United States Patent [19]

Kucher

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[54] **ROTATABLE DOWNWARDLY DIRECTED DRIVELINE**

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[52] **U.S. Cl.** **115/35;** 64/27; 74/423; 115/34; 115/41

[51] **Int. Cl.** **B63h 25/42**

[58] **Field of Search** ..... 115/34, 35, 41; 64/27 R, 64/27 NM; 74/423

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[57] **ABSTRACT**

This invention is directed to a rotatable downwardly directed driveline for use in boats. In certain boats, it is desirable to have such a downwardly directed driveline and which driveline can be rotatable through 360° or a circle.

One of the problems encountered with such a driveline in boats is the seepage of fresh water and salt water into the housing so as to contact the driveline and the gears. With the contacting of the driveline and the gears, the same corrode so as to shorten the life and the usefulness of the apparatus.

25 Claims, 9 Drawing Figures

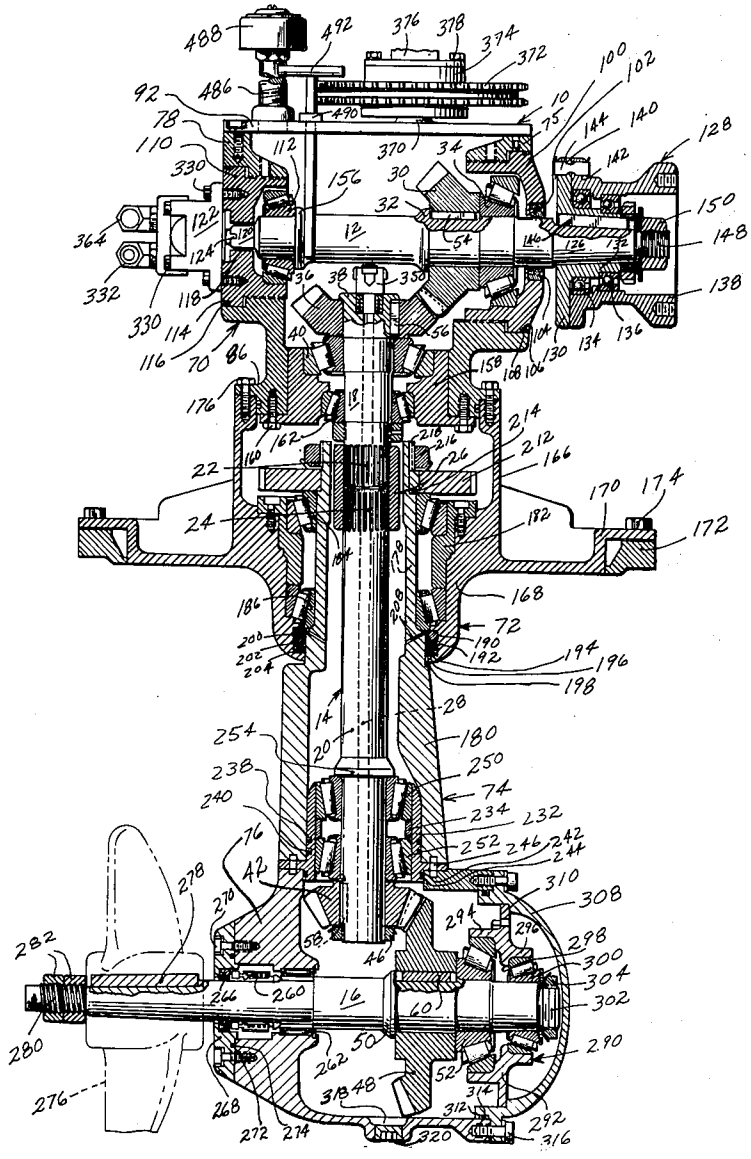
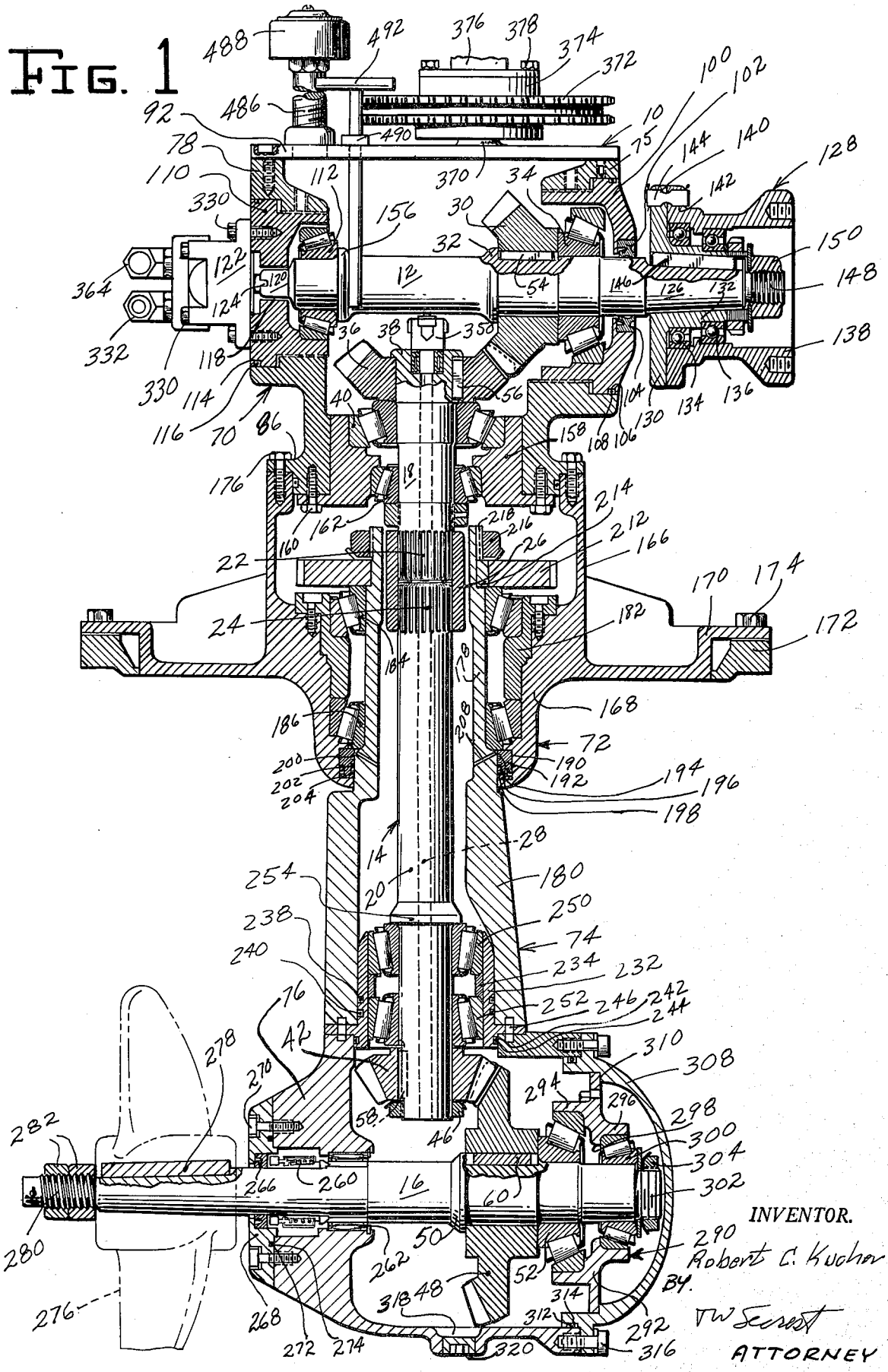


FIG. 1



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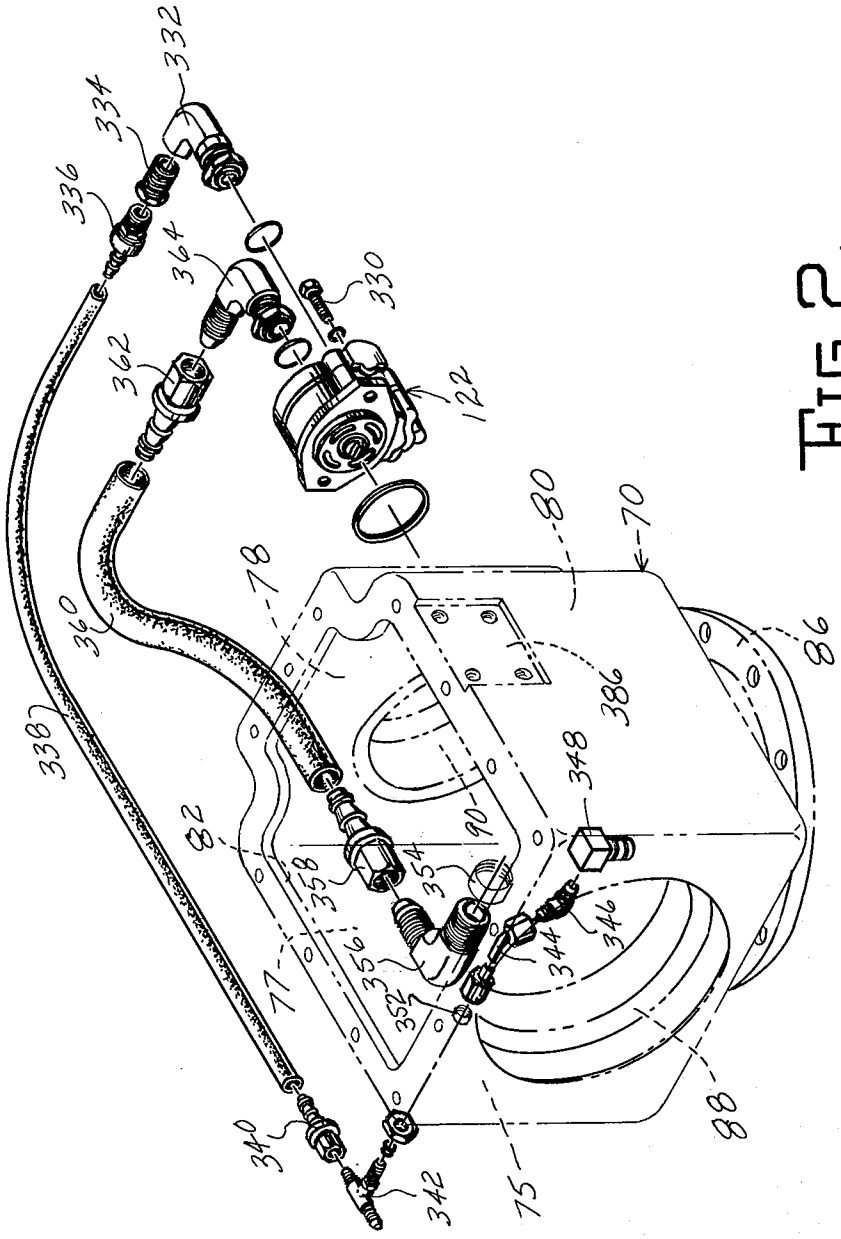

FIG. 2.

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FIG. 3

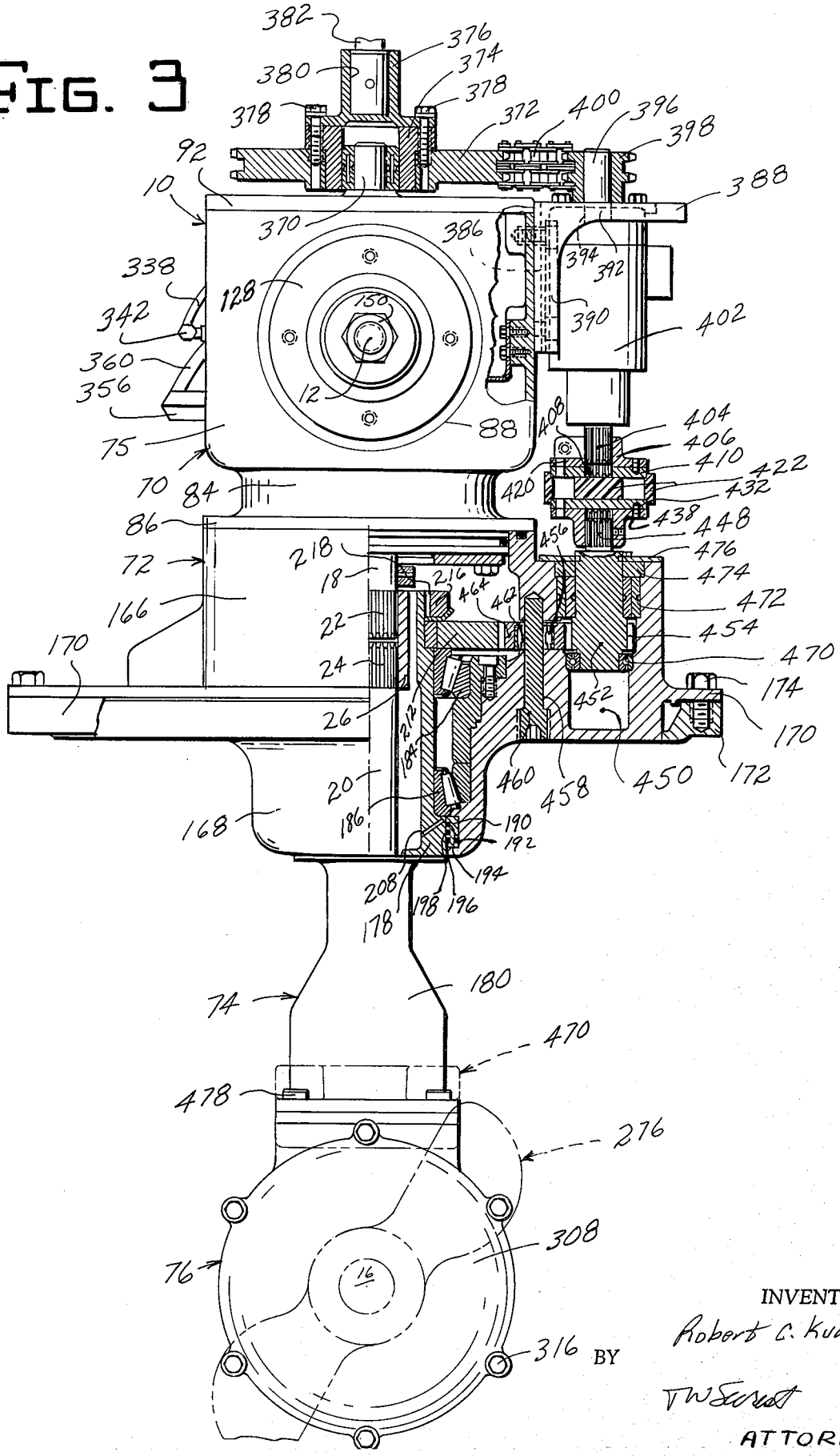

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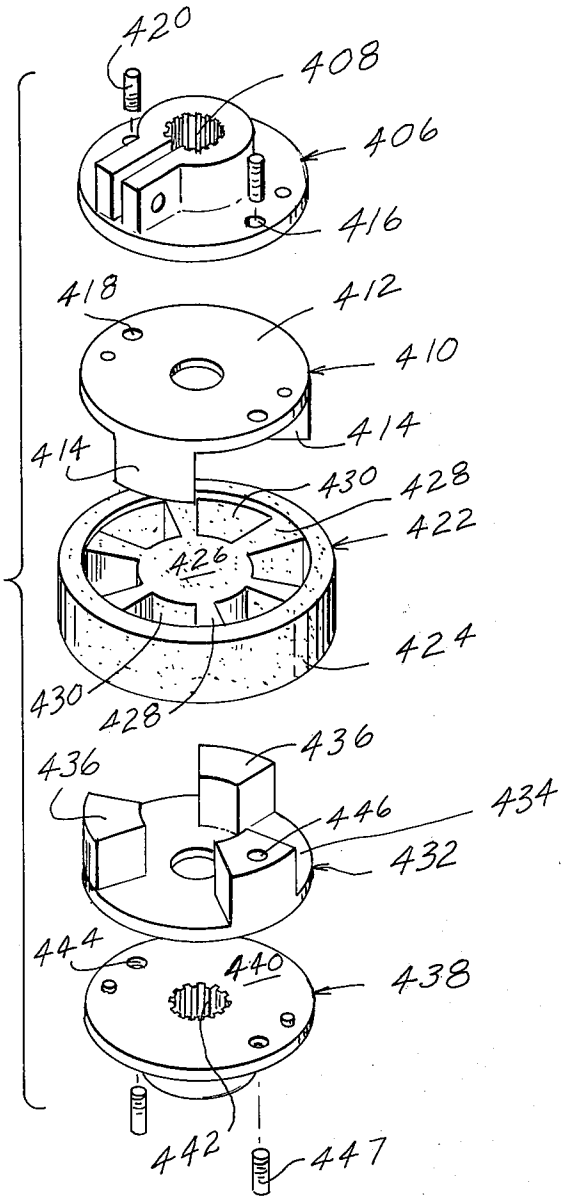
FIG. 4



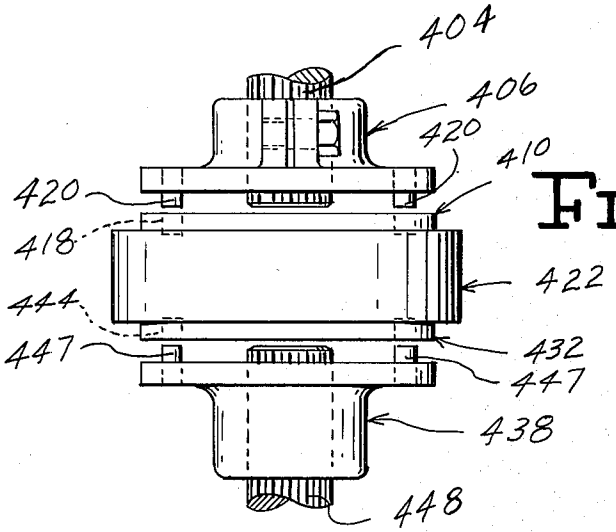


FIG. 5

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FIG. 6.

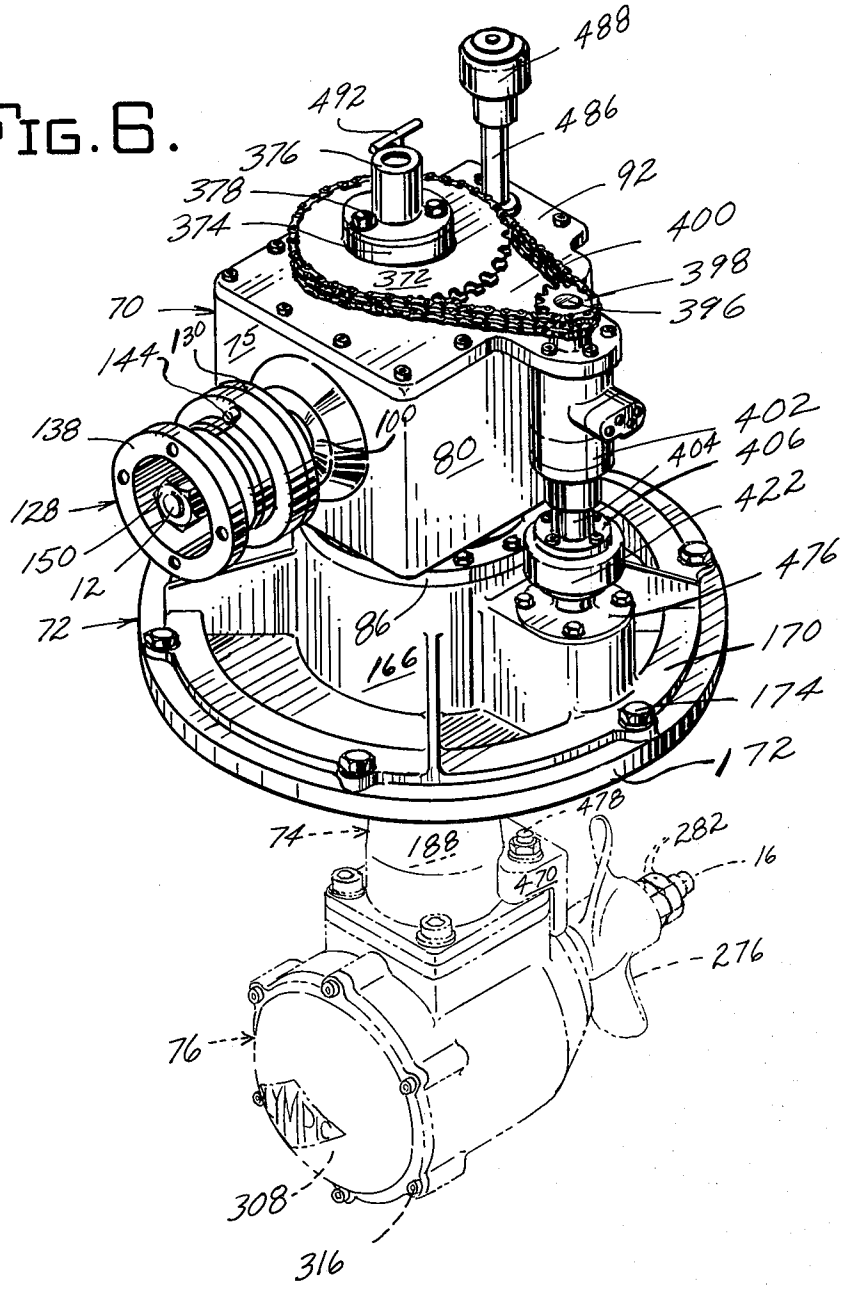

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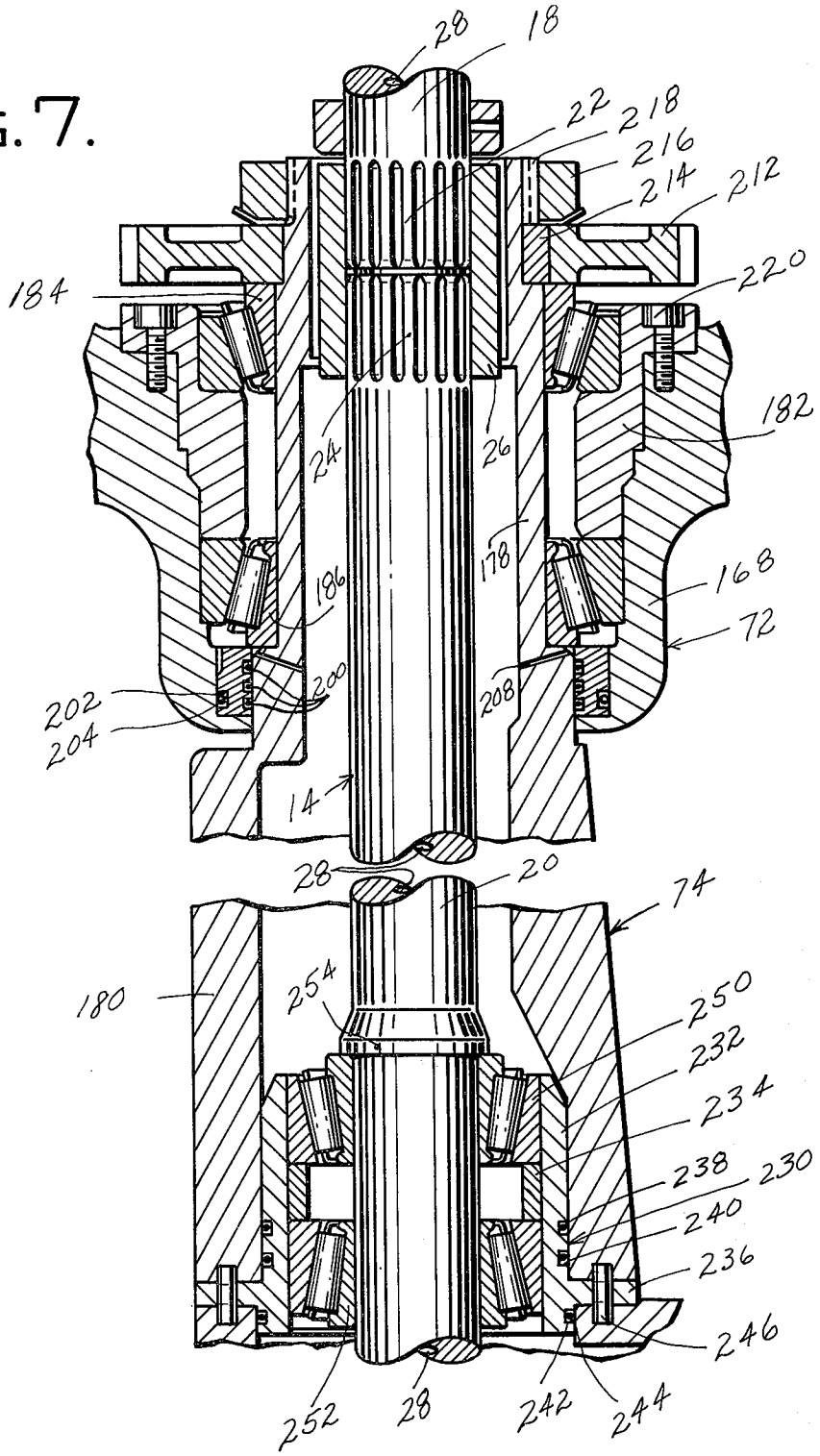
FIG. 7.



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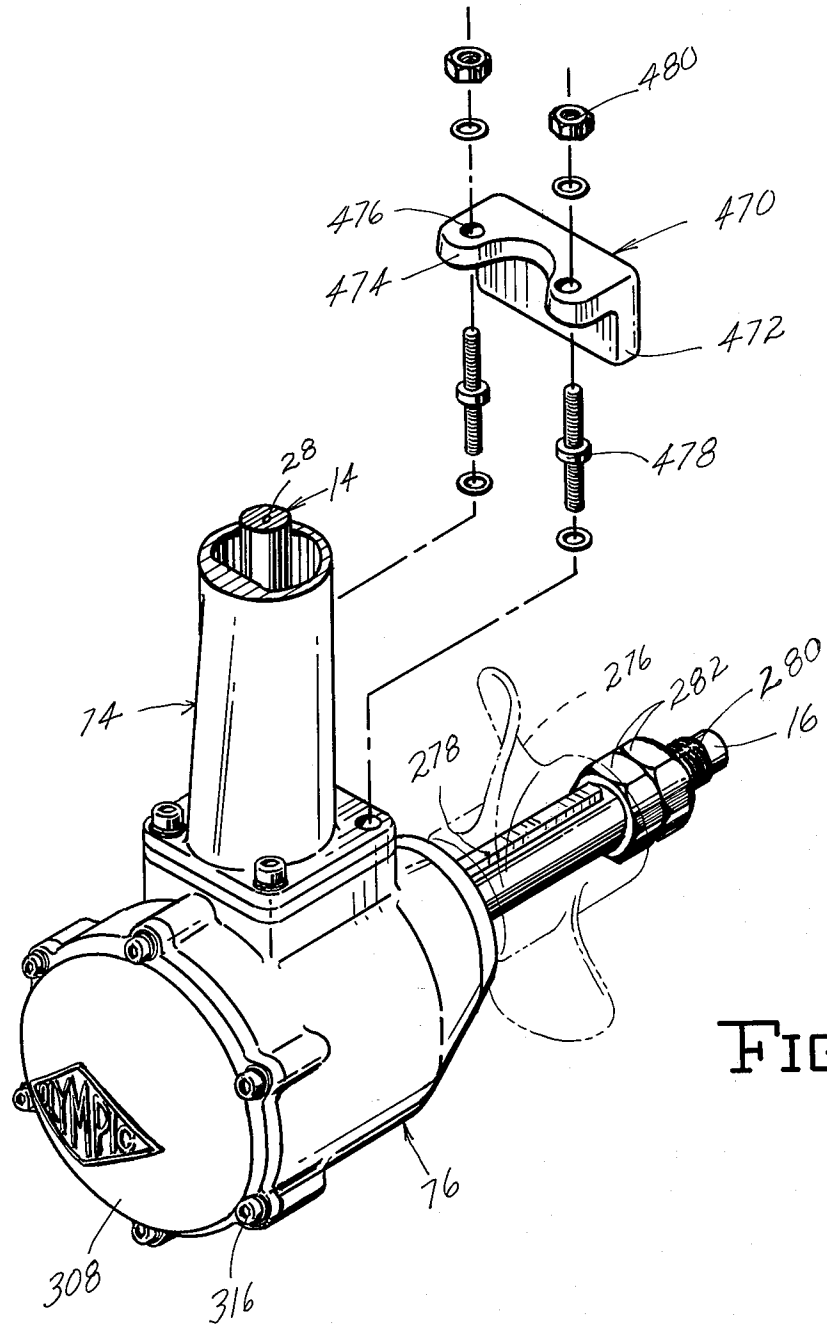

FIG. 8.

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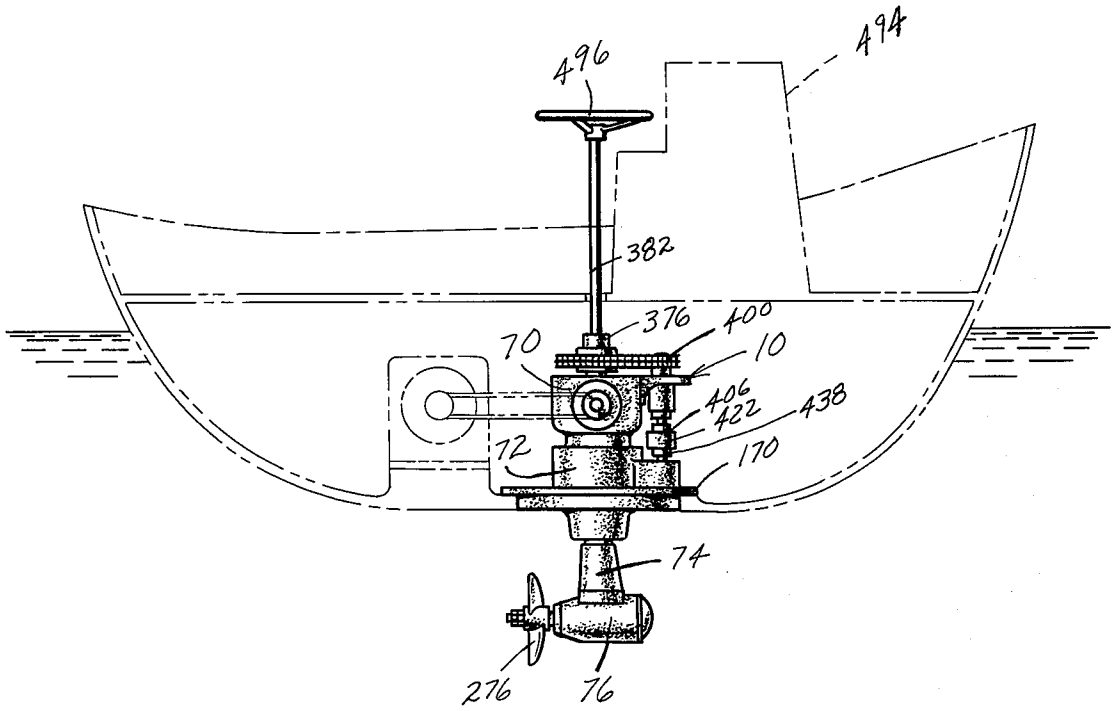

FIG. 9.

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ROTATABLE DOWNWARDLY DIRECTED DRIVELINE

This invention is directed to a rotatable, downwardly directed driveline and which driveline can rotate through 360° or a circle. Part of the driveline is in the boat and part of the driveline extends below the boat and is outside the boat. This driveline comprises a gear train and housing for the gear train.

The gear train comprises a horizontal input shaft, a downwardly directed drive shaft, and an output shaft. The horizontal input shaft is in the boat. The downwardly directed drive shaft is partly in the boat and partly underneath the boat. The output shaft is outside of the boat and underneath the boat. The output shaft is a propeller shaft and on the output shaft there is a propeller for propelling the boat.

As is readily appreciated, the housing for such a downwardly directed driveline, including the input shaft and the output shaft, comprises a number of separate housings which are united into the entire housing. At the junction of these separate housings, and especially those separate housings outside of the boat and below the boat, there is a possiblility of seepage of liquid such as fresh water and salt water, a corrosive liquid, into the housing so as to contact the various components of the gear train. One of the reasons for this seepage is the hydrostatic pressure of the water on the outside of the housing. Accordingly, an object and advantage of this invention is to provide a sealing means for the housing to keep out water and corrosive liquids from the housing so as to provide a longer life for the rotatable downwardly directed driveline in the housing and also for the rotatable housing; another object is to provide a positive pressure lubrication system having a flow through lubricant so as to maintain a positive pressure on the lubricant; to provide a steering train having a shock sbsorbing apparatus in the steering train so as to prolong the life of the components of the steering train; to provide a steering train for the downwardly directed driveline and which steering train make it easier to steer the downwardly directed driveline; to provide a self-sacrificing anode so as to prolong the life of the housing of the downwardly directed driveline; to provide a bearing configuration for the driveline and which bearing configuration imparts a longer life to the driveline; and, to provide a shaft bearing carrier for use with the downwardly directed driveline. These and other important objects and advantages of the invention will be more particularly brought forth upon reference to the accompanying drawings, the detailed description of the invention and the appended claims. In the drawings:

FIG. 1 is a vertical longitudinal cross-sectional view illustrating a specific embodiment of the invention constructed in accordance with the preferred teachings thereof and illustrates the horizontal horizontal input shaft, the downwardly directed driveline, and the output shaft, and illustrates the bearng connection between the upper portion of the housing and the rotatable lower portion of the housing;

FIG. 2 is a fragmentary exploded view of the positive lubrication system for the downwardly directed driveline and illustrates, in phantom, the upper housing, the lubrication pump, the input lines and the output lines connecting with the upper housing and with the lubrication pump;

FIG. 3 is a fragmentary view and illustrates, partially, in longitudinal, vertical cross-sectional view, the gear train between the input steering mechanism, the steering motor, and the output steering mechanism from the steering motor to the rotatable vertical housing;

FIG. 4 is a perspective exploded view of the cushioning apparatus for the steering means whereby shock encountered on the output shaft of the downwardly directed driveline is not imparted to the steering motor;

FIG. 5 is a fragmentary side elevational view of the cushioning means for the steering mechanism;

FIG. 6 is a perspective view looking at the upper housing and the center housing for the downwardly directed drive-line and illustrates the input shaft, the steering motor and the chain connection between the sprocket on the input shaft to the steering motor and the sprocket connecting with the drive means in the boat, the ring on the peripheral portion of the center housing and which ring fits with the corresponding opening in the bottom of the boat, and, in phantom, the lower housing and the output shaft projecting outwardly from said lower housing;

FIG. 7 is a fragmentary vertical longitudinal cross-sectional view illustrating the downwardly directed drive shaft and the bearing structure for said dirve shaft and also illustrates the center housing and the rotatable vertical housing and the bearing structure between the center housing and the vertical rotatable housing, and,

FIG. 8 is a fragmentary perspective view illustrating the lower housing, a portion of the rotatable vertical housing, the downwardly directed drive shaft and the self-sacrificing anode and the place of attachment for the self-sacrificing anode on the lower housing and rotatable vertical housing.

FIG. 9 is a longitudinal view of the preferred embodiment operatively positioned in a boat shown in phantom. The rotatable downwardly directed driveline **10** comprises an input shaft **12**, a downwardly directed drive shaft **14**, and an output shaft **16**. In FIG. **1** it is seen that the downwardly directed drive shaft **14** comprises an upper member **18** and a lower member **20**. The lower part of the upper member **18** has splines **22**. The upper part of the lower member **20** has splines **24**. The upper member **18** and the lower member **20** are united into the downwardly directed drive shaft **14** by means of a spline shaft coupling **26**. It is seen that the members **18** and **20** have a longitudinal passageway **28** throughout their length. The passageway **28** allows the flow of a lubricating fluid.

On the input shaft **12** there is a bevel ring gear **30**. The bevel ring gear **30** is positioned between a circumscribing shoulder **32** and a bearing **34**.

On the upper part of the shaft **14** there is a ring bevel gear **36**. The gear **36** is positioned between a circumscribing shoulder **38** and a bearing **40**.

On the lower part of the shaft **14** there is positioned a ring bevel gear **42**. The ring bevel gear **42** is positioned between a bearing **44** and a lock nut **46**.

On the output shaft **16** there is positioned a ring bevel gear **48**. The ring bevel gear **48** is positioned between a circumscribing shoulder **50** and a bearing **52**.

The ring bevel gear **30** is positioned on the shaft **12** by means of a key **54**. The ring bevel gear **36** is positioned on the shaft **14** by means of a key **56**. The ring bevel gear **30** and the ring bevel gear **36** mesh with each other in a driving and driven relation.

The ring bevel gear **42** is positioned on the shaft **14** by means of a key **58**. The ring bevel gear **48** is positioned on the shaft **16** by means of a key **60**. The ring

bevel gear 42 and the ring bevel gear 48 mesh with each other so as to be in a driving and driven relationship.

There is a housing for the shafts 12, 14, and 16. This housing comprises an upper housing 70, a center housing 72, a vertical housing 74 and a lower housing 76.

The upper housing 70, see FIG. 2, has four side walls 75, 77, 78, and 80. The housing 70 has an open top 82. In FIG. 3 it is seen that the housing 70 has a depending circular part 84 and on the lower part of 84 there is a circumscribing flange 86.

In the wall 75 it is seen that there is a circular opening 88. In the wall 78 it is seen that there is circular opening 90. And, there is a top or cap 92 for opening 82.

In the opening 88 in the side wall 75 there is a first bearing carrier 100. The bearing carrier 100 carries the bearing 34.

In the bearing carrier 100 there is an opening 102. In the opening 102 there is a seal 104. The seal 104 encircles the shaft 12.

In FIG. 1 it is seen that there is a circular recess 106 in the outer surface of the carrier 100 and in this recess 106 there is an O-ring 108. The O-ring 108 acts as the seal.

In the opening 90 in the wall 78 there is a carrier 110. The carrier 110 carries the bearing 112.

In the circular outside surface of the carrier 110 there is a recess 114 and in the recess 114 there is an O-ring 116. The O-ring 116 functions as a seal between the carrier 110 and the side wall 78.

The shaft 12 is journaled in the bearings 34 and 112. In the carrier 110 there is an opening 118. The shaft 12 has a reduced end 120 which projects into the opening 118. There is a lubrication pump or an oil pump 122. A shaft 124 connects the lubrication pump 122 and the reduced end 120 so that the shaft 12 is in a driving relationship with the lubrication pump 122.

On the other end of the shaft 12 the shaft is reduced at 126. There is mounted on the reduced end 126 a shear coupling assembly 128. The shear coupling assembly 128 comprises a shear flange 130. The shear flange 130 has a hub 132. There is mounted on the hub 132 a first bearing 134 and a second bearing 136. There is mounted on the bearings 134 and 136 a shear coupling flange 138.

In the shear flange 130 there is a passageway 140 and in the shear coupling flange 138 there is a passageway 142. A shear pin 144 connects the shear flange 130 and the shear coupling flange 138 so that the shear coupling flange 138 will rotate with the shear flange 130 and also with the shaft 12. A key 146 is between the reduced end 126 and the shear flange 130 so as to unite the two so that the two will rotate in unison. the shear coupling assembly 128 receives a drive means such as a belt or a pulley or the like. If there be some obstruction in the downwardly directed driveline 10 and the shear coupling flange 138 continues to rotate there is a possibility of damage to the downwardly directed driveline 10. If this obstruction be sufficiently large the shear pin 144 will shear so that the shear coupling flange 138 will continue to rotate but the shear flange 130 and the shaft 12 will not rotate.

The end of the shaft 12 beyond the reduced end 126, is threaded at 148. A nut 150 is screwed onto the threaded end 148 to firmly position the shear coupling assembly 128 on the shaft 12.

In FIG. 1 it is seen that there is a circumscribing shoulder 156 on the shaft 12 for positioning the bearing 112.

In FIG. 1 it is seen that there is a vertical bearing carrier 158. The vertical bearing carrier 158 is attached to the lower part of the upper housing 70 by means of bolts 160. The vertical bearing carrier 158 carries the bearing 40. Also, the vertical bearing carrier 158 carries the bearing 162. The bearings 40 and 162 position the upper end of the vertical shaft 14. More particularly, the bearings 40 and 162 position the stub shaft 18, which is the upper part of the vertical shaft 14.

In FIGS. 1, 3, and 6 it is seen that there is a center housing 72. The center housing 72 has an upright circular wall 166. Also, the center housing 72 has a lower circular wall 168. Further, the center housing 72 between the upright circular wall 166 and the lower circular wall 168 has a housing center 170. In FIGS. 1, 3 and 6 it is seen that the housing center 170 is of a circular flange-like configuration. The housing center 170 mounts on a mounting ring 172. The mounting ring 172 is positioned in the bottom of the boat and forms the enclosure around the opening in the bottom of the boat and also the support for the rotatable downwardly directed driveline 10. The rotatable downwardly directed driveline 10 may be attached to the mounting ring 172 by means of bolts 174. The upper housing 70 and the center housing 72 are united by means of bolts 176.

The center housing 72 and the upper housing 70 are fixedly positioned with respect to the boat. There is mounted, in a depending relation, in the center housing 72 the vertical housing 74. The vertical housing 74 is so mounted in the center housing 72 that the vertical housing 74 can rotate through a circle or through 360° or can make a complete revolution.

It is seen that the vertical housing 74 has an upper reduced nedk 178 and a lower main body 180. The upper reduced neck portion 178 is positioned in the center housing 72.

It is seen that the lower part of the center housing 72 has a bearing carrier 182. The bearing carrier on its upper part carries a bearing 184 which positions the upper part of the neck 178 of the vertical housing 74. There is positioned in the lower circular wall 168 of the center housing 72 a bearing 186. The bearing carrier 186 is positioned around the lower part of the neck 178 of the vertical housing 74.

The center housing 72 has a circular recess 190. In the circular recess 190 there is a bushing 192. The bushing 192 encircles the upper part of the main body 180 of the vertical housing 74. In the inner face of the bushing 192 there are three circular recesses 194, 196 and 198. In each of the circular recesses 194, 196 and 198 there is positioned an O-ring 200 to act as a seal between the bushing 192 and the upper part of the main body 180.

In the outer face of the bushing 192 there is a circular recess 202 and in the circular recess 202 there is an O-ring 204 which functions as a seal between the lower circular wall 168 of the center housing 72 and the bushing 192.

The circular recesses 194, 196 and 198 and the O-rings 200 and the circular recesses 202 and the O-ring 204 are essential to try and prevent water and directed liquids entering from the outside of the downwardly dorected driveline 10 into the interior of the downwardly directed drive line 10.

At approximately the junction of the neck **178** and the main body **180** it is seen that there are passageways **208.** These passageways allow the flow of lubricating oil to the bearing **186.**

On the upper end of the neck **178** there is a ring gear **212** or a steering gear **212.** The ring gear **212** is fixedly positioned on the upper end of the vertical housing **74** by means of a key **214.** The extreme upper end of the vertical housing **74** or the extreme upper end of the neck **178** is threaded and a nut **216** is screwed onto this thread and then a key **218** is positioned between the nut **216** and the extreme upper end of the neck **178** so as to fixedly position the nut with respect to the vertical housing **74.** Also, this assists in fixedly positioning the ring gear **212** on the neck **178.**

Bolts **220** connect the bearing carrier **182** with the center housing **72.**

In FIGS. **1** and **7** it is seen that there is a vertical shaft bearing carrier **230.** The carrier **230** is in a generally right circular cylinder configuration having a cylindrical body or wall **232.** In the interior of the body **232** there is an inner circular shouler **234.** Near the lower end of the carrier **230** there is an outer circular flange **236.**

Above the flange **236** and in the outer surface there are circular recesses **238** and **240.** Below the flange **236** and in the outer surface there is a circular recess **242.** In each of the circular recesses **238, 240** and **242** there is an O-ring **244.** The function of the O-ring is to act as a seal between the outer wall of the carrier **230** and the adjacent inner wall of the adjacent housing.

In the flange **236** there are a number of passageways and in the lower part of the housing **74** and the upper part of the housing **76** there are recesses aligned with these passageways. There are positioned in these passageways and in the recesses dowel pins **246.**

The carrier **230** carries an upper bearing **250** and a lower bearing **252.** These bearings journal the lower end of the vertical shaft **14.** The upper bearing **250** is positioned between the inner circular shoulder **234** and a circular shoulder **254** on the vertical shaft **14.** The lower bearing **252** is positioned between the inner circular shoulder **234** and the vertical shaft gear **42.**

It is seen that the vertical shaft **14** is journaled in its upper end by the bearings **40** and **162** which in turn are positioned by the upper housing **70.**

The shaft **14** is journaled in its lower end by the bearings **250** and **252** which are positioned by the vertical shaft bearing carrier **230** which in turn is positioned by the lower end of the vertical housing **74** and the upper end of the lower housing **76.**

In turn, the vertical housing **74** is journaled in the bearings **184** and **186** which in turn are positioned in the center housing **72** so as to allow the vertical housing **74** and the lower housing **76** to rotate.

In FIG. **1,** FIG. **3,** FIG. **6** and FIG. **8** there is illustrated the lower housing **76.**

In the lower housing **76** there is a passageway **260.** It is seen that the output shaft **16** is positioned in the passageway **260** and projects out and beyond said passageway. The output shaft is journaled in a bearing **262** in the passageway **260.** There is a seal **264** around said shaft and another seal **266** around said shaft. Then, there is a cap **268** on the lower housing **76.** The cap **268** carries the seal **266.** In the cap **268** there is a passageway through which the shaft **216** projects. The cap **268** is attached to the lower housing **76** by means of bolts **270.**

In the inner face of the cap **268** there is a circular recess **272** and in the circular recess **272** there is an O-ring **274.**

On the outer end of the shaft **16** there is a propeller **276,** in phantom. The propeller is keyed to the shaft **16** by key **278.**

The outer end of the shaft **16** is threaded at **280** and there are nuts **282** screwed onto the outer end of the shaft so as to more fixedly position the propeller **276** onto the shaft **16.**

There is a prop shaft bearing carrier **290.** The carrier **290** comprises a generally circular plate **292** having a circular shoulder **294** on one face and a circular shoulder **296** on the other face. In the carrier **290** there is a passageway **298.**

The carrier **290** and the shoulder **294** carry the bearing **52.** The carrier **290** and the shoulder **296** carry the bearing **300.** The shaft **16** is journaled in the bearings **52** and **300.** The outer end of the shaft **16** is threaded at **302.** A lock nut and washer **304** position the bearing **300** onto the shaft **16.**

The bearing **52** is positioned onto the shaft **16** between the ring gear **48** and the carrier **290.** The bearing **300** is positioned on the shaft **16** between the carrier **290** and the lock nut and washer **304.**

There is a lower housing cap **308.** The lower housing cap **308** has an inner circular shoulder **310.** The bearing carrier **290** is positioned so as to bear against the inner circular shoulder **310.**

In the outer face and the inner part of the lower housing cap **308** there is a circular recess **312.** In the recess **312** there is an O-ring **314.** The purpose of the O-ring **314** is to act as a seal between the lower housing cap **308** and the lower housing **76.**

The lower housing cap **308** is connected to the lower housig **76** by means of bolts **316.**

In the lower wall of the lower housing **76** there is a drain opening **318** and in the drain opening **318** there is a drain plug **320.**

In FIG. **2** there are illustrated the details of the oil pump of lubrication pump and connection with the upper housing **70.**

The oil pump **122** is connected to the upper housing **70** by means of bolts **330.**

As is recalled the oil pump **122** is driven by the shaft **12** through the connection **124.** With the rotation of the shaft **12** the oil pump **122** is activated to pump oil through the housings **70, 72, 74** and **76.** There connects with the oil pump **122** an elbow **332.** The elbow **322** connects with the reducer **334** which in turn connects with the swivel hose fitting **336.** The swivel hose fitting **336** connects with the hose **338.** The hose **338** connects with the swivel hose fitting **340** which in turn connects with the elbow **342.** The elbow **342** connects with adapters **344.** The adapters **344** connect with the elbow **346.** The elbow **346** connects with an oil transfer bushing **348.** The oil transfer bushihg **348** connects with a swivel adapter **350.** The swivel adapter **350** connects with the upper part of the shaft **14** and with the passageway **28** in the shaft **14.**

The fitting **342** is on the outside of the housing **70** and projects through an opening **352** in the housing. On the inside of the housing the fittings **344** connect with the fitting **342.**

The oil pump 122 forces the oil through the hose 338 and into the oil transfer bushing 348, the swivel member 350 and through the passageway 28 in the rotatable downwardly directed driveline. Then, the oil flows through the housing 76, the housing 74 and outside of the shaft 14, the housing 72 and also into the housing 70. It is now necessary to withdraw the oil from the housing 70. The connections for withdrawing the oil from the housing 70 are through an opening 354 in the wall of the housing 70. The opening 354 in the wall of the housing 70 is a tapped opening. An elbow 356 is screwed into the tapped opening. The elbow 356 connects with the swivel hose fitting 358 which in turn, through suitable adapters, connects with a hose 360. The hose or tube 360 connects with a swivel hose fitting 362 which in turn connects with an elbow 364. The elbow 364 connects with the oil pump 122. In this manner the oil is withdrawing from the upper housing 70, recirculated through the hose 360 to the oil pump 122. Then, from the oil pump 122 the oil is reintroduced into the upper housing 70 and the shaft 14 so as to positively lubricate the gear train and bearings, said lubrication being under pressure. With the lubrication being under pressure there is less possibility of outside liquids such as fresh water and salt water seeping into the interior of the rotatable downwardly directed driveline 10 so as to corrode parts of the gear train and also corrode bearings and other structure.

In FIGS. 1, 3, 4, 5 and 6 there is illustrated the steering mechanism.

In FIG. 3 it is seen that on the cover 92 for the upper housing 70 there is an upwardly directed stub shaft 370. There is positioned on this this stub shaft 370 a sprocket 372 having a hub 374. A circular flange 376 is connected to the hub 374 by means of bolts 378. The circular flange 376 has a recess 380. There is positoned in the recess 380 the steering shaft 382. It is to be understood that the steering shaft connects with suitable apparatus for rotating the steering shaft 382. For pond boats used in log booms the steering shaft 382 may project upwardly, through the deck of the boat 494 and above the deck of the boat 494 as shown in FIG. 9. There may be a steering wheel 496 or other suitable apparatus on the upper end of the steering shaft for rotating the steering shaft and thereby rotating the vertical housing 74 and the lower housing 76.

In FIG. 2 it is seen that in wall 80 of the housing 70 there is a recess 386. There is mounted in this recess 386 a bracket 388 having a leg 390 and an outwardly directed leg 392. In the outwardly directed leg 392 there is a passageway 394. Positioned in the passageway 394 is a shaft 396. The shaft 396 carries a sprocket 398. The shaft 396 and the sprocket 398 are keyed together. A chain 400 runs between the sprocket 372 and the sprocket 398.

The shaft 396 passes through the housing 402. In the housing 402 there is a suitable bearing structure for supporting and positioning the shaft 396.

The lower end of the shaft 396 is splined at 404.

There is a stub shaft adapter 406 having a splined passageway 408. The stub shaft adapter 406 connects with the shaft 404. The stub shaft adapter 406 connects with an upper shock plate 410. The upper shock plate 410 has a circular base 412 and depending bearing fingers 414. In the stub shaft adapter 406 there are passageways 416. In the upper shock plate 410 there are passageways 418. The stub shaft adapter 406 and the upper shock plate 410 are united and joined by means of dowel pins 420 which project through and are positoned in the passageways 416 and 418.

There is a shock ring 422. The shock ring 422 is of a flexible resilient material such as rubber or a suitable plastic or other suitable material. The shock ring 422 comprises a circular ring 424, a central portion 426 and six spokes 428 between the central portion or hub 426 and the ring 424. The hub 426, the six fingers 428 and the rim or ring 424 define six passageways 430 in the shock ring 422.

The bearing fingers 414 of the shock plate 410 project into and fit into three of said six passageways 430 in the shock ring 422.

There is a lower shock plate 432 having a circular base 434 and three bearing fingers 436. The bearing fingers 436 fit into three of the passageways 430 of the shock ring 422. More particularly, one of the bearing fingers 414 fits into a passageway 430 between two of the bearing fingers 436 in adjacent passageways 430 in the shock ring 422. Or, to rephrase this, a bearing finger 414 fits into a passageway 430 next to an adjacent passageway 430 housing a bearing finger 436. It is readily appreciated that the bearing fingers 414 and 436 do not contact each other but are separated by means of the spokes 428.

There is a stub shaft adapter 438 having a circular base 440 and a splined passageway 442. In the circular base 440 there are passageways 444. In the lower shock plate 432 there are passageways 446. Dowel pins 447 are positioned in the passageways 444 and 446 so as to unite the stub shaft adapter 438 and the lower shock plate 432.

The stub shaft adapter 438 is positioned on a splined shaft 448. The splined shaft 448 is positioned in a passageway 450 in the center housing 72. The splined shaft 448 is connected with the larger shaft 452.

On the lower end of the larger shaft 452 there is positioned a ring gear 454.

Between the passageway 450 and the interior of the center housing 72 there is a passageway 456.

In FIG. 3 it is seen that there is a vertical passageway 458 in the lower part of the housing 72. There is positioned in this upwardly directed passageway 458 a shaft 460. On the shaft 460 there is positioned a bearing 462 and on the bearing 462 there is an idler gear 464.

The gear 454 on the shaft 452 meshes with the idler gear 464. The idler gear 464 meshes with the ring gear 212 on the upper end or the neck 178 of the vertical housing 74.

The shaft 452 is journaled in suitable bearings. More particularly, on the lower end of the shaft 452 there is a bearing 470 between the shaft 452 and the inner surface of the walls of the cavity 450. Above the ring gear 454 there are sleeve bearings 472 between the shaft 452 and the inner surface of the wall of the cavity 450. There is positioned above the sleeve bearings 472 a seal 474. Above the seal 474 there is positioned a cover plate 476 for housing the seal 474 and for covering the cavity 450.

From the foregoing it is seen that the boat 494 may be steered by rotating the shaft 382 so as to rotate the sprocket 372 and the sprocket 398. Then, the shaft 396, the shock plate 410 and the shock ring 422 and the shock plate 432 are rotated. Likewise, the shaft 448, the gear 454, the gear 464 and the gear 212 are

rotated so as to rotate the vertical housing **74**, the lower housing **76** and the propeller **276**.

If the propeller **276** meets with resistance such as striking a log or a submerged article or some other resistance there is placed stress on the shaft **16**, the gears **48** and **42**, the shaft **14**, and the gear **212**. Prior to this invention I used a straight shaft connecting with the shaft **452** and with the shaft **396**. This straight shaft upon the propeller meeting the resistance would often shear and break. In certain instances I used a fixed gear drive and the gear teeth, upon the propeller meeting resistance, would break. This necessitated tearing down the steering mechanism and replacing the fixed shaft or the gear. Because of this breakage I devised the shock ring **422**. Now, with the propeller meeting resistance and stress being placed on the shaft **14** and the ring gear **212** there is also stress placed upon the gear **464** and the gear **444** in addition to the stress being placed on the shaft **452** and the splined shaft **448**. Now, instead of shafts or gears breaking or being damaged the shock ring **442** takes up some of this stress. The spokes **428** may be compressed between the bearing fingers **436** and the bearing fingers **414**. But with the compression of the spokes **428** the stress is not directly transferred but is absorbed. As a result, there is not the breakage encountered in the steering mechanism and there is not the necessity to tear down the rotatable downwardly directed driveline **10**, repair the steering mechanism and then reassemble the unit. The net effect is a steering mechanism and a rotatable downwardly directed drive which lasts longer than previously available equipment. Further, the shock ring **422** takes up some of the shock which would be transferred to the man steering the boat or directing the boat. This makes it easier for the operator of the boat to perform better service and possibly escape being injured.

In FIGS. **3** and **8** there is illustrated an anode sacrifice member **470**. This member **470** comprises a downwardly directed leg **472** and a curved member **474**. The curved member **474** has two passageways **476**. The anode sacrifice unit **470** is positioned on the lower part of the housing **74**, see FIG. **6** and FIG. **8**. There are bolts **478** which can be screwed into the passageways in the lower part of the vertical housing **74** so as to connect the vertical housing **74** with the lower housing **76**. Then, the anode sacrifice unit **470** may be positioned on the stud bolts **478** and nuts screwed onto the stud bolts **478** so as to firmly position the unit **470** on the stud bolts **478**.

The anode sacrifice unit **470** may be a suitable metal. One of the metals I have found to be suitable for this purpose is zinc. The anode sacrifice unit corrodes in water but lessens or prevents the corrosion of the housing for the rotatable downwardly directed driveline. Therefore, there is used the anode sacrifice unit **470** to lessen corrosion of the housing members. When the unit **470** is substantially completely corroded or dissolved away a new unit may be installed.

From the foregoing it is seen that I have presented a rotatable downwardly directed drive unit which is designed to lessen the possibility of corrosion of the gear train and the supporting structure for the gear train. Further, this unit is so designed as to have a steering mechanism which lessens the possibility of breaking a shaft or a gear and a steering mechanism as there is provided a shock ring for absorbing some of the shock being transmitted through the gear train. Further, there is provided a positive lubrication system for lubricating under pressure so as to prevent the ingress of outside liquids into the interior of the housing for the drive shafts and gear train. In FIGS. **1** and **6** it is seen that on the cover **92** that there is an upwardly directed pipe **486**. On top of the pipe **486** there is a cap or housing **488**. The pipe **486** connects with the interior of the upper housing **70** and functions as a breather for the interior of the housings **70, 72, 74** and **76**. Further, in FIG. **1** it is seen that in the cover **92** that there is a passageway and an adapter ring **490**. The adapter ring **490** positions a dip stick **492** for indicating the level of the lubricating oil or lubricant in the upper housing **70**.

What I claim is:

1. A combination of a boat and a substantially vertical downwardly directed drive unit for said boat, said combination comprising:

a. said boat having a bottom;
b. said boat having an opening in said bottom;
c. said drive unit fitting into said opening;
d. said drive unit comprising an input shaft;
e. a single downwardly directed drive shaft;
f. a propeller shaft;
g. a first driving means between said input shaft and said drive shaft;
h. a second driving means between said drive shaft and said propeller shaft;
i. a casing for said input shaft, said drive shaft and said propeller shaft;
j. said casing comprising a central housing for the upper part of said single drive shaft; said central housing extending below said bottom;
k. said casing comprising a vertical housing for the lower part of said single drive shaft;
l. two sets of lower tapered roller bearings;
m. the lower end of said single drive shaft being positioned in said tapered roller bearings of said drive shaft;
n. said lower tapered roller bearings being positioned with respect to the lower end of said vertical housing and inside of said vertical housing;
o. two sets of upper tapered roller bearings;
p. said two sets of upper tapered roller bearings being positioned between the upper part of said vertical housing and said central housing to allow relative rotation between said vertical housing and said central housing; at least one set of said two sets of upper tapered rollers bearings being positioned in said central housing below said bottom;
q. said input shaft being in said boat;
r. said drive shaft being in said boat and below the bottom of said boat; and,
s. said propeller shaft being outside said boat.

2. A drive unit according to claim **1** and comprising:

a. said vertical housing and said propelling means being connected to rotate; and,
b. a steering means connecting with said vertical housing to rotate said vertical housing and said propelling means.

3. A drive unit according to claim **2** and comprising:

a. said steering means comprising a resilient means to lessen mechanical stress.

4. A drive unit according to claim **2** and comprising:

a. said steering means comprising a power means for rotating said vertical housing and propelling means; and,

b. a resilient means between said power means and said vertical housing to lessen mechanical stress.

5. A combination according to claim **1** and comprising:

a. said drive shaft having a central longitudinal passageway; and,

b. a lubrication means for forcing a lubricant through said central longitudinal passageway.

6. A combination of a boat and a substantially vertical downwardly directed drive unit for said boat, said combination comprising:

a. said boat having a bottom;

b. said boat having an opening in said bottom;

c. said drive unit fitting into said opening;

d. said drive unit comprising an input shaft;

e. a single downwardly directed drive shaft;

f. a propeller shaft;

g. a frist gear on said input shaft;

h. a second gear on said drive shaft;

i. said first gear and said second gear in a meshing contact relationship with each other;

j. a third gear on said drive shaft;

k. a fourth gear on said propeller shaft;

l. said third gear and said fourth gear in a meshing contact relationship with each other;

m. a casing for said input shaft, said drive shaft and said propeller shaft;

n. said casing comprising a central housing for the upper part of said single drive shaft; said central housing extending below said bottom has been inserted;

o. said casing comprising a vertical housing for the lower part of said single drive shaft;

p. two sets of lower tapered roller bearings;

q. the lower end of said single downwardly directed shaft being positioned in said tapered roller bearings of said drive shaft;

r. said lower tapered roller bearings being positioned with respect to the lower end of said vertical housing and inside of said vertical housing;

s. two sets of upper tapered roller bearings;

t. said two sets of upper tapered roller bearings being positioned between the upper part of said vertical housing and said central housing to allow relative rotation between said vertical housing and said central housing; at least one set of said two sets of upper tapered roller bearings being positioned in said bottom;

u. said input shaft being in said boat;

v. said drive shaft being in said boat and below the bottom of said boat; and, w. said propeller shaft being outside said boat.

7. A combination according to claim **6** and comprising:

a. a shaft bearing carrier;

b. said lower tapered roller bearings being positioned by said shaft bearing carrier;

c. said shaft bearing carrier being positioned with respect to said vertical housing;

d. a first sealing means between the outer surface of said shaft bearing carrier and the inner surface of said vertical housing; and,

e. a second sealing means between the outer surface of said vertical housing and the inner surface of said central housing.

8. A drive unit according to claim **7** and comprising:

a. said second means comprising a bushing;

b. a third sealing means between the inner surface of said bushing and the outer surface of said downwardly directed housing; and,

c. a fourth sealing means between the outer surface of said bushing and the inner surface of said central housing.

9. A drive unit according to claim **7** and comprising:

a. said first sealing means being an O-ring; and,

b. said second sealing means comprising a bushing and an O-ring.

10. A drive unit according to claim **8** and comprising:

a. said third sealing means and said fourth sealing means comprising O-rings.

11. A drive unit according to claim **6** and comprising:

a. said vertical housing and said propelling means being connected to rotate; and,

b. a steering means connecting with said vertical housing to rotate said vertical housing and said propelling means.

12. A drive unit according to claim **11** and comprising:

a. said steering means comprising a resilient means to lessen mechanical stress.

13. A drive unit according to claim **11** and comprising:

a. said steering means comprising a power means for rotating said vertical housing and propelling means; and,

b. a resilient means between said power means and said vertical housing to lessen mechanical stress.

14. A drive unit according to claim **13** and comprising:

a. said resilient means comprising a cushion, a first driving member and a driven member; and,

b. said cushion being positioned between said driving member and said driven member to lessen the mechanical stress between the driving member and the driven member.

15. A combination according to claim **6** and comprising:

a. a metallic anode attached to the lower part of said casing and under the bottom of said boat.

16. A combination according to claim **6** and comprising:

a. said drive shaft having a central longitudinal passageway; and,

b. a lubrication means for forcing a lubricant through said central longitudinal passageway.

17. A drive unit according to claim **14** and comprising:

a. said drive shaft having a central longitudinal passageway; and,

b. a lubrication means for forcing a lubricant through said central longitudinal passageway.

18. A drive unit according to claim **17** and comprising:

a. a shear pin coupling mounted on the input end of said input shaft.

19. A combination of a boat and a substantially vertical downwardly directed drive unit for said boat, said combination comprising:

a. said boat having a bottom;

b. said boat having an opening in said bottom;

c. said drive unit fitting into said opening;

d. said drive unit comprising an input shaft;

e. a downwardly directed drive shaft;

f. a propeller shaft;

g. a first driving means between said input shaft and said drive shaft;
h. a second driving means between said drive shaft and said propeller shaft;
i. a casing for said input shaft, said drive shaft and said propeller shaft;
j. said casing comprising a central housing for the upper part of said drive shaft; said central housing extending below said bottom;
k. said casing comprising a vertical housing for the lower part of said drive shaft;
l. two sets of lower tapered roller bearings;
m. the lower end of said shaft being positioned in said tapered roller bearings of said drive shaft;
n. said lower tapered roller bearings being positioned with respect to the lower end of said vertical housing and inside of said vertical housing;
o. two sets of upper tapered roller bearings;
p. said two sets of upper tapered roller bearings being positioned between the upper part of said vertical housing and said central housing to allow relative rotation between said vertical housing and said central housing; at least one set of said two sets of upper tapered roller bearings being positioned in said central housing below said bottom;
q. said input shaft being in said boat;
r. said drive shaft being in said boat and below the bottom of said boat;
s. said propeller shaft being outside said boat;
t. a shaft bearing carrier;
u. said lower tapered roller bearings being positioned by said shaft bearing carrier;
v. said shaft bearing carrier being positioned with respect to said vertical housing;
w. a frist sealing means between the outer surface of said shaft bearing carrier and the inner surface of said vertical housing; and,
x. a second sealing means between the outer surface of said vertical housing and the inner surface of said central housing.

20. A drive unit according to claim **19** and comprising:
a. said second means comprising a bushing;
b. a third sealing means between the inner surface of said bushing and the outer surface of said downwardly directed housing; and,
c. a fourth sealing means between the outer surface of said bushing and the inner surface of said central housing.

21. A drive unit according to claim **19** and comprising:
a. said first sealing means being an O-ring; and,
b. said second sealing means comprising a bushing and an O-ring.

22. A drive unit according to claim **20** and comprising:
a. said third sealing means and said fourth sealing means comprising O-rings.

23. A combination of a boat and a substantially vertical downwardly directed drive unit for said boat, said combination comprising:
a. said boat having a bottom;
b. said boat having an opening in said bottom;
c. said drive unit fitting into said opening;
d. said drive unit comprising an input shaft;
e. a downwardly directed drive shaft;
f. a propeller shaft;
g. a first driving means between said input shaft and said drive shaft;
h. a second driving means between said drive shaft and said propeller shaft;
i. a casing for said input shaft, said drive shaft and said propeller shaft;
j. said casing comprising a central housing for the upper part of said drive shaft; said central housing extending below said bottom;
k. said casing comprising a vertical housing for the lower part of said drive shaft;
l. two sets of lower tapered roller bearings;
m. the lower end of said shaft being positioned in said tapered roller bearings of said drive shaft;
n. said lower tapered roller bearings being positioned with respect to the lower end of said vertical housing and inside of said vertical housing;
o. two sets of upper tapered roller bearings;
p. said two sets of upper tapered roller bearings being positioned between the upper part of said vertical housing and said central housing to allow relative rotation between said vertical housing and said central housing; at least one set of said two sets of upper tapered roller bearings being positioned in said housing below said bottom;
q. said input shaft being in said boat;
r. said drive shaft being in said boat and below the bottom of said boat;
s. said propeller shaft being outside said boat;
t. said vertical housing and said propelling means being connected to rotate;
u. a steering means connecting with said vertical housing to rotate said vertical housing and said propelling means.
v. said steering means comprising a power means for rotating said vertical housing and propelling means;
w. a resilient means between said power means and said vertical housing to lessen mechanical stress;
x. said resilient means comprising a cushion, a first driving member and a driven member; and
y. said cushion being positioned between said driving member and said driven member to lessen the mechanical stress between the driving member and the driven member.

24. A drive unit according to claim **23** and comprising:
a. said drive shaft having a central longitudinal passageway; and,
b. a lubricant means for forcing a lubricant through said central longitudinal passageway.

25. A drive unit according to claim **24** and comprising:
a. a shear pin coupling mounted on the input end of said input shaft.

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