope guard 11 acts as a housing for the accommodation of a planet gear serving to couple the aforesaid worm to suitable remote control means. In this connection the forward ends of the worm spindles 9 each carry a pinion 17, these pinions meshing with a common gear ring 18 loose upon the rear end of the propeller shaft 19, such pinions 17 also being in mesh with an outer ring gear 20 formed in the rear side of an annulus 21 in the chamber 10 upon the hub assembly 18a of the gear ring 18 and another gear ring 18b having the same diameter as 18, these two gear rings 18 and 18b being fixed relatively to each other at their hubs. The annulus 21 is formed in its front face with a ring gear 22 in mesh with and tracking about a pinion 23 on the trailing

end of a longitudinal shaft 24 extending parallel with another like shaft 25 parallel with and close to the trailing end of the propeller shaft tunnel 16. The longitudinal shaft 25 also carries a pinion 26 at its trailing end which meshes with the gear ring 18b, which as aforesaid is fixed in relation to the gear ring 18. The front ends of the said two longitudinal shafts 24 and 25 carrying pinions 24' and 25', see Fig. 1, respectively meshing individually with two gear wheels 27 and 28 respectively carrying or formed on brake drums 27' and 28' incorporating remote control operated brake applying means.

These two brakes can normally be operated through a telemotor control situated at the bridge of the ship, but may, in a case of emergency, be worked directly at their points of support either by hand or other suitable means.

When the reversible propeller is fitted in conjuction with stern tube lubrication, the chamber 10 is charged with lubricating oil at a suitable pressure, thus providing a constant oil supply to the propeller blades and the operating mechanism in the vicinity. The oil supply to the stern tube 16 may also be connected to a lubricating oil tank by a pipe 16', charged by air or other means to a greater pressure than that of the stern tube lubricating oil supply, and consequently, the propeller blade bearings may thus be temporarily subjected to a higher pressure during the period of moving the propeller blades. The U-shaped leather space 13' sealing the lubricating oil space from the sea may be connected to the inside of the ship and led by a pipe 29 to a centrifugal or other type of separator with the object of reducing the lubricating oil consumption to a minimum.

This arrangement allows the ship to be driven either ahead or astern with the propeller shaft 19 running in one direction. Thus if when the ship is being driven ahead, it is desired to go astern, a control lever 30 is moved to the astern position. The movement of the control lever through the telemotor system operates brake 28' bringing shaft 25 and also combined wheels 18, 18b to rest. The boss 1 rotates with the propeller shaft 19 and consequently the pinions 17 are made to revolve over the stationary wheel 18, thus rotating the worms 8, and at the same time, the propeller blades 3 each about its axis. This movement of each blade 3 continues until each blade reaches a stop corresponding to the astern position, when the worms 8 and the pinions 17 cease revolving. Consequently all the blades are simultaneously moved to the astern position.

The combined wheel elements 18, 18b as a unit are again made to revolve with the propeller boss 1 and consequently to rotate pinion 26, shaft 25 and the brake gear wheel 28, as hereinafter explained, is no longer restrained by the associated brake 28'. The control of the brakes 27' and 28' is effected by a hunting gear connected to shafts 25 and 24 and arranged so that while the propeller blades are set, the relative speeds of the two shafts 25 and 24 being equal, the hunting gear is inactive but, when either shaft is stationary, which occurs when the blades are being adjusted about their root axes the relative speeds of the shafts 25 and 24 are altered, the hunting gear comes into operation and at the completion of the change from one extreme pitch position to the other of the blades releases the appropriate brake.

In one arrangement of the hunting gear the two brake wheels 28 and 27 are geared to a differential 31 in such a manner that when the two brake wheels are free and, consequently, the combined wheels 18, 18b and the gear ring 21 are rotating with the propeller shaft, the differential is idle. When the brake is applied to 28' the differential will precess causing the shaft 32 to rotate in a direction such as to translate a nut 33 towards a contact 34. Alternatively, when the brake is applied to wheel 27 the differential will precess in the opposite direction causing the nut 33 to traverse the shaft 32 towards a contact 35.

The two brakes are operated by remote control hand levers 30 and 38 which actuate via switches, and if desired relays, telemotor cylinders 36 and 37 respectively having a remote control drive to the brakes 28' and 27' respectively in well known manner. The two levers are returned to the off position by solenoids 36' and 37'. When the levers are in the position 0 the telemotors are idle and the brakes are off but when either lever is moved to the position A the associated brake is applied to enable the propeller blades to move to the "full astern" or full ahead position whichever is appropriate. The contact 33 is now translated, by rotation of the feed screw shaft 32, towards the contact 35 so as to render the contact 34 inactive. When the moving contact 33 engages contact 35 the solenoid 36' is energised so that the induced force P^1 moves lever 30 to the "off" position to release the brake 28' and restore the differential gear 31 to normal or idle condition. Upon reversing the operation, i. e. to return to "full ahead" the lever 38 is moved to position A whereupon brake 27' is applied and the contact 33 returned to contact 34 whereupon solenoid 37' is energised and the induced force P^2 will return lever 38 to the "off" position.

The distance between the contacts 34 and 35 and the pitch of the screw thread in the shaft 32 must be such as to ensure the closing of the circuits to the solenoids 36' and 37' only at the completion of the change in setting of the blades to "full ahead" or "full astern."

It will be appreciated from the foregoing that when the propeller blades are about to be moved from the "full ahead" to the "full astern" position by moving the lever 30 into the position to apply the brake to wheel 28, shaft 25 and wheel elements 18, 18b are brought to rest relative to the shaft 19. When, in consequence, the worms 8 have made the necessary number of revolutions to move the blades 3 to the astern position, the wheel elements 18, 18b will be brought to rest relative to the propeller boss and consequently wheel 28 will be made to revolve.

To move the blades from the astern to the ahead setting, the lever 38 is moved to apply the brake 27' whereupon through the medium of the gear 27 and shaft 24 the gear ring 21 will be held against rotation relatively to the shaft and the pinions 17 will now track around this gear ring causing the worms 8 to drive the blades 3 back to the ahead position and upon reaching this position the pinions 17 will be retained from further tracking upon the gear ring 21 with the result that the shaft 24 will drive the gear 27 and, by reason of the contact nut 33 being engaged with the contact 35 immediately upon the blades reaching full ahead pitch position the solenoid 37' will return the lever 38 to the "brake-off" position and free the brake 27' to the normal or "off" state.

I claim:

1. A ship's propeller, comprising a main shaft,

a hub fixed on said shaft, a housing forming a water-tight seal between the front face of the hub and the stern of the ship, propeller blades seating against the hub, roots integral with said blades and journalled for rotation about their axes in the hub from a normal ahead setting to a normal astern setting of the pitch of the blades, a worm wheel on the inner end of each blade root, worm shafts corresponding in number to the number of said blades and parallel with the main shaft and journalled in said hub and extending at their front ends into said housing, the worms of said worm shafts meshing directly with the said worm wheels, a pinion on the front end of each worm shaft, a gear ring loose about the main shaft and located in said housing, the said pinions on the front ends of the worm shafts all meshing with said gear ring, another gear ring in said housing disposed concentrically in relation to the aforesaid gear ring and also meshing with the said pinions, a pair of normally inoperating brakes remote from said housing, a longitudinal lay shaft geared at its ends to one of the brakes and to one of the said gear rings, another longitudinal lay shaft geared at its ends to the other brake and the other gear ring, remote control means to bring selectively said brakes into operation to arrest rotation selectively of said two gear rings, and means controlled only by the arrival of the said blades at their normal ahead and normal astern settings to free the appropriate operated brake.

2. Means for changing the blades of a reversible propeller for ships from full ahead to full astern positions, and vice versa, comprising a main propeller shaft, a hub fixed on said shaft, blades with roots which are mounted for rotation about their axes within said hub from a normal ahead setting to a normal astern setting of the blades and vice versa, a number of longitudinal worm shafts journalled at their ends in the hub and corresponding to the number of blades, worm wheels on said roots with which mesh the worms of said worm shafts, a pinion on the front end of each worm shaft, a gear ring loose about the main shaft and located in said housing, the said pinions on the front ends of the worm shafts all meshing with said gear ring, another gear ring in said housing disposed concentrically in relation to the aforesaid gear ring and also meshing with the said pinions, a pair of normally inoperating brakes remote from said housing, a longitudinal lay shaft geared at its ends to one of the brakes and to one of the said gear rings, another longitudinal lay shaft geared at its ends to the other brake and the other gear ring, remote control means to bring selectively said brakes into operation to arrest rotation selectively of said two gears rings, switch means actuated off the two lay shafts via said brakes during the braking of one of said brakes, a pair of electrically operated brake releasing devices controlled and brought alternately into operation by said switch means and automatically releasing the said one brake upon the blades reaching the end of the predetermined direction of pitch adjustment, said switch means comprising a pair of spaced fixed contacts and a translatively movable contact, gear means driving the movable contact from one fixed contact to the other by rotation of one lay shaft relative to the other during said braking of one of the brakes, and electrical connections across the said contacts and the said electrically operated brake releasing devices made and broken by the movable contact.

GEORGE WOOD.

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