

Description

The present invention relates generally to marine drives and more particularly to a marine inboard-outboard drive for a marine engine positioned within the boat to which the drive is mounted.

My previous European Patent Specification No. EP—A—0037690 discloses a marine outdrive apparatus, for a boat having an inboard engine and a transom, comprising a support casing adapted to extend rearwardly from the transom, means on the rear end of the support casing for forming a ball-receiving socket, a propeller shaft carrier having a forward end and a rear end provided with a hollow pivot ball mounted thereon at the forward end thereof, said ball being pivotally received within said socket to permit universal movement of the ball about a pivot point relative to the socket, a rotatable drive shaft in said support casing and adapted to be connected to said inboard engine, a propeller shaft journaled in said propeller shaft carrier, and universal joint means inter-connecting the drive shaft and the propeller shaft at a location within the ball, the centre of said universal joint means substantially coinciding with the pivot point of the ball so that the propeller shaft carrier and the propeller shaft can pivot laterally about a steering axis and up and down about a trim axis, a propeller mounted on the rear end of the propeller shaft for rotation therewith, and means coupled with the propeller shaft carrier for pivoting the same about the trim axis. In accordance with the present invention in apparatus as described above, the steering axis is inclined upwardly and forwardly. This arrangement has the advantage that the propeller on the rear end of the propeller shaft will move up and down over an arcuate path as the propeller shaft carrier swings laterally relative to the support casing. Thus, the propeller will go deeper in to the water as the carrier swings to one side or the other and the propeller will be at its highest point when the propeller shaft carrier is longitudinally aligned with the drive shaft. Thus, when the boat in which the drive is fitted makes a turn, greater thrust will be achieved during the turn because the propeller will be lower in the water.

The invention also relates to a marine outdrive apparatus attachable to a boat.

Hereinafter the invention is described by way of example and with reference to the accompanying drawings wherein:

Fig. 1 is a perspective view of a first embodiment of marine outdrive apparatus of the present invention;

Fig. 2 is a side elevational view of the apparatus of Fig. 1;

Fig. 3 is an enlarged vertical sectional view taken along line 3—3 of Fig. 1;

Fig. 4 is an enlarged vertical sectional view taken along line 4—4 of Fig. 2;

Fig. 5 is a fragmentary, top plan view of the apparatus showing the steering cylinders thereof;

Fig. 6 is a vertical sectional view taken along line 6—6 of Fig. 2;

Fig. 7 is a vertical sectional view taken along line 7—7 of Fig. 2;

Fig. 8 is a vertical sectional view taken along line 8—8 of Fig. 1;

Fig. 9 is a schematic view of the steering and trim control system for the apparatus;

Fig. 10 is a top plan view of an embodiment of marine outdrive apparatus of the present invention using a pair of propeller shaft carriers;

Fig. 11 is a vertical sectional view taken along line 11—11 of Fig. 10;

Fig. 12 is a view similar to Fig. 8 but showing the steering axis arrangement in detail and also illustrating a second embodiment of the apparatus;

Fig. 13 is an enlarged, fragmentary, side elevational view of the lower stabilizing fin of the apparatus of Fig. 12 showing a trim fin secured thereto near the lower margin thereof;

Fig. 14 is a cross-sectional view taken along line 14—14 of Fig. 13;

Fig. 15 is a view similar to Fig. 13, but showing another embodiment of a trim fin;

Fig. 16 is a top plan view of another embodiment of a trim fin;

Fig. 17 is a side elevational view of the fin of Fig. 16;

Figs. 18 and 19 are top plan and side elevational views of another embodiment of a trim fin;

Fig. 20 is a cross-sectional view taken along line 20—20 of Fig. 18;

Fig. 21 is an enlarged cross-sectional view of a universal joint of the constant velocity type for the apparatus of the present invention for inter-connecting the drive and propeller shafts thereof;

Fig. 22 is a front elevational view of the universal joint of Fig. 21.

Fig. 23 is an elevational view of one end of a sealing ring for sealing the pivot ball of the apparatus of the present invention;

Fig. 24 is a cross-sectional view through the ring of Fig. 23;

Fig. 25 is a view similar to Fig. 23 but showing the opposite end of the ring;

Fig. 26 is a view similar to Fig. 2 but showing the way in which the apparatus of the present invention is used with an offset drive shaft of an inboard engine in a boat;

Fig. 27 is a vertical section through the power transmission unit of the apparatus of Fig. 28;

Fig. 28 is a fragmentary rear elevational view of the transom of a boat showing an inclined transmission unit thereon for coupling the drive shaft of an inboard motor with the apparatus of the present invention; and

Fig. 29 is a vertical section through a boat showing the way in which a pair of inboard motors in the boat are coupled to the propeller shaft of the apparatus of the present invention.

Referring to the drawings and particularly Figs. 1—9 thereof, there is shown a first embodiment of marine outdrive apparatus A embodying the present invention adapted for use with a conven-

tional boat B having a transom 20 upon which apparatus A is mounted. Apparatus A includes a tubular support casing 22 secured to transom 20 and having a ball socket 24 at its rear end. A tubular propeller shaft carrier 30 has, at its front end, a ball 32 which is universally pivotally mounted in the ball socket as shown in Fig. 8. A drive shaft 38 is journaled by bearings 54 and 56 in the support casing 22, the front end of the drive shaft connected to a single inboard engine (not shown) positioned within boat B. A propeller shaft 40 (Fig. 8) is journaled by bearings 76, 82 and 84 in propeller shaft carrier 30, with the aft end of propeller shaft 40 receiving a conventional surface-piercing propeller 44. Universal joint means 46, preferably a conventional double universal or constant speed joint, connects the rear end of drive shaft 38 to the forward end of propeller shaft 40. The center of such universal joint 46 coincides with the pivot point 50 about which ball 32 pivots relative to ball socket 24.

Support casing 22 has a main body 50 of cylindrical configuration having an open rear end. The front end of body 50 is integrally formed with a tubular boss 52 extending through transom 20. Oil seals 58 and 60 close the front and rear ends of boss 52, so as to confine a quantity of oil there-within.

Support casing 22 is rigidly affixed to the rear surface of transom 20 by a plurality of bolts 62. The front end of drive shaft 38 may be connected to a coupling, such as a universal joint 63 (Fig. 2) forming part of a drive train directly connected to and rotated by the shaft of an inboard engine.

Ball socket 24 is preferably formed of a synthetic plastic, such as nylon, and includes front and rear rings 24a and 24b whose inner surfaces complementally engage the adjacent outer surface portions of ball 32. Front ring 24a abuts an annular shoulder 64 of the support casing, and rear ring 24b is secured in the rear end of the support casing by a snap ring 66. An O-ring 68 (Fig. 8) is between front and rear rings 24a and 24b of ball socket 24 in sealing engagement with the rings and the outer surface of ball 32.

Propeller shaft carrier 30 includes an open end housing 70. The forward portion of housing 70 is formed with ball 32 thereon. The rear portion of housing 70 is provided with an integral, externally threaded neck 72 to which is coupled the internally threaded forward end of a frusto-conical tube 74. Bearings 76, 82 and 84 are mounted in tube 34, and oil seals 78 and 80 are also provided in tube 74 immediately outboard of respective bearings. The space between oil seals 78 and 80 and surrounding propeller shaft 40 is preferably oil-filled. An O-ring seal 86 is interposed between the front end of tube 74 and the rear wall of housing 70.

A lower stabilizing fin 90 (Figs. 1 and 2) is secured to and depends from tube 74. Fin 90 tends to keep the propeller shaft carrier from rising when the boat is in a turn. The upper margin of fin 90 is preferably cast onto such tube. An upper fin 92 of similar configuration to that of lower fin 80 extends upwardly from the tube 74 in generally vertical

alignment with fin 90. The bottom margin of upper fin 92 is preferably cast onto the tube. The upper end of fin 92 supports a horizontal cavitation plate 94, the cavitation plate preferably being secured to the front portion of upper fin 92 by means of bolts 98. The rear edge of the cavitation plate 94 is spaced rearwardly from fin 92 and overhangs propeller 44 to protect it against contact with a dock or the like. Such cavitation plate also contains the boat's roostertail.

The intermediate side portions of tube 74 are provided with respective, laterally extending ears 100 and 102. Such ears are pivotally connected to brackets 103 (Fig. 5) affixed to the rear ends of piston rods 104 and 106 shiftably coupled to power-operated hydraulic steering cylinders 108 and 110, respectively. The forward ends of such steering cylinders are provided with ball pivots 112 and 114, respectively, rotatably received within complementary recesses 116 and 118 formed in a pair of mounts 120 and 122 (Fig. 5). Such mounts are preferably cast onto the midportion of opposite sides of support casing 22. In the alternative, such mounts may be secured to transom 20.

The pivot points 124 and 126 (Fig. 5) about which spheres 112 and 114 rotate relative to their sockets 116 and 118, are disposed upon a horizontal line 128 (Fig. 5) extending through the aforementioned pivot point 50 about which ball 32 rotates relative to its socket 24. Line 128 is normal to the longitudinal axis of drive shaft 38.

The front and rear portions of steering cylinders 108 and 110 are provided with fluid conduits 130, 131, 132 and 133 (Fig. 1) in communication with conventional hydraulic steering system shown in Fig. 10. The operation of this system will be described hereafter.

A hydraulic trim cylinder 140 having a piston rod 142 extends between the boat's transom 20 and the propeller shaft carrier 30 as shown in Figs. 1, 2, and 9. Rod 142 is locked against rotation relative to trim cylinder 140 as by complementary splines and grooves indicated at 143 in Fig. 1. The front end of the cylinder 140 is provided with a ball pivot 144 pivotally received within a socket 145 of a mount secured to transom 20 by fasteners 151. The rear end of rod 142 is provided with a bifurcated bracket 152 which straddles an upwardly extending pad 154 (Fig. 1) rigidly affixed to the upper, intermediate portion of tube 74 near the lower front end of fin 92. A pivot pin 156 interconnects brackets 152 and pad 154. Hydraulic conduits 158 and 160 (Fig. 1) connect the front and rear ends of trim cylinder 140 with the hydraulic system shown in Fig. 9.

Referring to Fig. 3, socket 145, trim cylinder 140, and rod 142 are shown as being locked against rotation relative to mount 146. To this end, an upright pin 170 is received within an arcuate slot 172 on the underside of ball pivot 144 in a vertical plane therethrough. Pin 170 limits the pivotal movement of ball pivot 144 to an acute angle in a vertical plane.

The hydraulic system of Fig. 9 includes a conventional power source 180, such as a conventional electric motor coupled to a hydraulic pump

181. A reservoir 182, conventional control valves 184 and 186 are coupled to pump 181. Steering cylinders 108 and 110 and trim cylinder 140 are connected to valves 184 and 186, respectively, by conduits 130, 131, 132, 133, 158 and 160. Valve 184 is operatively connected to a steering wheel 190 of the boat in a conventional manner while valve 186 is operatively connected to an up-down trim lever 192 in a conventional manner. Rotation of steering wheel 190 will operate valve 184 so as to control the flow of pressurized hydraulic fluid from pump 181 to steering cylinders 108 and 110. In this manner, piston rods 104 and 106 of the steering cylinders will be concurrently extended and retracted, respectively to swing propeller shaft carrier 30 laterally about a steering axis S—S (see Figs. 2 and 6) which extends through point 50 about which ball 32 pivots relative to ball socket 24. Pivot point 164 of ball pivot 144 lies on the steering axis S—S.

The steering axis S—S is inclined forwardly, i.e. pivot point 164 of ball pivot 144 is forwardly of point 50 of ball 32, as shown particularly in, and hereafter discussed with reference to Fig. 12. Therefore the lateral movements of propeller shaft carrier 30 are not be in a flat plane but along a curved path. As propeller shaft carrier 30 moves to either side, its rear end will move downwardly, thereby causing the propeller to go deeper into the water. Return of propeller shaft carrier 30 to its central operating position (Fig. 5) causes the propeller to rise to its normal position in the water. Thus, when the boat is in turns, the drive apparatus of the present invention will provide for greater thrust when steering axis is inclined forwardly because the propeller is then deeper in the water.

Movement of the up-down trim lever 192 (Fig. 9) will effect operation of valve 186 to control the flow of pressurized hydraulic fluid into the opposite ends of trim cylinder 140. This causes extension or retraction of rod 142 relative to trim cylinder 140, thereby swinging the propeller shaft carrier 30 about a trim axis T—T (Fig. 8) extending through the aforementioned pivot point 50 and coinciding with aforementioned line 128. The non-rotatable connection (Fig. 3) between the trim cylinder sphere 144 and housing 146 and between the trim cylinder 140 and its rod 142 serves to resist twisting forces applied to the propeller shaft carrier 30 upon rotation of propeller 44. Similarly, the positioning of the steering cylinders and rods in a plane through the center of propeller shaft carrier 30 also resists such twisting forces.

The compact construction of ball 32 and ball socket 14 permits support casing 22 to be secured at the lower portion of boat transom 20. Accordingly, the propeller shaft 40 may be maintained in close longitudinal alignment with drive shaft 38 during normal forward travel of boat B. The line of propeller thrust is thereby maintained low relative to the boat and below the boat's center of gravity. Maximum efficiency with respect to the transmission of torque is thereby obtained. Also, drive

shaft 38 may be coupled to any conventional power transfer means (not shown) and, the engine may be mounted at any convenient position in the boat, including an amidships position or a position just forwardly of the transom through the use of a conventional transmission (not shown).

The teachings of the present invention can be employed with a pair of inboard engines (not shown), mounted within the boat B (Figs. 10 and 11). In such a case, a pair of marine outdrives A-1 and A-2, substantially identical to the aforescribed marine outdrive apparatus A, are coupled with respective inboard engines. Accordingly, parts in Figs. 10 and 11 which correspond to parts in Figs. 1—9 bear primed reference numerals.

The marine outdrive apparatus of Figs. 10 and 11 uses a different steering cylinder arrangement than that employed with the embodiment of Figs. 1—9. This arrangement includes right and left hydraulic steering cylinders 200 and 202 having piston rods 204 and 206. The forward ends of these steering cylinder are, respectively, secured to ball pivots 208 and 210. Such spheres are rotatably positioned within sockets formed in the rear portion of a mount 216 secured to boat transom 20' by fasteners 218. Points 220 and 222 about which ball pivots 208 and 210 rotate relative to their sockets are on a generally horizontal line 224 that is normal to the longitudinal axes of the drive shafts of the marine outdrives A-1 and A-2. Line 224 extends through pivot points 50' about which the balls 32' pivot relative to their sockets 24'. Line 224 coincides with the trim axes T'—T' of the propeller shaft carriers 30'.

The rear ends of piston rods 204 and 206 are affixed to ears 228 and 230 pivotally attached to brackets 232 and 234 on respective propeller shaft carrier 30' by pins 236 and 238. These brackets are preferably cast onto the inner surfaces of the intermediate portions of carriers 30'. A tie rod 220 (Fig. 10) has its opposite ends secured to brackets 232 and 234 by pins 236 and 238. The front ends of steering cylinders 200 and 202 are provided with hydraulic conduits in communication with a conventional control system (not shown) that effects concurrent extension and retraction of plungers 204 and 206 to thereby swing propeller shaft carriers 30' about a pair of steering axes S'—S' which extends through trim axis T'—T' and pivot points 50'.

Propeller shaft carriers 30' are each provided with trim cylinders (not shown) identical to those described above for swinging such carriers about trim axis T'—T'. As indicated in Fig. 11, the pivot points about which trim cylinder spheres 144' rotate relative to their sockets 145' are located on the steering axes S'—S'.

The operation of the twin engine marine outdrive apparatus of Figs. 10 and 11 will be similar to the operation of the apparatus of Figs. 1—9. Both embodiments of the invention provide high efficiency, minimum drag and weight, and minimum maintenance. With respect to maintenance, the propeller shaft carrier 30 may be readily replaced

and installed by disconnecting the universal joint 46. Boat trim may be readily adjusted for load and wave conditions. Moreover, it is a particular advantage that maximum acceleration can be obtained by raising the propeller relative to the water's surface and increasing engine RPM into the engine's power curve by permitting the propeller to slip, and thereafter lowering the propeller toward the water as boat speed increases. This procedure is especially useful under heavy load conditions.

Fig. 12 shows a detailed arrangement of another embodiment of the marine outdrive apparatus of the present invention. It is denoted by the numeral 250 and is generally of the same construction as illustrated in Figs. 1—9 in that it has a tubular support casing 252 secured to the rear face 254 of a boat transom 256. Support casing 252 extends rearwardly of the transom and has a rear, open end provided with a socket 258 formed by a pair of nylon sealing rings 260 and 262 separated by an O-ring seal 264. The socket pivotally receives a pivot ball 266 at the forward end of a propeller shaft carrier 268 which extends rearwardly of support casing 252. Carrier 268 has a cylindrical segment 269 to which is threaded a tubular, frusto-conical segment 271 surrounding a propeller drive shaft 272 journaled in carrier 268 by bearings 274 and 276. A propeller (not shown) is mounted on the rear end of shaft 272.

A universal joint 278 interconnects the front end of propeller shaft 272 and the rear end of a drive shaft 280 of an inboard motor, shaft 280 extending through a tubular front segment 282 of support casing 252 and extending through a hole 284 in transom 256, bearings and 288 journal shaft 280 in segment 282.

Universal joint 278 has a pivot point 290 about which ball 266 can pivot. This point 290 corresponds generally with pivot point 50 described above with respect to ball 32 of apparatus of Figs. 1—9.

A trim cylinder 292 has a piston rod 293 whose lower, outer end is coupled by pin 294 to propeller shaft carrier 268 near the front lower margin of an upper stabilizing fin 296 rigid to the rear end of carrier 268. A cavitation plate 297 is secured to the top margin of fin 296 and extends rearwardly thereof. A lower stabilizing fin 295 is secured to and extends downwardly from carrier 268.

Cylinder 292 has a ball pivot 298 at the upper end thereof and received within the socket of a mount 300 secured in any suitable manner to the rear face 254 of transom 256. The pivot point 302 of pivot 298 lies along a steering axis 304 which also passes through pivot point 290 of universal joint 278. This steering axis is inclined forwardly with respect to the vertical by a small angle of at least several degrees and, with this inclination of the steering axis, the propeller on the rear end of propeller shaft 272 will move up and down along an arcuate path as carrier 268 swings laterally relative to support casing 252 under the influence of a pair of steering cylinders of the type shown in Fig. 5 and identified as numerals 108 and 110 in

Fig. 5. Thus, the propeller will go deeper into the water as the carrier 268 swings to one side or the other and the propeller will be at its highest point when the propeller shaft carrier 268 is generally longitudinally aligned with drive shaft 280. Thus, in making a turn of the boat, greater thrust will be achieved from apparatus 250 since the propeller will be lower in the water during a turn.

Trim fin means is provided on the lower margin of lower stabilizing fin 295 in the manner shown in Fig. 13. To this end, a pair of trim fins 306 are adjustably mounted on opposite sides of fin 295, the fins having a negative angle of attack by virtue of the airfoil design thereof shown in Fig. 13. Fins 306 are typically below water level about 12 inches and project laterally from fin 295 a distance sufficient to provide a net downward force on fins 306 due to the movement of such fins through the water. This downward force is provided to offset porpoising and the tendency for the stern of the boat to ride up due to propeller lift.

Fins 306 are adjustably coupled in any suitable manner to fin 295. For purposes of illustration, the fins 306 are provided with adjusting devices so that the angle of attack of each fin 306 can be adjusted to provide a predetermined force. One of the adjusting devices includes a pin 310 carried by a first trim fin 306 on one side of fin 295. Pin 310 is eccentrically mounted in a disk 311 carried in a hole in fin 295. Pin 310 then extends into a holder 312 in the other trim fin 306. Disk 311 can rotate relative to fin 295 to cause pin 310 to move up and down relative to fin 295.

Rearwardly of eccentric 308, a pin 313 is carried by the first trim fin 306 and is received at the center of a disk 314 rotatably received in a second hole in fin 295. Pin 313 then extends into a holder 315 in the other trim fin 306. By rotating disk 311 relative to fin 295 and pin 313, the angle of attack of both fins 306 can be varied. Some suitable means (not shown) for holding the eccentric in a fixed position is provided.

Fig. 15 shows another embodiment of a trim fin 318 for the lower margin of fin 295. Fin 318 has a curved lower surface 320 which provides a downward force exerted on fin 295 to keep the bow of the boat from rising excessively at high speeds. Fin 318 has a side flange 322 secured by fasteners 324 to fin 295. Another fin 318 is provided on the opposite side of fin 295 and the other fin will have a flange 322 secured by fasteners 324 to fin 295.

Fig. 16 shows a top plan view of another embodiment of a trim fin assembly for attachment to the lower margin of fin 295. Trim fin assembly 326 is comprised of a single, delta-shaped, rigid fin 328 having a pair of spaced flanges 330 on its upper surface, the flanges having holes 332 for receiving attachment devices for securing assembly 326 to fin 295 when the lower margin of fin 295 is in the gap 334 between flanges 330. A hole 332 in each flange is adapted to receive a disk which eccentrically receives a pin carried in the other, aligned holes 332 in some suitable fashion so that the fin 328 can be adjustably mounted on fin 295. This feature permits the

angle of attack of assembly 326 to be changed to vary the downward force generated by the fin moving at high speeds through the water. Fin 328, as shown in Fig. 17 has a curved lower surface to provide an airfoil effect.

Figs. 18—20 show another embodiment of a trim for one side of fin 295. Fin 336 has a side flange 338 for attaching fin 336 to the lower margin of fin 295. Flange 338 has holes 340 for receiving attachment devices which can be eccentrically mounted to adjustment of the angle of attack of fin 336 relative to fin 295. In Fig. 19, the curvature of the fin is shown and Fig. 20 shows the cross-section of the fin intermediate its front and rear ends, the fin being delta-shaped throughout a major part of its length as shown in Fig. 18. A corresponding fin will be provided for the opposite side of fin 295.

Instead of using the universal joint described above with respect to Figs. 8 and 12, a constant velocity universal joint 350 can be used, joint 350 being shown in detail in Figs. 21 and 22. Universal joint 350 is a Rzeppa type and is adapted for carrying heavier loads for its size than other types of constant velocity joints. A universal joint of this type can be obtained from Spicer Universal Joint Division of Dana Corporation, Detroit, Michigan.

Joint 350 includes an inner race 352 having a splined, central hole 354 for receiving the drive shaft 356 of an inboard motor. Joint 350 further includes an outer race 358 which is coupled by a number of circumferentially spaced balls 360 to inner race 352. A cage 362 holds the balls 360 in place and grooves 363 and 365 in inner and outer races 352 and 358, respectively, allow pivotal movement of outer race 350 universally in all directions through a given angle. Such pivotal movement can be as much as a total of 35° in substantially all directions, a pivotal action greater than that achieved by the universal joint shown in Figs. 1—9 and Fig. 12. The pivot axis of universal joint 350 is denoted by 351 and it is also the pivot point of ball 380 in which joint 350 is positioned.

Joint 350 has a number of bolts 364 which secure the outer race 358 to the front, annular face 367 of a conical member 336 splined to the front end 368 of a propeller drive shaft 370 extending rearwardly to a propeller. A snap ring 372 holds member 366 on shaft 370.

Shaft 370 is rotatably mounted by bearings 374 within a frusto-conical, tubular segment 376 of a propeller shaft carrier 378 having a pivot ball 380 at the forward end thereof. Ball 380 is pivotally mounted in a ball socket 382 at the rear, open end of support casing 252. A number of screws 384 secure a cylindrical segment 386 rearwardly of ball 380 to the front end of segment 376, segment 376 being threaded onto segment 386 and an O-ring seal 388 being between segments 376 and 386.

As shaft 356 is rotated, it rotates inner and outer races 352 and 358 together as a unit, causing member 366 and thereby shaft 370 to rotate at the same speed as shaft 356. If it is desired to pivot the propeller shaft 370 relative to shaft 356, i.e., when ball 380 pivots relative to socket 382, this can be

accomplished with steering and trim cylinders of the type shown above with respect to Figs. 2 and 5. As propeller shaft 370 is pivoted, outer race 358 continues to rotate with inner race 352 notwithstanding the fact that propeller shaft 370 is pivoted out of longitudinal alignment with shaft 356. Also, the speed of rotation of propeller shaft 370 remains substantially the same as that of drive shaft 356; thus, joint 350 provides a constant velocity relationship between the two shafts.

Socket 382 is an improvement over sockets 24 and 258 of Figs. 1—9 and 12 and includes a first ring 390 of a suitable material, such as nylon. Ring 390 has a spherically configured inner surface 392 in sealing and rolling relationship to the outer surface of ball 380. Ring 390 bears against an annular shoulder 394 on tubular support casing 391 secured to the transom of a boat. An O-ring seal 396 is at the rear end of ring 390 and also is in sealing relationship to the outer surface of ball 380.

A second sealing ring 398 is threadably connected to the inner surface of casing 391 at the rear open end thereof as shown in Fig. 21. Ring 398 is shown in more detail in Figs. 23—25 wherein the ring 398 has external threads 400 and a plurality of circumferentially spaced, rigid tabs 402 at the outer end thereof. These tabs are for use in rotating ring 298 with a spanner wrench or other tool. Thus, ring 398 can be tightened in place to any desired torque. The ring can then be adjusted for wear and other changes to assure a proper seal yet allow ball 380 to pivot uninterruptedly relative to socket 382.

Fig. 26 shows a marine outdrive apparatus 420 made in accordance with the teachings of the present invention. Apparatus 420 is adapted to be coupled to a drive shaft 422 of an inboard motor (not shown) carried in boat 424 having a transom 426. The steering and trim cylinders are omitted from apparatus 420 in Fig. 26 for purposes of simplifying the drawing; however, it is to be understood that trim cylinders of the type shown in Figs. 1—9 and 12 are used with apparatus 420 to pivot the propeller shaft carrier 428 laterally and up and down about steering and trim axes. The steering axis can be vertical or inclined as described above with respect to Figs. 1—9 and Fig. 12.

Drive shaft 422 is offset from the propeller drive shaft in propeller shaft 428, and a transmission unit 430 is secured to the rear face of transom 426 for interconnecting drive shaft 422 with a shaft 432 (Fig. 27) which, in turn, is coupled by a universal joint (not shown in Fig. 27) to the propeller shaft in propeller shaft carrier 428.

A chain drive assembly 434 (Fig. 27) is used in transmission 430 for interconnecting shafts 422 and 432. Chains 436 are coupled with upper sprockets 438 on shaft 422 and lower sprockets 440 on shaft 432. Thus, as shaft 422 is rotated by the motor, shaft 432 is correspondingly rotated to cause rotation of the propeller drive shaft.

A cover 442 is removably mounted on a support 444 secured to the 426. Cover 442 protects the interior of transmission 430 and suitable seals (not

shown) are provided to assure that no water will leak into the interior of the transmission. Also, a tubular support casing 448 is secured to transmission unit 430 to provide a ball socket at the rear end of casing 448 for pivotally receiving a ball 450 (Fig. 26).

Shaft 422 can be in the same vertical plane as shaft 432 or be in a vertical plane laterally offset from shaft 432.

Fig. 28 shows how the drive shaft 422 can be offset laterally and above as shaft 432 and transmission 430 can still be used to interconnect the shafts. Plate 448 (Fig. 28) represents the attachment point for the upper end of the trim cylinder on transom 446, and plate 450 represents the attachment point for the corresponding steering cylinder. Particularly, the configuration shown in Fig. 28 is used with a pair of drives as shown in Fig. 10 although it could be used with a single drive if desired.

Fig. 29 shows the way in which a pair of inboard motors 460 and 462 can be coupled to the drive apparatus of the present invention, such as apparatus 250. To this end, the output drive shafts 464 and 466 of motors 460 and 462 are coupled by universal joints 468 and 470 to respective shafts 472 and 474. A transmission 476 which is similar in substantially all respects to transmission 430 (Figs. 26 and 27) is used with the system of Fig. 29. A chain drive assembly 478 in transmission 476 couples shaft 474 with shaft 472 and shaft 472 corresponds to shaft 432 for transmission 430. Thus, shaft 472, coupled through a universal joint 480 to a propeller drive shaft 482 can be driven either by one motor or by both motors 460 and 462 to provide output power for the marine outdrive apparatus of Fig. 29.

Claims

1. Marine outdrive apparatus for a boat having an inboard engine and a transom, comprises a support casing (252) adapted to extend rearwardly from the transom, means on the rear end of the support casing for forming a ball-receiving socket (258), a propeller shaft carrier (268) having a forward end and a rear end and provided with a hollow pivot ball (266) mounted thereon at the forward end thereof, said ball being pivotally received within said socket to permit universal movement of the ball about a pivot point relative to the socket, a rotatable drive shaft (280) in said support casing and adapted to be connected to said inboard engine, a propeller shaft (272) journaled in said propeller shaft carrier, universal joint means (278) interconnecting the drive shaft and the propeller shaft at a location within the ball, the centre (290) of said universal joint means substantially coinciding with the pivot point of the ball so that the propeller shaft carrier and the propeller shaft can pivot laterally about a steering axis and up and down about a trim axis, a propeller (44) mounted on the rear end of the propeller shaft for rotation therewith, and means

(108, 104, 292, 293) coupled with the propeller shaft carrier for pivoting the same about the steering axis and about the trim axis, characterised in that said steering axis is inclined upwardly and forwardly.

2. Marine outdrive apparatus according to Claim 1 characterised in that a stabilizing fin (295) is included, secured to and extending downwardly from the propeller shaft carrier.

3. Marine outdrive apparatus according to Claim 2 characterised in that trim fin means (306) is included, secured to the stabilizing fin for exerting a downward force thereon as a function of the movement of the trim fin means through the water.

4. Marine outdrive apparatus according to Claim 3 characterised in that the bottom surface of the trim fin means (306) has a curvature greater than the upper surface thereof.

5. Marine outdrive apparatus according to Claim 3 or Claim 4 characterised in that the trim fin means (306) is adjustably mounted on the stabilizing fin (295).

6. Marine outdrive apparatus according to any of Claims 3 to 5 characterised in that the trim fin means (306) extends laterally from opposed sides of the stabilizing fin (295).

7. Marine outdrive apparatus according to any of Claims 3 to 6 characterised in that the trim fin means comprises a pair of trim fins for respective, opposed sides of the stabilizing fin, and means (311, 313) coupled with the trim fins for adjustably mounting same on a lower end of the stabilizing fin so that the angle of attack of the trim fins can be changed.

8. Marine outdrive apparatus according to any of Claims 3 to 6 characterised in that the trim fin means comprises a trim fin of one piece construction (336), and means coupling the trim fin to the lower end margin of the stabilizing fin so that opposed side portions of the trim fin extend laterally from respective sides of the stabilizing fin.

9. Marine outdrive apparatus according to any preceding claim characterised in that the means for pivoting the propeller shaft carrier relative to the support casing includes a first fluid actuated piston (293) and cylinder (292) assembly for pivoting the propeller shaft carrier about the trim axis, and a second fluid actuated piston (104) and cylinder (108) assembly for pivoting the propeller shaft carrier about said steering axis.

10. Marine outdrive apparatus according to Claim 9 characterised in that the second piston and cylinder assembly has a rear end pivotally coupled to a respective side of the propeller shaft carrier and a mounting means (112) for pivotally coupling the forward end of the second piston cylinder assembly near the transom, the trim axis passing through the pivot point of the ball and the pivot joint of the mounting means at the forward end of the second piston and cylinder assembly.

11. Marine outdrive apparatus according to any preceding claim characterised in that the

shown) are provided to assure that no water will leak into the interior of the transmission. Also, a tubular support casing 448 is secured to transmission unit 430 to provide a ball socket at the rear end of casing 448 for pivotally receiving a ball 450 (Fig. 26).

Shaft 422 can be in the same vertical plane as shaft 432 or be in a vertical plane laterally offset from shaft 432.

Fig. 28 shows how the drive shaft 422 can be offset laterally and above as shaft 432 and transmission 430 can still be used to interconnect the shafts. Plate 448 (Fig. 28) represents the attachment point for the upper end of the trim cylinder on transom 446, and plate 450 represents the attachment point for the corresponding steering cylinder. Particularly, the configuration shown in Fig. 28 is used with a pair of drives as shown in Fig. 10 although it could be used with a single drive if desired.

Fig. 29 shows the way in which a pair of inboard motors 460 and 462 can be coupled to the drive apparatus of the present invention, such as apparatus 250. To this end, the output drive shafts 464 and 466 of motors 460 and 462 are coupled by universal joints 468 and 470 to respective shafts 472 and 474. A transmission 476 which is similar in substantially all respects to transmission 430 (Figs. 26 and 27) is used with the system of Fig. 29. A chain drive assembly 478 in transmission 476 couples shaft 474 with shaft 472 and shaft 472 corresponds to shaft 432 for transmission 430. Thus, shaft 472, coupled through a universal joint 480 to a propeller drive shaft 482 can be driven either by one motor or by both motors 460 and 462 to provide output power for the marine outdrive apparatus of Fig. 29.

Claims

1. Marine outdrive apparatus for a boat having an inboard engine and a transom, comprises a support casing (252) adapted to extend rearwardly from the transom, means on the rear end of the support casing for forming a ball-receiving socket (258), a propeller shaft carrier (268) having a forward end and a rear end and provided with a hollow pivot ball (266) mounted thereon at the forward end thereof, said ball being pivotally received within said socket to permit universal movement of the ball about a pivot point relative to the socket, a rotatable drive shaft (280) in said support casing and adapted to be connected to said inboard engine, a propeller shaft (272) journaled in said propeller shaft carrier, universal joint means (278) interconnecting the drive shaft and the propeller shaft at a location within the ball, the centre (290) of said universal joint means substantially coinciding with the pivot point of the ball so that the propeller shaft carrier and the propeller shaft can pivot laterally about a steering axis and up and down about a trim axis, a propeller (44) mounted on the rear end of the propeller shaft for rotation therewith, and means

(108, 104, 292, 293) coupled with the propeller shaft carrier for pivoting the same about the steering axis and about the trim axis, characterised in that said steering axis is inclined upwardly and forwardly.

2. Marine outdrive apparatus according to Claim 1 characterised in that a stabilizing fin (295) is included, secured to and extending downwardly from the propeller shaft carrier.

3. Marine outdrive apparatus according to Claim 2 characterised in that trim fin means (306) is included, secured to the stabilizing fin for exerting a downward force thereon as a function of the movement of the trim fin means through the water.

4. Marine outdrive apparatus according to Claim 3 characterised in that the bottom surface of the trim fin means (306) has a curvature greater than the upper surface thereof.

5. Marine outdrive apparatus according to Claim 3 or Claim 4 characterised in that the trim fin means (306) is adjustably mounted on the stabilizing fin (295).

6. Marine outdrive apparatus according to any of Claims 3 to 5 characterised in that the trim fin means (306) extends laterally from opposed sides of the stabilizing fin (295).

7. Marine outdrive apparatus according to any of Claims 3 to 6 characterised in that the trim fin means comprises a pair of trim fins for respective, opposed sides of the stabilizing fin, and means (311, 313) coupled with the trim fins for adjustably mounting same on a lower end of the stabilizing fin so that the angle of attack of the trim fins can be changed.

8. Marine outdrive apparatus according to any of Claims 3 to 6 characterised in that the trim fin means comprises a trim fin of one piece construction (336), and means coupling the trim fin to the lower end margin of the stabilizing fin so that opposed side portions of the trim fin extend laterally from respective sides of the stabilizing fin.

9. Marine outdrive apparatus according to any preceding claim characterised in that the means for pivoting the propeller shaft carrier relative to the support casing includes a first fluid actuated piston (293) and cylinder (292) assembly for pivoting the propeller shaft carrier about the trim axis, and a second fluid actuated piston (104) and cylinder (108) assembly for pivoting the propeller shaft carrier about said steering axis.

10. Marine outdrive apparatus according to Claim 9 characterised in that the second piston and cylinder assembly has a rear end pivotally coupled to a respective side of the propeller shaft carrier and a mounting means (112) for pivotally coupling the forward end of the second piston cylinder assembly near the transom, the trim axis passing through the pivot point of the ball and the pivot joint of the mounting means at the forward end of the second piston and cylinder assembly.

11. Marine outdrive apparatus according to any preceding claim characterised in that the



propeller shaft carrier (268) has a substantially conical outer surface which reduces in cross-section as the rear end of the propeller shaft is approached.

12. Marine outdrive apparatus according to any preceding claim characterised in that the ball socket is in sealing, pivotal engagement with the outer surface of the ball, there being means (260, 262, 264) near the forward end of the support casing for sealing the junction between the support casing and the drive shaft so that the interior of the ball containing the universal joint means is a closed space which may contain a fluid.

13. Marine outdrive apparatus according to any preceding claim characterised in that the propeller shaft carrier has sealing means at a pair of spaced locations thereon to present a closed space in the carrier which may contain a flowable lubricant.

14. Marine outdrive apparatus according to any preceding claim characterised in that the universal joint means comprises a universal joint ((350) of the constant velocity type.

15. Marine outdrive apparatus according to Claim 14 characterised in that the universal joint comprises an inner race (352) secured to the drive shaft and rotatable therewith, an outer race (358) secured to the propeller drive shaft and rotatable therewith, and ball bearing means (360) interconnecting the inner and outer races to permit the races to rotate as a unit about the axis of the drive shaft and to permit the outer race to pivot universally relative to the inner race.

16. Marine outdrive apparatus according to any preceding claim characterised in that a second drive shaft (474) is included, coupled to a motor and spaced about the first-mentioned drive shaft in the support casing, and including a transmission unit (476) secured to the support casing and connecting the second drive shaft with the first drive shaft.

17. Marine outdrive apparatus attachable to a boat having a fore and aft axis and an inboard engine, the apparatus comprising:

a support casing (252) securable to a said boat;
a socket (258) supported by the support casing;
a propeller shaft carrier (268) having a forward portion formed with a ball (266) that is pivotally carried by the socket to form a ball and socket joint having a pivot point;

a drive shaft (280) adapted for connection to a said engine;

a propeller shaft (272) rotatably supported by the propeller shaft carrier (268), and receiving a propeller (44);

universal joint means (278) interconnecting the drive and propeller shafts, the centre (290) of the universal joint means coinciding with the pivot point of the ball and socket joint;

the propeller shaft carrier (268) being swingable laterally about a substantially vertical axis S, S relative to said fore and aft axis of the boat for steering the boat,

and means (104, 108, 292, 293) for swinging the

propeller shaft carrier (268) relative to the support casing (252)

characterised in that the axis S, S about which the propeller shaft carrier (268) swings laterally is inclined upwardly and forwardly.

18. Marine outdrive apparatus according to Claim 17 characterised in that a stabilizing fin (295) is included, secured to an extending downwardly from the propeller shaft carrier (268).

19. Marine outdrive apparatus according to Claim 18 characterised in that trim fin means (306) is included on the stabilizing fin (295) for exerting a downward force thereon as a function of the movement of the trim fin through the water.

Patentansprüche

1. Schiffsaustriebsvorrichtung für ein Boot mit einem Innenbordmotor und einer Heckplatte, mit einem sich rückwärts von der Heckplatte erstreckenden geeigneten Stützgehäuse (252), Mitteln am Hinterende des Stützgehäuses zum Bilden einer kugelaufnehmenden Hülse (258), einem Propellerwellenträger (268) mit einem Vorderende und einem Hinterende und mit einer darin, an dem Vorderende, befestigten hohlen Drehkugel (266), wobei die besagte Kugel drehbar innerhalb der besagten Hülse aufgenommen wird, um allseitige Drehungen der Kugel um einen Drehpunkt relativ zur Hülse zu gestatten, einer im besagten Stützgehäuse befindlichen und zum Verbinden mit besagtem Innenbordmotor geeigneten, drehbaren Antriebswelle (280), einer im besagten Propellerwellenträger gelagerten Propellerwelle (272), die Antriebswelle und die Propellerwelle an einer innerhalb der Kugel befindlichen Stelle miteinander verbindenden Kardangelenmitteln (278), wobei der Mittelpunkt (290) der besagten Kardangelenmittel im wesentlichen mit dem Drehpunkt der Kugel zusammentrifft, so dass der Propellerwellenträger und die Propellerwelle seitlich um eine Steuerachse und auf und ab um eine Trimmachse schwenkbar sind, einem am Hinterende der Propellerwelle zur Drehung mit derselben befestigten Propeller (44) und mit dem Propellerwellenträger verkuppelten Mitteln (108, 104, 292, 293) zum Schwenken desselben um die Steuerachse und um die Trimmachse, dadurch gekennzeichnet, dass besagte Steuerachse nach oben und nach vorne geneigt ist.

2. Schiffsaustriebsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, dass eine am Propellerwellenträgerbefestigte und sich davon nach unten erstreckende Stabilisierungsflosse (295) eingeschlossen ist.

3. Schiffsaustriebsvorrichtung nach Anspruch 2, dadurch gekennzeichnet, dass ein an der Stabilisierungsflosse befestigtes Trimmflossenmittel (306) zum Ausüben einer nach unten gerichteten Kraft auf dieselbe als Funktion der Bewegung des Trimmflossenmittels durch das Wasser eingeschlossen ist.

4. Schiffsaustriebsvorrichtung nach Anspruch 3, dadurch gekennzeichnet, dass die Krümmung der



unteren Oberfläche des Trimmflossenmittels (306) grösser als die der oberen Oberfläche desselben ist.

5 5. Schiffsaustriebsvorrichtung nach Anspruch 3 oder Anspruch 4, dadurch gekennzeichnet, dass das Trimmflossenmittel (306) verstellbar an der Stabilisierungsflosse (259) befestigt ist.

10 6. Schiffsaustriebsvorrichtung nach einem beliebigen der Ansprüche 3 bis 5, dadurch gekennzeichnet, dass sich das Trimmflossenmittel (306) seitlich von entgegengesetzten Seiten der Stabilisierungsflosse (295) erstreckt.

15 7. Schiffsaustriebsvorrichtung nach einem beliebigen der Ansprüche 3 bis 6, dadurch gekennzeichnet, dass das Trimmflossenmittel ein Paar Trimmflossen für entsprechende, entgegengesetzte Seiten der Stabilisierungsflosse umfasst, und mit den Trimmflossen verkuppelte Mittel (311, 313), um diese verstellbar so an einem unteren Ende der Stabilisierungsflosse zu befestigen, dass der Anstellwinkel der Trimmflossen verändert werden kann.

20 8. Schiffsaustriebsvorrichtung nach einem beliebigen der Ansprüche 3 bis 6, dadurch gekennzeichnet, dass das Trimmflossenmittel eine Trimmflosse in einstückiger Bauweise (336) umfasst, und Mittel zum Verkuppeln der Trimmflosse mit dem Rand am unteren Ende der Stabilisierungsflosse, so dass sich entgegengesetzte Seitenteile der Trimmflosse seitlich von entsprechenden Seiten der Stabilisierungsflosse aus erstrecken.

25 9. Schiffsaustriebsvorrichtung nach einem beliebigen vorhergehenden Anspruch, dadurch gekennzeichnet, dass das Mittel zum Schwenken des Propellerwellenträgers relativ zum Stützgehäuse eine erste flüssigkeitsbetätigte Kolben- (293) und Zylinder- (292) Baugruppe zum Schwenken des Propellerwellenträgers um die Trimmachse enthält und eine zweite flüssigkeitsbetätigte Kolben- (104) und Zylinder- (108) Baugruppe zum Schwenken des Propellerwellenträgers um besagte Steuerachse.

30 10. Schiffsaustriebsvorrichtung nach Anspruch 9, dadurch gekennzeichnet, dass die zweite Kolben- und Zylinderbaugruppe ein schwenkbar mit einer entsprechenden Seite des Propellerwellenträgers verkuppeltes Hinterende besitzt und ein Befestigungsmittel (112) zum schwenkbaren Verkuppeln des Vorderendes der zweiten Kolben- und Zylinderbaugruppe in der Nähe des Heckplatte, wobei die Trimmachse den Drehpunkt der Kugel und das Drehgelenk des Befestigungsmittels am Vorderende der zweiten Kolben- und Zylinderbaugruppe durchläuft.

35 11. Schiffsaustriebsvorrichtung nach einem beliebigen vorhergehenden Anspruch, dadurch gekennzeichnet, dass der Propellerwellenträger (268) eine im wesentlichen konische äussere Oberfläche besitzt, die sich mit Annäherung an das Hinterende der Propellerwelle im Querschnitt verringert.

40 12. Schiffsaustriebsvorrichtung nach einem beliebigen vorhergehenden Anspruch, dadurch gekennzeichnet, dass sich die Kugelhülse im dicht-

enden, drehbaren Eingriff mit der äusseren Oberfläche der Kugel befindet, wobei in der Nähe des Vorderendes des Stützgehäuses Mittel (260, 262, 264) zum Abdichten der Fuge zwischen dem Stützgehäuse und der Antriebswelle vorgesehen sind, so dass das Innere der das Kardangelnittel enthaltenden Kugel ein geschlossener Raum ist, der eine Flüssigkeit enthalten kann.

13. Schiffsaustriebsvorrichtung nach einem beliebigen vorhergehenden Anspruch, dadurch gekennzeichnet, dass der Propellerwellenträger an einem darauf befindlichen Paar beabstandeter Stellen Abdichtmittel besitzt, um in dem Träger einen geschlossenen Raum zu bieten, der ein fließfähiges Schmiermittel enthalten kann.

14. Schiffsaustriebsvorrichtung nach einem beliebigen vorhergehenden Anspruch, dadurch gekennzeichnet, dass das Kardangelnittel ein Kardangelnittel (350) der Doppelgelenkart umfasst.

15. Schiffsaustriebsvorrichtung nach Anspruch 14, dadurch gekennzeichnet, dass das Kardangelnittel einen an der Antriebswelle und damit drehbaren inneren Laufring (352) umfasst, einen an der Propellerantriebswelle befestigten und damit drehbaren äusseren Laufring (358) und die inneren und äusseren Laufringe miteinander verbindende Kugellagermittel (360), um die Laufringe sich als eine Einheit um die Achse der Antriebswelle drehen zu lassen und um den äusseren Laufring sich allseitig relativ zum inneren Laufring schwenken zu lassen.

16. Schiffsaustriebsvorrichtung nach einem beliebigen vorhergehenden Anspruch, dadurch gekennzeichnet, dass eine zweite mit einem Motor verkuppelte und oberhalb der ersterwähnten Antriebswelle im Stützgehäuse beabstandete Antriebswelle (474) mit einer am Stützgehäuse befestigten und die zweite Antriebswelle mit der ersten Antriebswelle verbindenden Übersetzungseinheit (476) eingeschlossen ist.

17. An einem Boot mit einer in Längsrichtung verlaufenden Achse und einem Innenbordmotor anbringbare Schiffsaustriebsvorrichtung mit:

einem an einem besagten Boot befestigungsfähigen Stützgehäuse (252);

einen vom Stützgehäuse gestützten Hülse (258);

einem Propellerwellenträger (268) mit einem mit einer Kugel (266) gebildeten Vorderende der schwenkbar von der Hülse getragen wird, um ein Kugelgelenk mit einem Drehpunkt zu bilden;

einer für Verbindung mit einem besagten Motor geeigneten Antriebswelle (280);

einer drehbar vom Propellerwellenträger (268) getragenen und einen Propeller (44) aufnehmenden Propellerwelle (272);

die Antriebs- und Propellerwellen miteinander verbindenden Kardangelnittel (268), wobei der Mittelpunkt (290) des Kardangelnittels mit dem Drehpunkt des Kugelgelenks zusammen-

trifft; wobei der Propellerwellenträger (268) seitlich um eine im wesentlichen senkrechte Achse S, S relativ zur besagten Längsrichtungsachse des Bootes zum Steuern des Bootes schwenkbar ist,



und Mitteln (104, 108, 292, 293) zum Schwenken des Propellerwellenträgers (268) relativ zum Stützgehäuse (252),

dadurch gekennzeichnet, dass die Achse S, S, um die der Propellerwellenträger (268) seitlich schwingt nach oben und nach vorne geneigt ist.

18. Schiffsaustriebsvorrichtung nach Anspruch 17, dadurch gekennzeichnet, dass eine am Propellerwellenträger (268) befestigte und sich davon nach unten erstreckende Stabilisierungsflosse (295) eingeschlossen ist.

19. Schiffsaustriebsvorrichtung nach Anspruch 18, dadurch gekennzeichnet, dass an der Stabilisierungsflosse (295) ein Trimmflossenmittel (306) zum Ausüben einer nach unten gerichteten Kraft auf dieselbe als Funktion der Bewegung der Trimmflosse durch das Wasser eingeschlossen ist.

Revendications

1. Dispositif de propulsion hors-bord pour un bateau comportant un moteur in-bord et un tableau, comprenant un carter de support (252) propre à s'étendre vers l'arrière du tableau, des moyens sur l'extrémité postérieure du carter de support pour former un logement de rotule (258), un fourreau d'arbre d'hélice (268) comportant une extrémité antérieure et une extrémité postérieure et pourvu d'une rotule de pivotement creuse (266) montée sur son extrémité antérieure, la rotule étant montée à pivotement dans le logement afin de pouvoir effectuer un mouvement universel autour d'un point de pivotement par rapport au logement, un arbre d'entraînement tournant (280) dans le carter de support, accouplé au moteur in-bord, un arbre d'hélice (272) tournant dans le fourreau d'arbre d'hélice, un joint universel (278) reliant l'arbre d'entraînement et l'arbre d'hélice à un endroit situé à l'intérieur de la rotule, le centre (290) du joint universel coïncidant en substance avec le point de pivotement de la rotule, de sorte que le fourreau d'arbre d'hélice et l'arbre d'hélice peuvent pivoter latéralement autour d'un axe de direction et verticalement autour d'un axe d'assiette, une hélice (44) montée sur l'extrémité postérieure d'arbre d'hélice de manière à tourner avec lui, et des moyens (108, 104, 292, 293) couplés au fourreau d'arbre d'hélice pour le faire pivoter autour de l'axe de direction et autour de l'axe d'assiette, caractérisé en ce que l'axe de direction est incliné vers le haut et vers l'avant.

2. Dispositif de propulsion hors-bord suivant la revendication 1, caractérisé en ce qu'un stabilisateur (295) est prévu, fixé au fourreau d'arbre d'hélice et s'étendant vers le bas depuis celui-ci.

3. Dispositif de propulsion hors-bord suivant la revendication 2, caractérisé en ce qu'un système d'ailerons d'assiette (306) est prévu, fixé au stabilisateur pour exercer sur celui-ci une force vers le bas qui soit fonction du déplacement des ailerons d'assiette dans l'eau.

4. Dispositif de propulsion hors-bord suivant la revendication 3, caractérisé en ce que la surface inférieure du système d'ailerons d'assiette (306)

présente une courbure supérieure à celle de sa surface supérieure.

5. Dispositif de propulsion hors-bord suivant la revendication 3 ou 4, caractérisé en ce que le système d'ailerons d'assiette (306) est monté de façon réglable sur le stabilisateur (295).

6. Dispositif de propulsion hors-bord suivant l'une quelconque des revendications 3 à 5, caractérisé en ce que le système d'ailerons d'assiette (306) s'étend latéralement à partir des côtés opposés du stabilisateur (295).

7. Dispositif de propulsion hors-bord suivant l'une quelconque des revendications 3 à 6, caractérisé en ce que le système d'ailerons d'assiette comprend deux ailerons d'assiette pour les côtés opposés respectifs du stabilisateur, et des moyens (311, 316) couplés aux ailerons d'assiette pour le monter de façon réglable sur une extrémité inférieure du stabilisateur, de telle sorte que l'angle d'attaque des ailerons d'assiette puisse être modifié.

8. Dispositif de propulsion hors-bord suivant l'une quelconque des revendications 3 à 6, caractérisé en ce que le système d'ailerons d'assiette comprend un aileron d'assiette d'une seule pièce (336) et des moyens reliant l'aileron d'assiette au bord d'extrémité inférieure du stabilisateur, de telle sorte que des parties latérales opposées de l'aileron d'assiette s'étendent latéralement à partir des côtés respectifs du stabilisateur.

9. Dispositif de propulsion hors-bord suivant l'une quelconque des revendications précédentes, caractérisé en ce que le dispositif destiné à faire pivoter le fourreau d'arbre d'hélice par rapport au carter de support comprend un premier vérin à piston actionné par fluide (293) et cylindre (292) pour faire pivoter le fourreau d'arbre d'hélice autour de l'axe d'assiette, et un second vérin à piston actionné par fluide (104) et cylindre (108) pour faire pivoter le fourreau d'arbre d'hélice autour de l'axe de direction.

10. Dispositif de propulsion hors-bord suivant la revendication 9, caractérisé en ce que le second vérin à piston et cylindre comporte une extrémité postérieure articulée à un côté respectif du fourreau d'arbre d'hélice et un dispositif de montage (112) pour articuler l'extrémité antérieure du second vérin près du tableau, l'axe d'assiette passant par le point de pivotement de l'articulation à rotule du dispositif de montage situé à l'extrémité antérieure du second vérin.

11. Dispositif de propulsion hors-bord suivant l'une quelconque des revendications précédentes, caractérisé en ce que le fourreau d'arbre d'hélice (268) comporte une surface extérieure en substance conique qui va en s'amincissant en coupe à mesure que l'on se rapproche de l'extrémité postérieure de l'arbre d'hélice.

12. Dispositif de propulsion hors-bord suivant l'une quelconque des revendications précédentes, caractérisé en ce que la douille de rotule est en contact de pivotement étanche avec la surface extérieure de la rotule, des moyens (260, 262, 264) étant prévus près de l'extrémité antérieure



rieure du carter de support pour assurer l'étanchéité de la jonction entre le carter de support et l'arbre d'entraînement, de sorte que l'intérieur de la rotule contenant le joint universel soit un espace clos qui puisse contenir un fluide.

13. Dispositif de propulsion hors-bord suivant l'une quelconque des revendications précédentes, caractérisé en ce que le fourreau d'arbre d'hélice comporte des moyens d'étanchéité en deux endroits espacés qui sont destinés à former dans le fourreau, un espace clos pouvant contenir un lubrifiant fluide.

14. Dispositif de propulsion hors-bord suivant l'une quelconque des revendications précédentes, caractérisé en ce que le joint universel est un joint universel (350) du type homocinétique.

15. Dispositif de propulsion hors-bord suivant la revendication 14, caractérisé en ce que le joint universel comprend un chemin de roulement intérieur (352) fixé à l'arbre d'entraînement et pouvant tourner avec celui-ci, un chemin de roulement extérieur (358) fixé à l'arbre d'entraînement d'hélice et pouvant tourner avec celui-ci, et un roulement à billes (360) reliant les chemins de roulement intérieur et extérieur pour permettre à ces chemins de roulement de tourner d'un bloc autour de l'axe de l'arbre d'entraînement et pour permettre au chemin de roulement extérieur de pivoter de manière universelle par rapport au chemin de roulement intérieur.

16. Dispositif de propulsion hors-bord suivant l'une quelconque des revendications précédentes, caractérisé en ce qu'un second arbre d'entraînement (474) est prévu, accouplé à un moteur, et est espacé au-dessus du premier arbre d'entraînement dans le carter de support, et une unité de transmission (476) est fixée au carter de support et relie le second arbre d'entraînement au premier.

17. Dispositif de propulsion hors-bord pouvant

être attaché à un bateau comportant un axe longitudinal et un moteur in-bord, comprenant:
un carter de support (252) pouvant être fixé au bateau;

5 un logement (258) supporté par le carter de support;

un fourreau d'arbre d'hélice (268) comportant une partie antérieure pourvue d'une rotule (266) qui est supportée à pivot par le logement pour former une articulation à rotule comportant un point de pivotement;

un arbre d'entraînement (280) propre à être accouplé à un moteur;

15 un arbre d'hélice (272) supporté à rotation par le fourreau d'arbre d'hélice (268) et recevant une hélice (44);

un joint universel (278) reliant l'arbre d'entraînement et l'arbre d'hélice, le centre (290) du joint universel coïncidant avec le point de pivotement de l'articulation à rotule;

20 le fourreau d'arbre d'hélice (268) pouvant pivoter latéralement autour d'un axe en substance vertical S, S par rapport à l'axe longitudinal du bateau en vue de diriger le bateau, et

25 des moyens (104, 108, 292, 293) pour faire pivoter le fourreau d'arbre d'hélice (268) par rapport au carter de support (252);

caractérisé en ce que l'axe S, S autour duquel le fourreau d'arbre d'hélice (268) pivote latéralement est incliné vers le haut et vers l'avant.

30 18. Dispositif de propulsion hors-bord suivant la revendication 17, caractérisé en ce qu'un stabilisateur (295) est prévu, fixé au fourreau d'arbre d'hélice (268) et s'étendant vers le bas à partir de celui-ci.

35 19. Dispositif de propulsion hors-bord suivant la revendication 18, caractérisé en ce qu'un système d'ailerons d'assiette (306) est monté sur le stabilisateur (295) pour exercer sur celui-ci une force dirigée vers le bas qui soit fonction du déplacement des ailerons d'assiette dans l'eau.

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