Sept. 18, 1962 A. G. SCHNEIDER 3,054,376

INBOARD-OUTBOARD POWER BOAT PROPULSION MEANS

Filed April 18, 1960 3 Sheets-Sheet 1

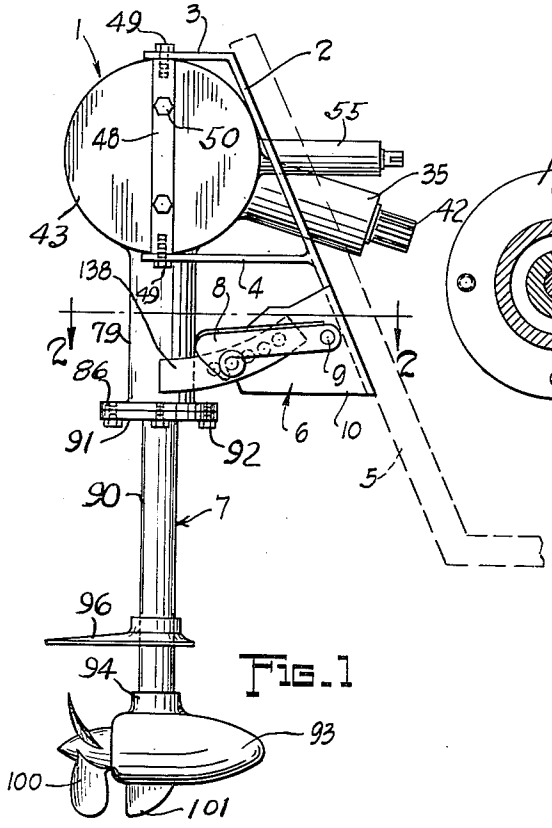


Fig. 1

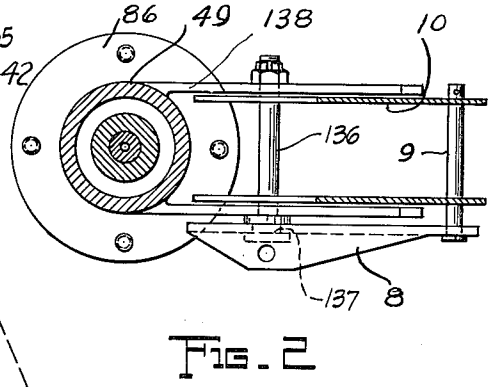


Fig. 2

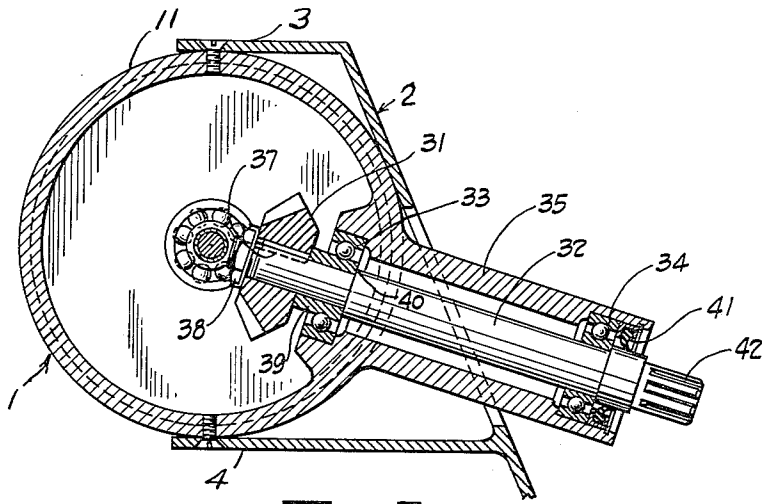


Fig. 3

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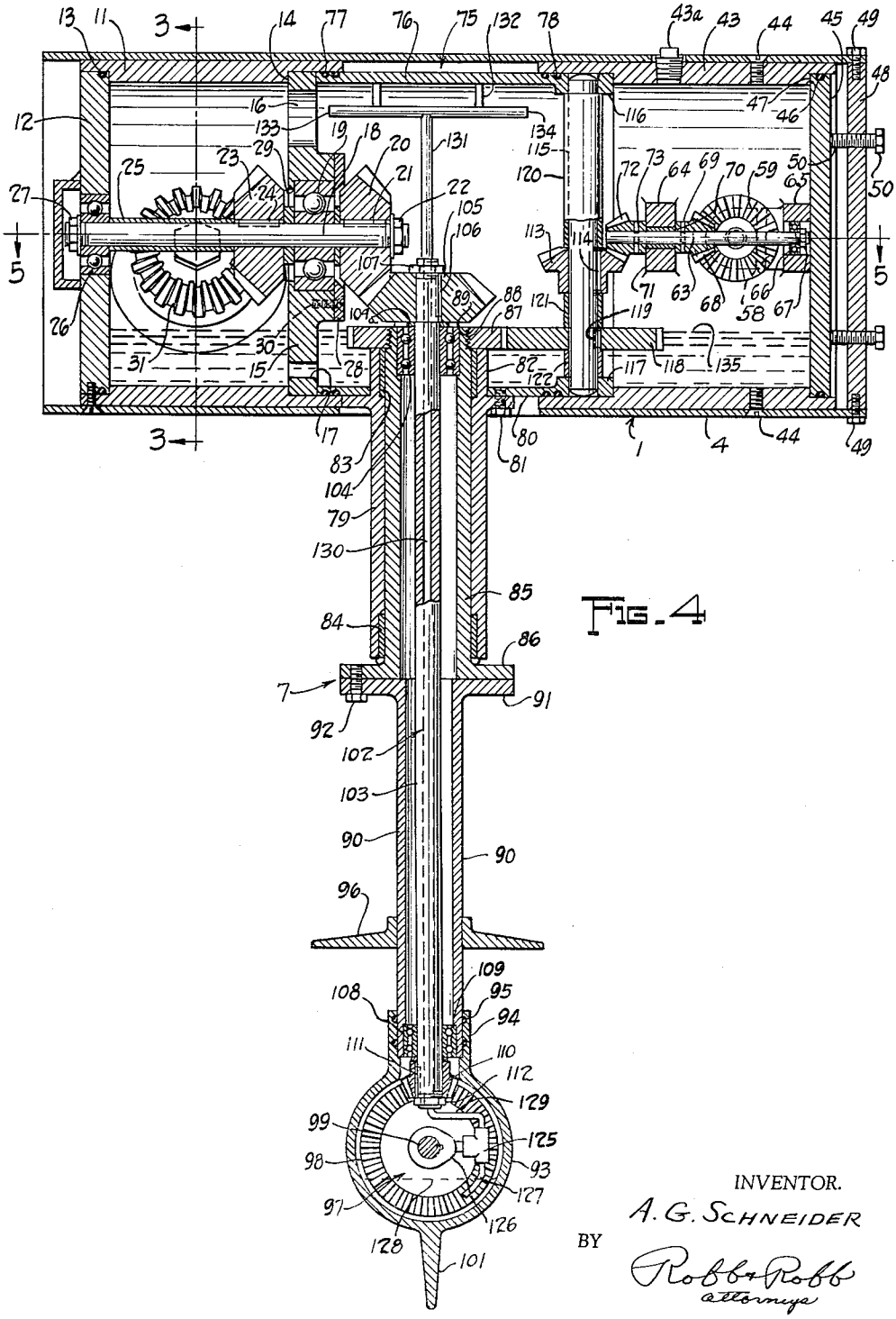


Fig. 4

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INBOARD-OUTBOARD POWER BOAT PROPULSION MEANS

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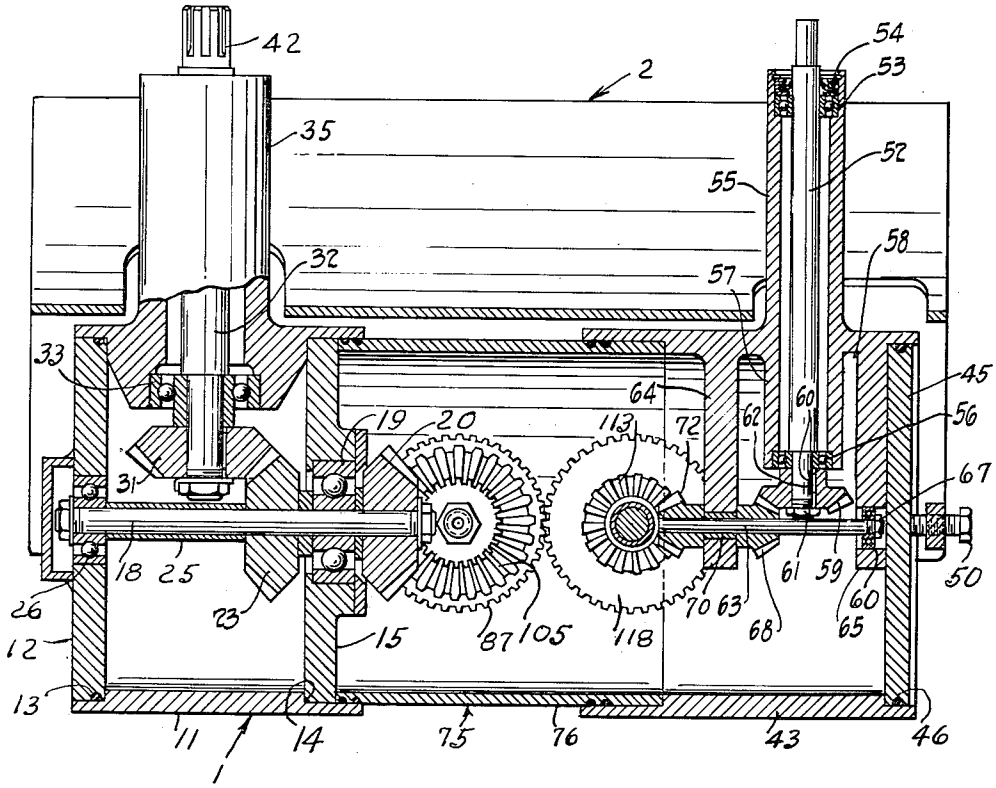


FIG. 5

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United States Patent Office 3,054,376 Patented Sept. 18, 1962

3,054,376
INBOARD-OUTBOARD POWER BOAT PROPULSION MEANS

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Filed Apr. 18, 1960, Ser. No. 22,810
14 Claims. (Cl. 115—35)

This invention relates to boat propulsion units and particularly to units adapted to transfer inboard power to transom mounted propeller operating means.

The general field to which this invention is related, has been explored to some extent, but heretofore some serious objections have been raised to the type of unit offered, in several aspects. Some of these difficulties involve the fact that for rather large power output, the units have not been properly designed to transfer such power, or in the alternative have of necessity been so complicated as to be prohibitedly expensive and thus not generally adopted.

It will be appreciated that several important advantages arise in connection with the use of a unit of the class to which this invention is directed, particularly as the same may be designed for use with pleasure boats which for many reasons can benefit most by reason of an outboard type of unit.

The provision of outboard units generally, where the same are self contained or so to speak out board motors, has been such as to limit the real horsepower delivered, and at the same time be relatively inefficient in contrast to inboard power units necessary to drive boats of large size, which inboard power units are substantially more efficient in most respects.

The difficulty with inboard power units in boat operation, is that of necessity they have fixed propeller and rotary units which limit the draft, or more particularly limit the depth of water which can be navigated by such units, not to mention the difficulties involved in striking obstructions which cause substantial damage to fixed underwater drive and steering means of boats.

Another advantage of the outboard drive unit of the class hereinunder consideration, over the conventional inboard type of power and drive therefor, is the ability in the particular instance herein, to provide power steering in effect, because the thrust of propeller itself is used to impart power operation in turning of the boat with which the unit may be associated.

With the foregoing generally outlined situation in mind, it is a principal object of this invention to provide an outboard propulsion unit, driven by inboard power means, which includes all the advantages of commonly known outboard motors with none of the disadvantages thereof, and likewise combines the improved efficiency of inboard power units and includes the ability to absorb and deliver large amounts of power.

Another object of this invention, is to provide a propulsion unit of the class described, which will not only transfer the power delivered by an inboard engine, but in so doing be provided with novel steering instrumentalities, so as to take the fullest advantage of the unit in respect of the ability to steer under power while absorbing and delivering large amounts of power through the unit.

Yet another object of this invention is to provide a propulsion unit of the class herein considered, in which the same is comprised of a relatively few simple parts, readily assembled and dissassembled by reason of the novel construction so that replacement and operation is easily effected, efficiency in operation being a prime consideration.

A more specific object of this invention, is to provide a novel propulsion unit which is susceptible of having incorporated therein, means to reduce the amount of wear which is usually present in power transfer mechanism,

availing of novel cooling instrumentalities to minimize lubricant heating and in fact to maintain the lubricant at proper operating temperature.

Another object of the invention which is particularly emphasized, is the ability to transfer steering effort under all conditions of operation of the unit with which the same is associated, and without regard for the power directed therethrough, obviating any possible disconnection of such power either in forward or rearward operation. Further in this connection, the ability of the steering mechanism to be operable under all conditions, and make possible the elimination of reverse gear which may be found desirable under some conditions is provided, the driving force being either imparted by pushing or by tractive effort of the propeller associated therewith.

Other and further objects of the invention will be set forth in the specification appended hereto which contains a detailed explanation and as shown in the drawings wherein:

FIGURE 1 is a side elevation of a unit as the same may be mounted upon a boat transom or the like, being illustrative primarily.

FIGURE 2 is a sectional view taken about on the line 2—2 of FIGURE 1 looking in the direction of the arrows.

FIGURE 3 is a sectional view on a somewhat enlarged scale as compared with FIGURE 1, of a portion of the propulsion unit including the input drive means therefor, FIGURE 3 being taken about on the line 3—3 of FIGURE 4 looking in the direction of the arrows.

FIGURE 4 is a vertical sectional view, illustrating the relationship of the various drive and steering instrumentalities provided.

FIGURE 5 is a horizontal sectional view taken about on the line 5—5 of FIGURE 4 looking in the direction of the arrows.

Referring now to the drawings and particularly to FIGURE 1, the propulsion means of this invention comprises a main upper body generally designated 1 which is supported on a mounting bracket 2 having the upper horizontally extending member 3 and the lower member 4 which are fixed in any preferred manner to the body 1 as will be explained more in detail hereinafter.

The transom of a boat is generally designated 5, and the mounting bracket 2 may be bolted or otherwise secured to the same so that the propulsion means hereof will generally assume the position shown in the said figure with respect to such transom there being provided certain adjusting means generally designated 6 to position the drive housing 7 with regard to the transom, such adjusting means including a latch member 8 pivotally mounted at 9 to a secondary bracket part 10 of the bracket 2. The operation of this adjusting and restraining mechanism will be explained in more detail hereinafter.

Referring now to the FIGURE 4 disclosure, primarily, the body 1 is comprised of what may be termed an input section 11, which for the purposes hereof is of generally cylindrical nature being provided at the left as viewed in the said figure with a cap or closure member 12 suitably engaged with the section 11, which will be hereinafter described as an input drive case when considered with the member 12. Suitable sealing means such as 13 may be provided, seated in a groove extending peripherally of the member 12, the member 12 being bolted or otherwise secured to the end of the part 11 in any preferred manner.

Suitably seated against a shoulder 14, is a transverse gear set supporting member 15 which for the purposes hereof is generally circular as will be readily understood, including an opening at the upper portion thereof at 16 and a further opening at 17 the lower portion.

The transverse gear set which is a portion of the drive

means, includes a transverse shaft 18 supported in the member 15 by a combination radial and thrust bearing 19 of the anti-friction type, the shaft 18 having affixed at one end a suitable bevel gear 20 operatively connected to the shaft 18 by means of a key 21 and a nut and washer combination 22.

The shaft 18 supports at the other side of the bearing 19, and on the other side of the member 15, a further bevel gear 23, operatively connected to the shaft 18 by a key 24, and maintained in position on the shaft by the provision of a sleeve 25, which engages with a bearing 26 mounted in the end member 12 previously mentioned, a further nut and washer combination 27 being availed of to maintain the bearing 26, sleeve 25 and gears associated with the shaft 18, in proper position, the bearing 26 being suitably mounted in the member 12. The bearing 19 is maintained in the member 15 by the provision of a plate 28, and shoulder 29 of the member 15, the plate 28 being fastened thereto in any preferred manner as by suitable bolts such as 30.

Referring now to FIGURE 5, the bevel gear 23 is shown as being drivably engaged with a further bevel gear 31, mounted on the end of a shaft 32. As indicated in FIGURE 3 the shaft 32 is provided with suitable radial and thrust bearings 33 at one end and 34 at the other, the said bearings 33 and 34 being suitably located in the supporting member 35, which is preferably integral with the drive case member 11 extending at an angle therefrom as shown in FIGURE 3. The gear 31 previously mentioned, is a gear of the same size as the gear 23 and is drivably connected by means of the key 37 to the shaft 32. A suitable nut and washer combination 38 is furnished to maintain the gear 31 in position on the shaft, by abutment with the inner race member 39 of the bearing 33 which race member in turn engages a shoulder 40 on the shaft 32.

A suitable seal 41 is furnished at the other end of the shaft 32 and on that said other end is a suitable spline 42 for engagement by universal joint or other connection from a motor or the like. The shaft 32 and its associated and driven parts thereby become the input drive means for driving the transverse gear set supported on the shaft 18 as previously set forth.

Turning now to a consideration of the other end of the body 1, there is shown what may be termed a steering section of the unit, including a steering drive case 43, being of similar preferably cylindrical configuration as the member 11 previously mentioned, and being suitably fastened to the mounting means 3, as by means of the screws 44.

An end member 45 is furnished, of generally circular configuration, having a seal in a peripheral groove 46, the end member 45 being seated against a shoulder 47 formed at the end of the steering drive case 43 and maintained in such position by the provision of a vertically extending pressure bar 48 as seen in FIGURE 1, in end elevation and in section in FIGURE 4. The said bar 48 is connected at upper and lower ends by means of bolts 49 to the mounting members 3 and 4. Suitable adjusting screws or bolts 50 are furnished which are entered in suitable tapped sections of the bar 48 and by manipulation, effect a pressure against the end member 45 to maintain the same in sealed condition against the shoulder 47 as previously mentioned. These provisions will facilitate access to the interior of the entire unit and yet provide for adequate sealing of lubricant therewithin.

The steering drive means which is supported within the steering drive case 43 largely, includes a main shaft 52 supported in anti-friction bearing at 53 with a seal 54 being mounted at the outer extremity of an extension 55 of the steering drive case 43, which extension is preferably integral with such case and positioned about as shown in FIGURE 1 under some conditions or if desired it may occupy the same angle with regard to the body 1 as the member 35 for the input drive means.

The shaft 52 extends into the drive case 43 and at its inner end, is carried by an anti-friction bearing 56, which

bearing is in turn supported on the legs 57 and 58 which are suitably connected at the innerside of the case 43 and formed to support the bearing 56. A bevel gear 59 is provided and suitably fastened on the end 60 of the shaft 52 as by means of the nut 61 for example. The nut 61 maintains the gear in its connected relation to the shaft 52, suitable key means being provided in addition as indicated at 62, the inner race of the bearing 56 being fixed against a shoulder of the shaft in accordance with conventional practice.

A transverse gear set for the steering mechanism is shown in FIGURES 4 and 5, as comprising a transverse shaft 63, suitably supported about centrally of the steering drive case upon the arms 64 and 65, an anti-friction bearing 66 being suitably mounted in the arm 65 and the shaft 63 being connected thereto as by means of a suitable nut 67.

The shaft 63 is equipped with a bevel gear 68 engaging the gear 59 previously mentioned, the gear 68 being suitably fastened as by means of the pin 69 extending through the gear hub and shaft 63. A short sleeve 70 is mounted on the shaft 63 and extends through the support arm 84 into engagement with the hub of a further bevel gear 72, similarly fastened to the shaft 63 by the pin 73. Thus the gears 72 and 68 will rotate in unison as compelled so to do by the gear 59 which in turn is operated by the shaft 52 from the steering mechanism of the boat or the like in which this unit is installed.

For the sake of clarity the description of this unit will now be directed to an output drive section, which is intermediate the input drive section and the steering drive section which have been described. The output drive section is generally denoted 75, and includes an output drive case 76 of generally cylindrical configuration, which drive case is provided with O-rings 77 seated in peripheral grooves on the case 76, which sealing rings engage the inner surface of the input drive case 11. The end of the output drive case engages the member 15 previously described and maintains such member in position to support the transverse drive gearing previously described in detail.

At the opposite end of the output drive case 76, further sealing or O-rings 78 are provided, sealingly engaging the steering drive case 43 as indicated in FIGURES 4 and 5. The drive case 76 is thereby rotatably mounted between the cases 11 and 43 and includes an output drive case extension 79, suitably fastened to the drive case 76 by means of the flange 80 provided at the mounting end, which flange 80 is maintained in connection by means of suitable bolts such as 81, there being a series of these and the flange being of suitable construction so as to sealingly engage with the outer surface of the output drive case 76. Alternatively this flange may be welded or otherwise secured to the case 76.

The output drive case extension 79, extends inwardly into the output drive case 76 as at 82 and is equipped with a suitable sleeve bearing 83, a similar sleeve bearing 84 being provided at the opposite extremity of such extension.

The output drive housing 79 including an upper member 85 of cylindrical nature, is shown supported within the output drive case extension 79, such housing part 85 having a flange 86 at its lower extremity and being rotatable in the sleeve bearings 83 and 84. The housing part 85 is provided with a gear 87, forming a part of the steering gear train to be particularly described subsequently, the gear 87 being threadedly engaged at 88 with the housing part 85 by suitable threads 89 provided thereon, and prevented in any conventional manner from subsequently loosening with respect to such housing part 85, thereby in effect providing a nut for this part to maintain the same in position for rotation with respect to the drive case extension 79, the gear 87 being a spur gear as will be understood.

The flange 86 of the output drive housing, is engaged with a lower housing member 90 of generally tubular

form having a corresponding flange **91** at its upper extremity, engaged in a sealing manner with the flange **86** previously mentioned by means of bolts such as those indicated at **92**.

The housing member **90**, is sealingly and nonrotatively connected at its lower extremity with a propeller drive case **93**, the drive case **93** having the extension **94** which is arranged to receive the housing part **90** therein and be fastened thereto in any preferred manner, suitable seals such as **95** being provided if necessary.

A suitable anti-cavitation plate **96** is shown positioned on housing part **90** at any preferred location to perform its function and in any preferred manner to be fastened to such housing part.

The propeller drive case **93**, supports therewithin the propeller gear set generally denoted **97**, including the relatively large bevel gear **98**, suitably fastened to a shaft **99**, which shaft **99** in turn drives the propeller **100** which is fastened thereto, at outside of the case **93**, such fastening being effected in well known manner and not shown in detail.

The shaft **99** may be supported within the drive case in similar preferred manner which is well known and thus not further illustrated. The drive case may also include a skeg such as **101** extending therefrom in accordance with conventional practice.

Adverting to the gearing and drive, particularly the input drive as the same may be connected to the propeller by means now to be described, there is illustrated an angular gear set generally denoted **102**, which includes the shaft **103**, mounted at its upper end in a suitable combination radial and thrust anti-friction bearing **104**, which bearing **104**, is supported in the upper end of the output drive housing member **85**. The shaft **103** is provided at its upper extremity with a suitable bevel drive gear **105**, keyed at **106** to such shaft, the gear being maintained on the shaft by means of a suitable nut such as **107**. The gear **105** will engage, through a washer **104***a* with the inner race of the bearing **104**, such gear **105** being in driving engagement with the gear **20** of the transverse gear set previously described in detail.

At the lower end of the shaft **103**, a further combination radial and thrust anti-friction bearing **108** is positioned on the shaft and mounted in the lower extremity of the output drive housing part **90** against a shoulder **109** provided.

A bevel gear **110** is keyed at **111** to the shaft **103** and maintained in position by a nut **112**. The gear **110** is in driving engagement with the bevel gear **98** previously mentioned as being supported on the propeller drive shaft **99**. The drive to the shaft **99** is thus effected by means of driving rotation of the input drive shaft **32**, transferring the drive to the bevel gear **31** thereon, which bevel gear **31** is in engagement with the transverse drive gear set including the gear **23** thereon, which in turn drives the gear **20** through the shaft **18**. The gear **20** being drivably engaged with the gear **105**, in turn rotates the shaft **103** and transfers the driving effect to the gear **110** and thence to the gear **98** and shaft **99** thereby rotating the propeller by such connection.

Turning now to a consideration of the steering drive mechanism, in order to complete a description of the same, the transverse gear set including the gears **68** and **72**, is arranged to engage with a gear **113** keyed at **114** to a shaft **115**. The shaft **115** is supported at its upper end as viewed in FIGURE 4 for example, in a boss **116**, formed interiorly of the output drive case **76**. At the lower end, the shaft **115** is supported for rotation in a further boss **117** similarly formed interiorly of the output drive case **76**.

Suitably keyed to the shaft **115**, is a spur gear **118**, in driving engagement with the gear **87** previously described as being fixed at the upper end of the output drive housing member **85**. The gear **118** is keyed at **119** to the shaft **115**, the gear **113** and the gear **118** being maintained in their relative positions by the provision of suitable sleeves as **120**, **121** and **122**. Since the shaft is prevented from moving upwardly and downwardly by engagement of the end extremities thereof with the innerside of the steering drive case **43** as a consideration of FIGURE 4 will indicate, the simple assembly of this device will be readily appreciated.

The steering drive effect, is accomplished by provision of means to rotate the shaft **52** for the input, which in turn operates the bevel gear **59** engaged with the mating bevel gear **68** mounted on the transverse steering gear set. The gear **68** being connected to the shaft **63**, in turn drives the gear **72** and this gear rotates the gear **113** and shaft **115** to which the same is connected.

The gear **113** in turn rotates the gear **118**, which is engaged with the mating gear **87** fixed to output drive housing member **85** and thus causing the same to rotate when the action now being described of rotation of the shaft **52** is effected.

As will be understood from the foregoing, this rotation of the housing including the upper part **85** and lower part **90** will in turn impart rotation to the propeller drive case **93**, carrying with it the propeller and thus directing the drive of such propeller. Obviously a three hundred sixty degree (360°) movement of the housing being possible, will in turn transfer similar effect to the propeller itself and thus reverse operation of the boat may be resorted to if thought desirable in this manner.

One of the main problems with drive mechanism of this type is to be able to put in a substantial amount of power, and the gearing shown herein is desirably properly lubricated, and suitable means for effecting such lubrication is necessary.

In this particular instance, a novel lubricating system has been devised by provision of a pump **125** in the propeller drive case operated by a cam **126**, drivably connected to the shaft **99**. The pump **125**, includes an inlet line **127** the end of which is immersed in lubricant to a level **128**.

In order to circulate the lubricant, the drive shaft **103** is provided with a central passage **130** leading to a T-shaped pipe distributor **131** which is supported in any preferred manner in the output drive case **76** as indicated at **132**. When the lubricant is forced through the distributor **131** it is expelled at the ends **133** and **134** in spray fashion over the various gears operating in the body **1** and the oil or other lubricant is accumulated in such body to a level about as indicated at **135**.

As the lubricant level builds up in the various cases, the said lubricant is permitted to flow through the anti-friction bearing **104**, down along the outside of the shaft **103**, through the bearing **108** and into the propeller drive case **93** where it is picked up again as required, by the pump **125**.

One of the novel features residing in this invention is in the construction which makes possible the cooling of the oil or the lubricant by the circulation system outlined, which originates in propeller drive case **93** which in this case of course is under water to effectively transfer the heat which may be developed in operation of the device thereto. A constant circulation is desirable and is effected in the manner described in detail, the various seals being furnished to prevent leakage. In order to provide for supplying of suitable lubricant, a suitable filler plug may be furnished as indicated at **43***a*.

Since obstructions may be encountered under many conditions where the boat to which the unit is connected may be operated, the adjusting means **6** previously mentioned is provided. For such adjustment the latch member **8** engages with a bolt **136** at the end thereof, which end includes a section of reduced cross-section, the end being adapted to shear off when an obstruction is encountered by the drive case **93**. The drive housing is thus permitted to swing rearwardly, or counter-clockwise

as viewed in FIGURE 1, the entire output drive case and associated mechanism simultaneously swinging by reason of the connections previously mentioned. It is thereafter necessary to replace the bolt **136** with a new bolt which is similarly formed to that first described, and effective for the purposes hereof.

When it is desired to raise the propeller **100** out of the water, the latch **8** may be moved about the pivot **9** to permit the bolt **136** to swing with the drive case **7**, the entire unit being movable through a one hundred eighty (180°) degree arc so that the propeller **100** is accessible from within the boat to change the same or for other purposes.

A suitable adjusting quadrant **138** is provided connected to the housing extension **79** so that the drive angle of the propeller **100** may be changed as found desirable in operation.

From the foregoing it will be understood and apparent that a novel combination of elements has been provided which facilitates ready assembly of the parts so that an outboard drive is provided to be driven by inboard power as may be available from an inboard engine in a boat or similar vehicle.

It should be noted that a constant drive connection is provided from the input drive shaft **42** through the gearing and to the angular gear set including the shaft **103** thereof and the propeller **100**. This is true irrespective of the angular relationship of the output drive housing **7** including the output drive case extension **79**, the output drive case being rotatable or swingable as the case may be, so as to permit such driving effect to take place. It should further be noted that by reason of the axial arrangement of the shaft **18** of the transverse gear set of the input drive, the drive mentioned can take place through the gearing and particularly the bevel gears **20** and **105** described previously.

By this novel arrangement wherein the output drive case is mounted so as to be rotatable with respect to the cases between which the same is located, a further advantage is obtained in being able to maintain a constant steering engagement by means of the steering gearing provided. In this connection the driving connection from the shaft **52** of the steering gearing, to the gear **59**, and the transverse gear set with which the same is engaged, through the angular gear set including the shaft **115** and gear **113** mounted thereon as well as the gear **118** driven thereby which is in constant engagement with the gear **87** and thus effectively arranged to rotate the output drive housing **85** and part **90** connected therewith whereby the propeller gear case **93** is similarly rotated. This is one of the substantial advances provided by the mechanism hereof, enabling the drive and steering to be effected irrespective of the angular relationship of the output section with respect to other sections, there being no disconnection at any time of the drive gearing or steering gearing.

I claim:

1. In propulsion means of the class described, in combination, mounting means for attachment to a boat transom, an input drive case fixed thereto, input drive means extending thereinto, a steering drive case fixed to the mounting means, steering drive means extending thereinto, an output drive case supported by and intermediate the first described cases and swingable with respect thereto, an output drive housing connected to the output drive case, a propeller drive case connected to the output drive housing, propeller means extending from the propeller drive case, main drive means constantly engaged for transferring drive power from said input drive means and extending through said drive housing to drive the propeller means, and constantly engaged means to rotate said housing whereby to direct the propeller means, said steering drive means operating said rotating means by connections thereto.

2. The combination as claimed in claim 1, wherein the main drive means includes a transverse gear set, and an angular gear set engaged therewith and supported by the output housing, said transverse gear set being arranged axially of the output drive case.

3. The combination as claimed in claim 1, wherein the steering drive means includes a transverse gear set and an angular gear set operated thereby, said angular gear set being arranged to rotate the output drive housing.

4. The combination as claimed in claim 3, wherein the steering transverse gear set is arranged axially of the output drive case.

5. In propulsion means of the class described, in combination, a power input drive case, a steering drive case, an output drive case supported by and intermediate said first named cases and rotatable about an axis with respect thereto, an output drive housing rotatable with respect to said cases, a propeller unit movable with said housing, constantly engaged power drive means extending into and through the input drive case and drive housing to the propeller unit, and steering drive means extending into and through the steering drive case to the said housing whereby to rotate the latter and the propeller unit.

6. The combination as claimed in claim 5, wherein transverse gear sets are supported in the drive cases, said gear sets are driven from means external of said cases, an angular gear set is provided for the output drive housing and connected to the gear set in the input drive case, and the steering transverse gear set is connected to the output drive housing to effect rotation thereof.

7. The combination as claimed in claim 6, wherein the propeller unit includes a drive case, a gear set is mounted therein driven by the angular gear set, and the propeller gear set is connected to a propeller, rotation of the drive housing effecting changes in propeller thrust direction.

8. The combination as claimed in claim 5, wherein the drive cases support a transverse gear set for the power drive means and a transverse gear set for the steering drive means, said gear sets being located on the axis of the output drive case.

9. In propulsion means of the class described, in combination, a drive unit for mounting on a boat transom comprising an input drive section, a steering drive section and an output drive section intermediate and supported by the first named sections, mounting means for said sections, said output drive section having a drive housing and a propeller unit carried thereby, constantly engaged power drive gearing extending through such transom, drive section and housing to the propeller unit to drive a propeller carried thereby, and constantly engaged steering drive gearing extending through the steering drive section and arranged to rotate the drive housing whereby to direct the thrust of the propeller aforesaid.

10. The combination as claimed in claim 9, wherein the drive housing is rotatable with respect to the mounting means, said power and steering drive gearing being in constant engagement with their respective drive parts.

11. The combination as claimed in claim 9, wherein the output drive section includes a generally cylindrical drive case, an extension is fixed thereto and projects radially, the drive housing is rotatably supported thereby and the steering drive gearing is connected to rotate the housing in all positions thereof.

12. The combination as claimed in claim 9, wherein the output drive section is provided with means to support the drive housing for rotation with respect to said section, the steering drive gearing includes a gear set located on the axis of rotation of the drive housing, and the power drive gearing includes a gear set arranged on the axis of rotation of said drive housing, an angular gear set being carried by said housing and in constant engagement with said axially located output drive gear set.

13. The combination as claimed in claim 9, wherein

means are provided to compel circulation of lubricant from the propeller unit to the several sections aforesaid, whereby cooling of said lubricant is effected.

14. The combination as claimed in claim 9, wherein the input and steering drive sections include drive cases, the output drive section includes an output drive case rotatably supported intermediate those first mentioned, transverse drive and steering gear sets are located on the axis of rotation of the output case, an angular gear set drivably connected to the transverse gear set is supported

in an output drive housing rotatably carried by said output case, and the transverse steering gear set effects the housing rotation as stated.

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