This invention relates to improvements in vertical axis propellers of the general type embodied in U.S. Patent No. 2,037,069 to Josef Ehrhart, this type of mechanism generally employing means for alteration of the propeller pitch with respect to its magnitude and direction. Specifically this invention relates to the propeller blade mount and contemplates a structure permitting the removal and exchange of the vertical axis propeller blade.

In the present day constructions, vertical axis propellers sometimes require replacement or repair due to damage done by virtue of impact loads and as now constructed this operation requires a dry docking of the boat or use of a diver or other means applied from the outside.

One of the main features of the invention is to provide a mounting for vertical axis propeller blades which will permit removal and inspection, and repair of the propeller blade or substitution of a new propeller blade while the vessel is afloat and entirely from the inside of the vessel.

More specifically, the invention includes the provision of a case or blade pot which locates the blade unit axially and radially with its appropriate bearings and associated parts.

Another object of the invention is to construct a rotor with cylindrical containers or housings for these blade pots which will permit the blade pots to be lowered into the rotor from inside the vessel to water and oil-tight seats in the rotor.

Another object of the invention is to provide means to permit the actuating link to be disconnected and laterally displaced to free the blade assembly so that it may be removed vertically.

Other objects of the invention will more clearly hereinafter appear by reference to the accompanying drawings forming a part of the instant specification, wherein like characters of reference designate corresponding parts throughout the several views, in which:

Fig. 1 is a vertical section through the propeller assembly;

Fig. 2 is a vertical section through the propeller blade mounting with the propeller blade pot in place taken on line 2—2 of Fig. 4;

Fig. 3 is a vertical section similar to Fig. 2 with the propeller blade pot partially removed; and

Fig. 4 is a section on line 4—4 of Fig. 2.

In the present disclosure the shell of the vessel is indicated generally as embodying the spaced plates 1 and 2 with the cylindrical opening for the propeller rotor assembly defined by plate 3 providing a housing in which the assembly is located. The propeller assembly includes the fabricated rotor 4 driven from a suitable source through gear 5 with the propeller blades 6 operated through connecting rods 7 from the maneuvering mechanism.

A housing 9 is supported on the upper deck plate 1 and encloses the drive mechanism. This housing 9 has attached on the outside reinforcing elements 10 and one access opening 11 is provided at the highest place of the rotor well, usually at the rear of the vessel.

This access hole 11 is provided with a removable cover plate 12 permitting the lifting of the propeller blade pot as shown in Fig. 1. The opening 11 is provided with its cover on and on the other side open to permit the passage of the propeller pot assembly 23. Due to the unavoidable clearance between the revolving rotor bottom plate 4 and the stationary well cylinder 3 water will fill the rotor well up to the waterline 15 of the vessel. When operating, the propeller rotor is filled with oil to a level above the housing top 9, the oil having access to all moving parts of the rotor under pressure equivalent to the oil level head and considerably greater than the water head in the rotor well, thus insuring that oil will rather leak out than water come into the mechanism.

The rotor is provided with suitably spaced cylindrical wells or housings indicated at 20, the number of wells being determined by the number of propeller blades to be used and each well being provided with upper reinforced annular marginal portions 21 and lower annular reinforced inwardly flanged marginal portions 22, the flanges 22 of which are faced inwardly and upwardly for receiving the propeller blade pot 23 and forming a support therefor. Each of the wells 20 are formed with arcuate slots 24 which extend circumferentially about the structure a suitable length to permit the essential movement of the connecting rod 7 which is pivotally connected by means of a connection at 26 (Fig. 4) to the lever arm 7 of the propeller blade.

In Figs. 2 and 3 the structure of the blade pot or housing 23 is shown to be of cylindrical form and to include upper outwardly extending marginal flange 28 and lower marginal flange 29, the latter being spaced outwardly of the bottom face 30 of the blade pot 23. A shoulder 31 which seats in the flange 23a of the lower annular flanged margin 22 of the well structure. The outer diameter of the flanges 28 and 29 is just sufficient to snugly engage the inner face of the upper flange 21 and lower flange 22 of the well structure, so that the blade pot 23 is contained in vertical alignment in the well 20. Thus the blade pot 23 is vertically aligned in the well 20 and is supported by the flange 22a of the well of the rotor housing.

The base of the blade pot 23 has its lower portion substantially thickened and projecting inwardly to provide a relatively heavy annular inner portion or supporting ring 32. The supporting ring 32 is provided with a flat upper face 33, inner cylindrical bearing supporting portion 34 and off-set downwardly facing portion 35. The pot housing 23 is solid but immediately above the portion and throughout the supporting ring structure 32, webs 36 are provided (see Fig. 4) which space the ring 32 from the outer shell wall and form a rigid structure as between these parts. The lower solid base of the pot housing 23 below the supporting ring 32 and inwardly of the shoulder 31 is formed as an annular depending ring A with its lower face 30 adapted to be generally flush with the bottom face of the rotor. The annular depending ring A is defined by lateral faces 37 and 38 terminating at their upper extremities in annular recesses 39, these annular recesses 39 which are at the junction of the side walls of the ring A and the case are adapted to receive O-rings 40, when the parts are assembled form a sealed joint with the annular recesses 39, it will be noted that the lower flange 29 of the housing 23 seats upon the annular shoulder 31 of the well casing 29 of the rotor, and that the upper flange 28 at the top of the pot housing engages snugly the inner annular surface 44 of the well casing and also that the pot housing has its upper surface 34 terminating below the face 41 of the well housing. The outer structure provides for the reception of a novel form of cap 45 which forms a closure for the well and for the blade pot, as
best shown in Fig. 2. This cap 45 is provided with a central hollow cavity 46 having a bearing receiving inner annular face 47 provided with annular slots 48 for receiving snap rings for locking a bearing assembly in position to be interposed between the pot structure and the upper end portion of the blade shank, as will be hereinafter described. The cap has a medial web portion 49 which is of conical form and is provided with reinforcing slots 50 and the outer marginal edge portion of the web is provided with an inner downwardly projecting annular ring 51 and a relatively wide flat annular downwardly facing flange portion 52, the ring 51 being adapted to seat upon the upper face of the blade pot 23 and the downwardly facing face 52 being adapted to seat up against the upper flat face 41 of the well flange 21. Bolts 55 extend through the outer marginal edge portion of the cap and into threaded openings 56 in the upper flange 21 of the well for holding the cap in fixed position. It will be noted that the flange 28 at the upper marginal edge of the blade pot 23 is provided with vertical slots 31 for receiving the dowel pin 61 projecting from the inner face of the upper flange 21 of the well. This structure provides for alignment and sealing of the blade pot structure within the well in proper predetermined position.

The propeller blade 6 has a stepped, gradually reduced shank. The bottom portion 65, being adjacent to the propeller blade 6, has the greatest diameter. Upward of shank portion 65 is a shank portion 66 of reduced diameter with the inwardly tapered shoulder 67 the transition between the diameters at portions 65 and 66. Above the shank portion 66 the shank structure is reduced to provide a bearing area 68 for the connecting rod 7. This area is provided with a vertical recess 69 for receiving the key 70 which is secured in the slot 69 by the screw 70. Immediately above the bearing portion 66 of the shank there is a threaded area 71 for receiving the lock nut 72 and lock washer 72a which is provided to seat and retain the connecting rod and associated parts in their proper position. Above the threaded portion 71 the blade shank is further reduced in diameter as at 73 and this diameter is maintained until the bearing extremity 74 is provided, this extremity being reduced with respect to the diameter 73 and the reduction providing an accurate annular area 75 for receiving a spacer ring 76 which holds the inner race of the needle bearing in position. The needle bearing includes an outer race 80 which seats in the cylindrical bearing area 47 of the cap and the inner race 81 which seats on the bearing area 74 at the end of the blade shank and heretofore mentioned. Needle bearings 82 are positioned between the raceways and the inner race is locked in position by the upper snap ring 83 seating into a groove 84 adjacent the extremity of the shank. Spacer ring 76 supports the bottom of the inner race 81 while the bottom of the outer race 80 is supported by the snap ring 85 which seats in the slot 86 in the inner wall of the cap hub. With the connecting rod 7 in position on the medial portion 68 of the blade shank and with the lock nut 72 in position, the force can be transmitted to acquire the proper positioning of the propeller blades from the maneuvering mechanism.

The enlarged shank portion 65 of the propeller shank is aligned and packed by the syntron seal 90, the latter having its upper facing shoulder 91 engaging the O-ring 49, heretofore mentioned. The annular metal body 90 of the syntron has inwardly projecting flanges 92 which are positioned generally intermediate between its upper and lower ends and at each side of this flange 92 are the packing gaskets 93 and 94. Immediately this syntron packing at the blade shank is a needle bearing associated with the bearing area 66 of the shank and including inner raceway 95 and outer raceway 96 with the needle bearings 97 arranged therebetween. The bottom of the inner race 95 rests on a shoulder 98 defining the first two stepped portions of the shank structure, while the upper end of the inner race engages the retainer ring 100. The outer raceway 96 engages the bearing supporting ring 104 of the packing assembly and has its upper end abutting an annular cap 105 which is removed of the clamp ring 102. The clamp ring 102 provides a thrust surface for supporting the weight of the blade and is clamped to the syntron seal body 90 by cap screws 103 which extend through the ring 33 of the blade pot housing. The supporting plate 108 is provided for gaging the bottom face of the outer race 96 and a post 109 extends through this plate and through the syntron bearing permitting the passage of lubricant therethrough. The plate 108 is clamped between the syntron seal body 90 and the ring 32 of the blade pot 23 and supports the bottom of the outer race 96.

The upper end portion 74 of the shank structure has an axial threaded bore 109 for receiving an eye bolt 109 (see Fig. 3) for use in connecting hoisting mechanism in removing the propeller blade and its blade pot from the well of the rotor.

It will be noted that by the present construction, the connecting rod 7 can be disconnected from its associated bearing part 68 of the shank and swung into the recess 110 (see Fig. 4) of the rotor housing, this arrangement clearing the blade pot and the propeller blade pot for a lifting movement from the well of the rotor. This operation is shown in Fig. 5 in which figure the cap 50 has been removed after removing the cap screws 55 which secure the cap into sealing engagement with the well and blade pot. The removal of the cap removes the outer race 90 and needle bearings leaving in position the inner race 84 on the reduced upper extremity 74 of the blade shank. With the cap removed the hoisting of the blades will simultaneously lift the blade pot, the lower bearings 95-96 and the syntron packing arranged about the enlarged area 65 of the shank. The cap screws 103 lock the lower bearing and the syntron packing together and all of these associated elements, being stacked one upon another and tied together by the mechanism described and being of lesser diameter than the inner diameter of the well, are free to move vertically with respect to the well by means of any suitable hoisting mechanism.

It will be understood that in removing the propeller blade and blade pot assemblies from the rotor by the means described it will be first desirable to lower the oil level in the rotor to that indicated by line 16 on Fig. 1 and then so ballast the boat that the water level 15 will be beneath the oil level 16 of the rotor. In this manner the various propeller blades may, when the occasion arises, be hoisted from within the boat without dry docking or without aid of outside equipment or diving aid.

What we claim is:

1. In a vertical axis propeller assembly for use in marine vessels having spaced decking provided with an annular housing for receiving a rotor, said rotor including drive and control mechanism operating from its central axis, a plurality of cylindrical well housings formed in the rotor and spaced about its outer marginal portion, said well housings having walls formed with a lateral arcuate opening for passage of the control mechanism and having upper and lower arcuate openings, the lower marginal portions of the casing being provided with an inwardly projecting upwardly facing flange, cylindrical blade ports arranged in said housing with their bottom outer marginal portions seating on said upwardly facing flanges, a propeller blade having its shank portion supported in each of said blade pots with its medial portions connected with said propeller blade, each of said said well housings, said caps each having an inner downwardly facing bottom portion for abutting the top portion of said blade pots, and including a bearing for embracing the upper shank extremities of the propeller blade, bearing means between the lower portion of said blade pots and said propeller blade shanks, said propeller blade...
In a rotor assembly for use with vertical axis propellers, said rotor mechanism including spaced upper and lower walls, a plurality of wells connecting said walls, said wells being of annular form and having medially arranged transverse slots, propeller blade assemblies for axial arrangement in said wells, said propeller blades including blade portions and shank portions, the shank portions being enclosed in a blade pot having a transverse slot for alignment with the transverse slot in the well when the parts are assembled, bearings between the blade pot and the shank, means for limiting the axial movement of the propeller shank in said blade pot and for supporting the latter in said well, a cap for locking the blade pot in said well, said cap being removable from the well and including means for embracing the free end of the shank, said shank having its free end provided with means for attachment to a hoisting means, whereby the blade and blade pot assembly can be removed vertically as a unit from the well after the cap is removed.

5. The structure of claim 4 characterized in that upper and lower bearings are provided with the propeller shank, the upper bearing being contained in the cap and the lower bearing being positioned immediately above a packing which latter is positioned at the junction of the shank and the propeller blade.

6. The structure of claim 4 characterized in that a well is provided in the blade pot for receiving and containing oil and means are provided for feeding the oil in the blade pot to adjacent bearing portions.

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