United States Patent

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[54] **MARINE DRIVE**
10 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **115/41**
[51] **Int. Cl.** **B63h 5/12**
[50] **Field of Search** ..... 115/41, 41 AT, 35, 37

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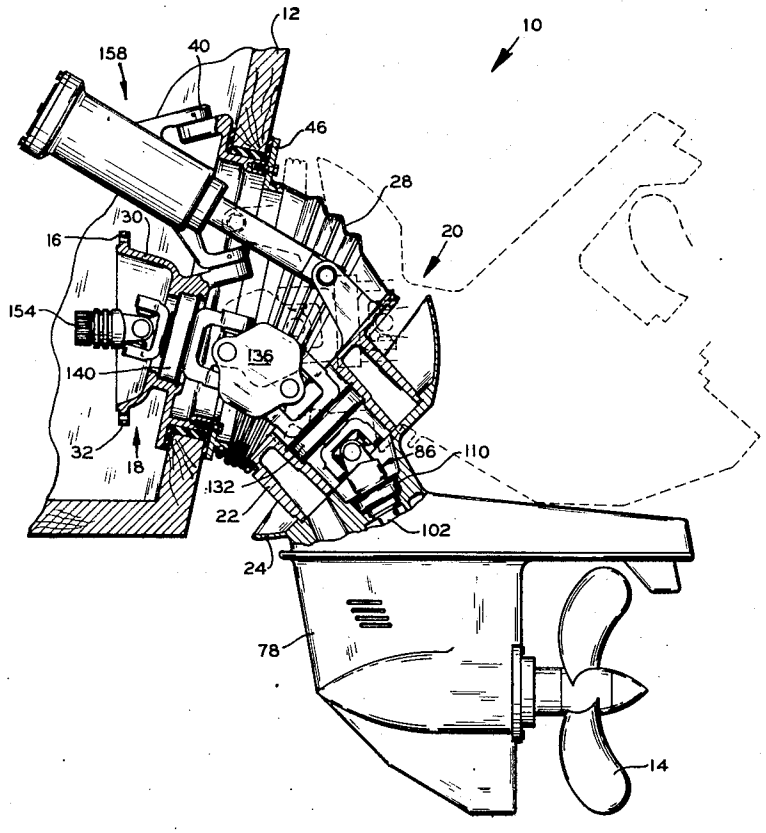
ABSTRACT: A marine outdrive unit is disclosed in which the outdrive unit is supported substantially on a four-bar linkage. One bar of the four-bar linkage is formed by spaced locations adjacent the transom of the boat on which the outdrive unit is mounted. The second and opposite bar is formed by fixed portions of the housing for the outdrive unit. Pivotal kickup and trim for the unit is provided by the other two bars of the four-bar linkage, one of these being formed in a series of universal joints joining the gear drive, drivingly connected to the marine engine, to the shafting driving the propeller for the marine outdrive unit. The last bar of the four-bar linkage is provided by a hydraulic means which is pivotally attached to the outdrive unit at its piston end and mounted adjacent to the transom. Thus, retraction of the hydraulic piston means causes tiltup of the outdrive unit for either the trim or kickup function. The hydraulic piston means is also pivotally mounted on the transom on an angularly extending axis relative to the vertical so that steering of the outdrive unit may be obtained by movement of the hydraulic piston means, pivotally, relative to this axis.



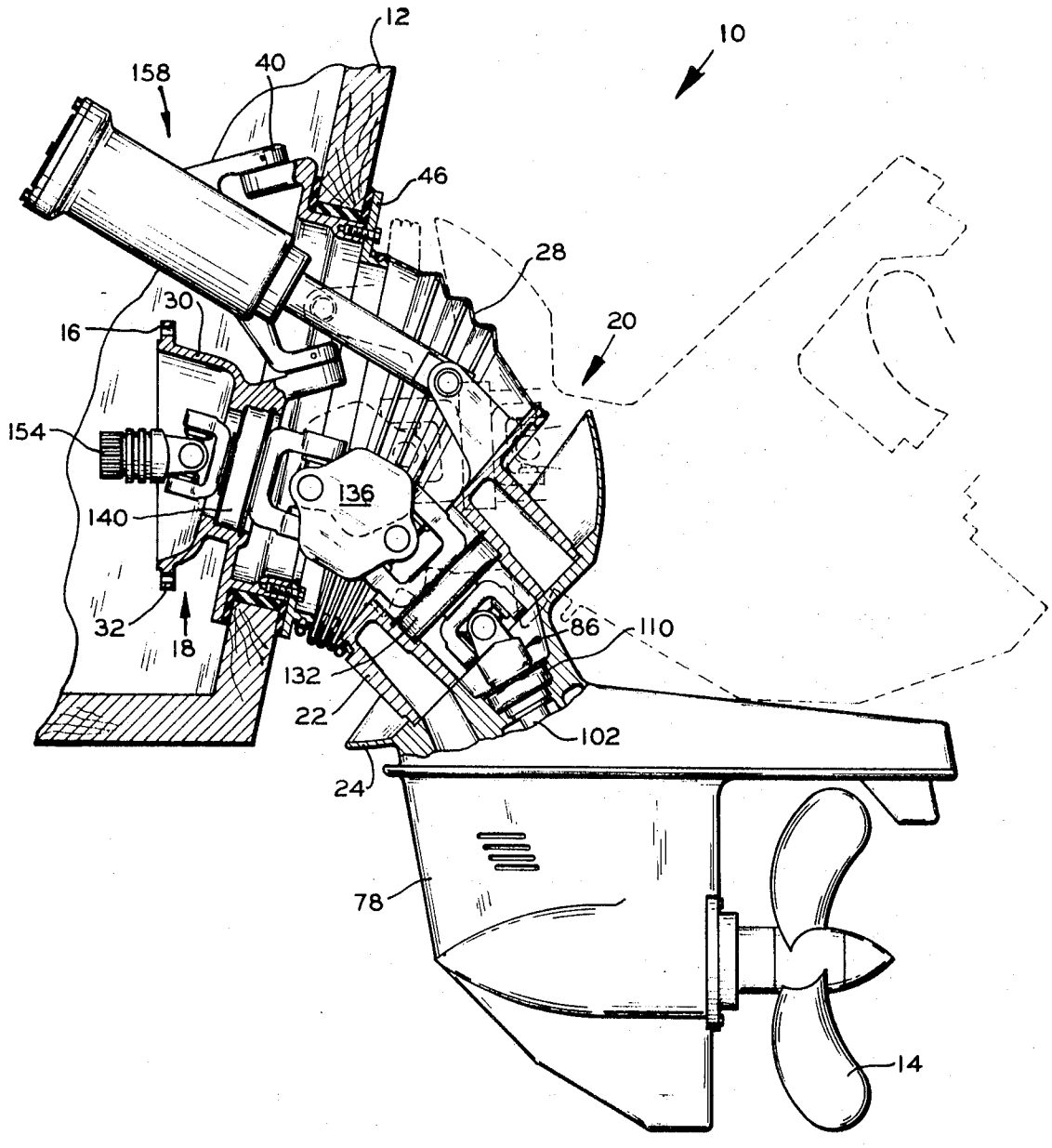


FIG. 1

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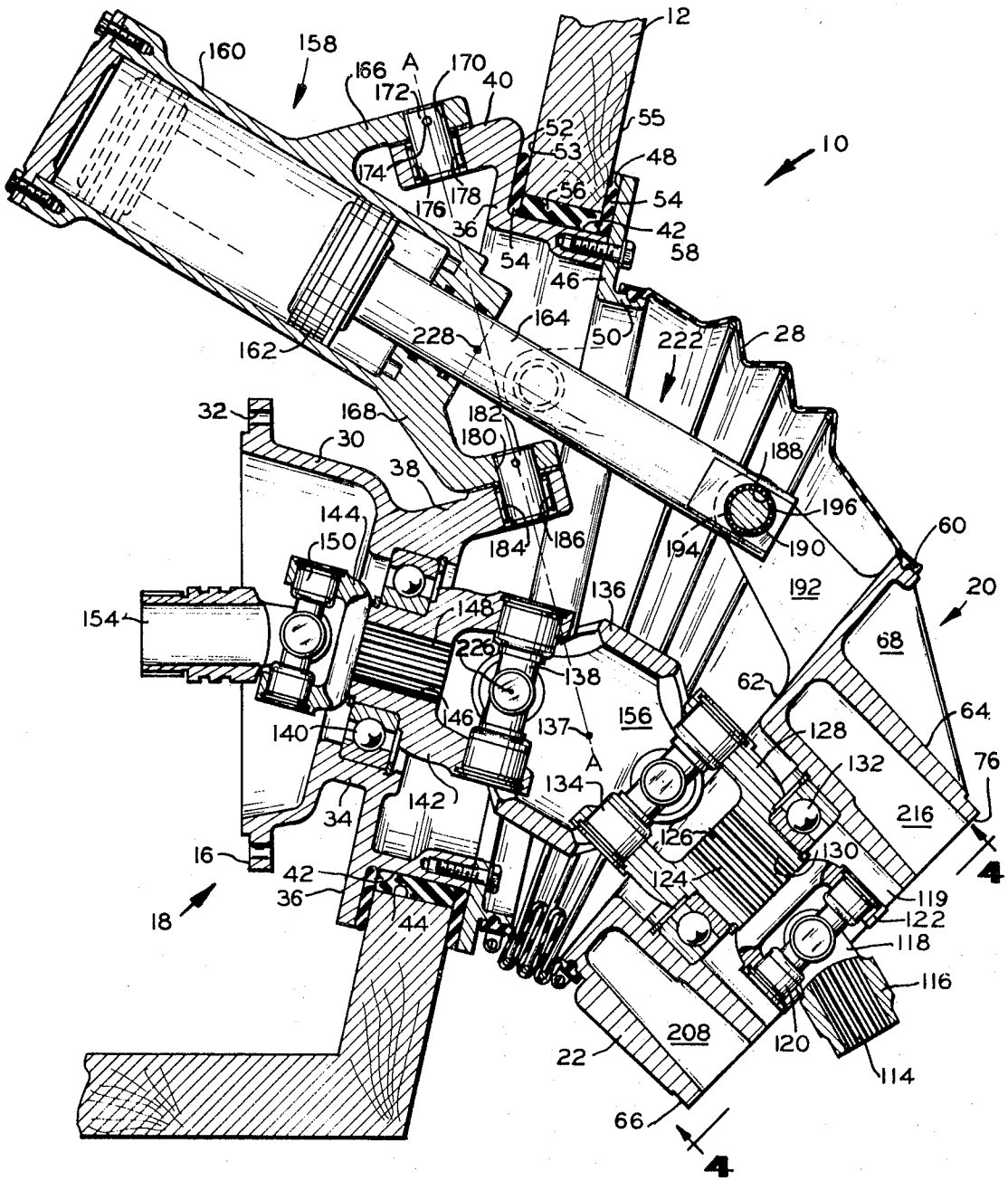

FIG. 2

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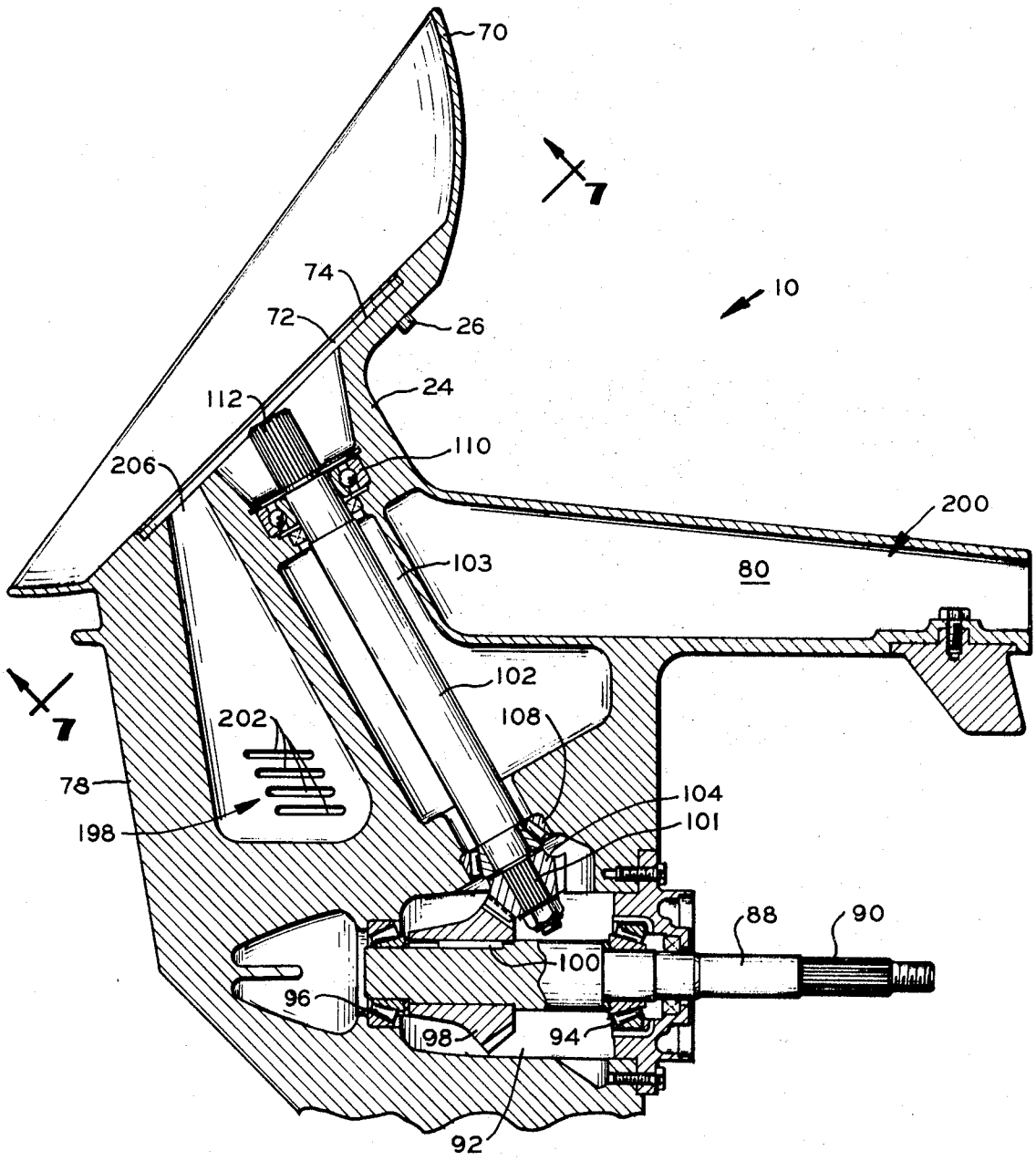

FIG. 3

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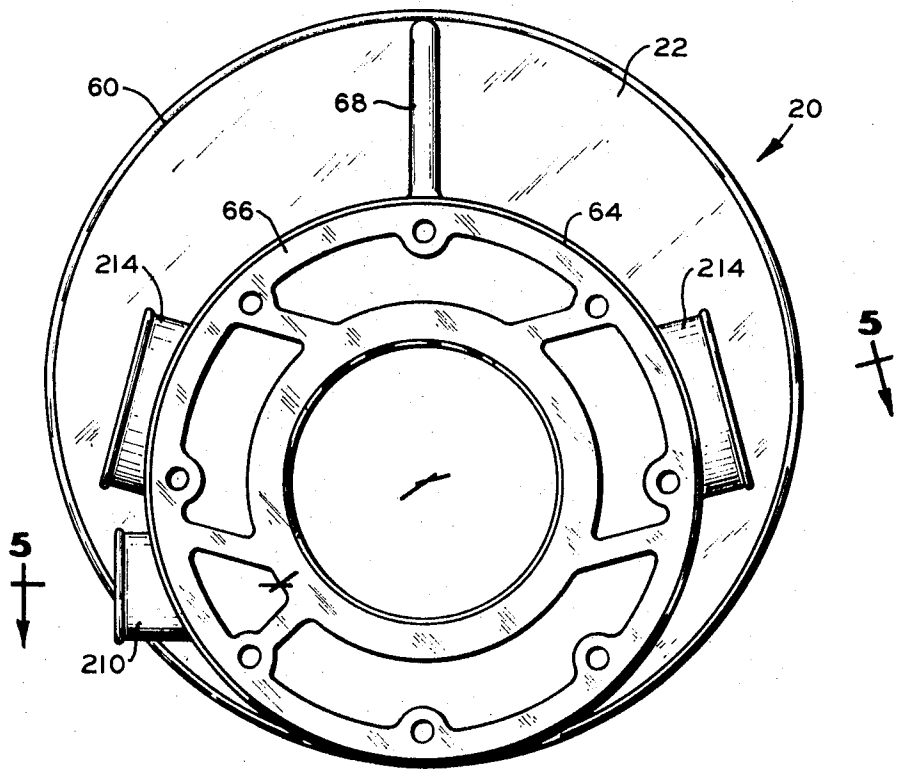

FIG. 4

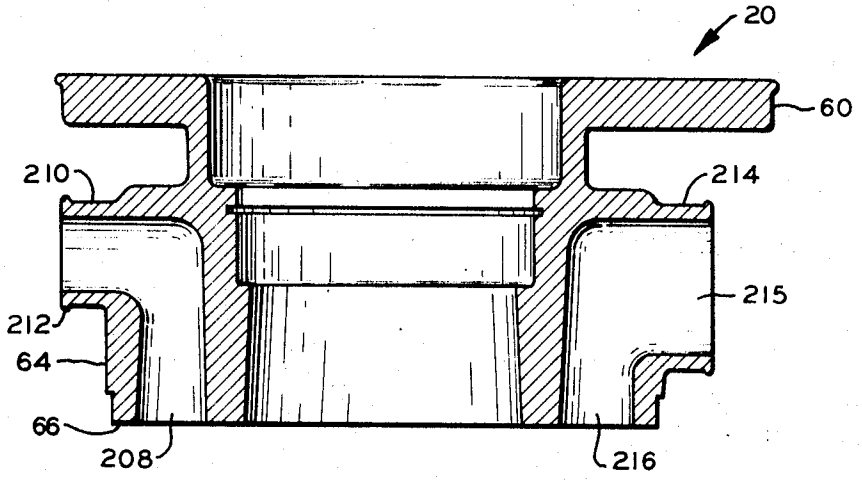

FIG. 5

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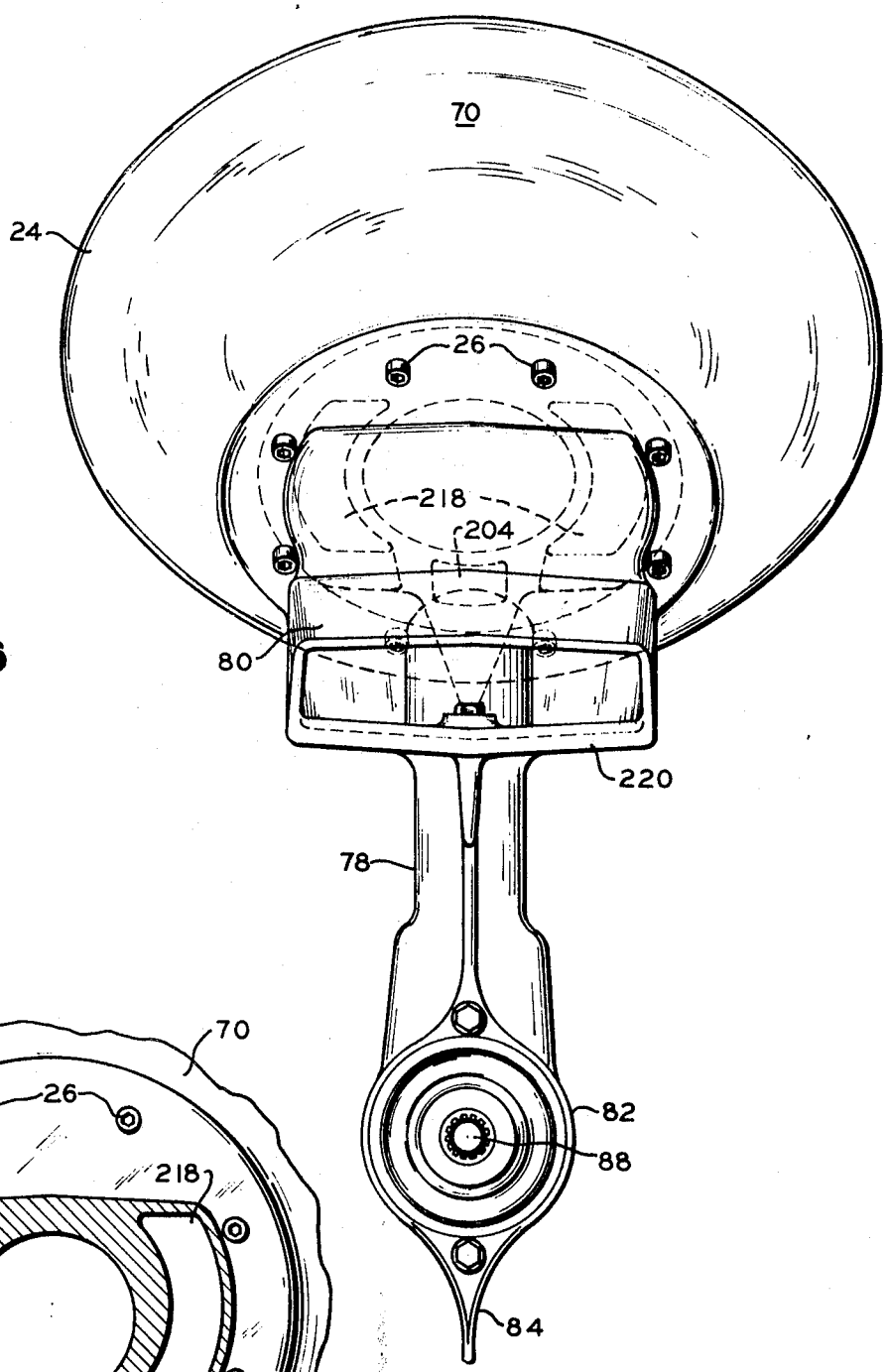

FIG. 6

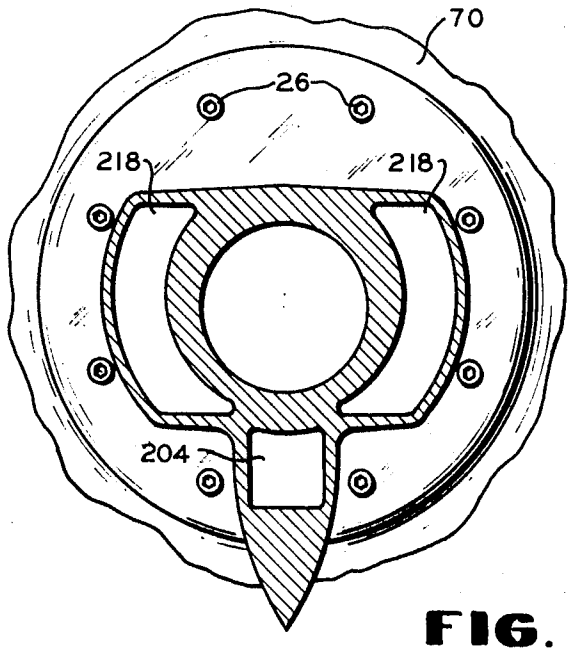

FIG. 7

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MARINE DRIVE

This application relates generally to marine drives and, more specifically, to an improved mounting arrangement for an outdrive unit so that the outdrive unit may be easily steered, trimmed and provided with kickup.

Prior art marine outdrive propulsion units are known wherein pivoting for steering, trim and kickup are provided by gimbal ring arrangements or yoke-type mounting arrangements. Mounting of an outdrive propulsion unit, in this manner, requires the use of an intermediate member disposed between the fixed portion of the outdrive unit mounted with the boat and the movable portions of the outdrive unit depending therefrom. The use of such an intermediate member still necessitates a driveline arrangement that must pass through the intermediate member and a separate steering arrangement for turning the outdrive unit on its vertical steering axis which, in some manner, is attached to or adjacent the intermediate member. It would, therefore, be advantageous to provide a marine outdrive unit which utilized the driveline arrangement and trim means for steering and kickup and, thus did not require the use of a supplementary intermediate member arrangement to provide these functions in an effective manner.

Accordingly, it is an object of this invention to provide an outdrive propulsion unit for marine application wherein no intermediate member is required to furnish the outdrive unit with the kickup and steering functions.

It is an additional object of this invention to provide a marine drive unit which is mounted for trim, kickup and steering on a four-bar linkage means.

It is a further object of this invention to provide an outdrive unit which has as the oscillating member of the four-bar linkage a hydraulic cylinder means with this hydraulic means thereby providing trim for the outdrive unit.

It is a still further object of this invention to provide a driveline having a plurality of universal joints so that the driveline may serve as a pivotal and guiding means for the outdrive unit as it pivots on either its horizontal trim and kickup axis or its generally vertical steering axis.

It is a still further object of the invention to provide a power trim arrangement for an outdrive unit with this power trim arrangement advantageously being utilized as a pivotal and support means for the lower housing of the outdrive unit.

Other and further objects of this invention and its details will be apparent to those skilled in the art from the following detailed description and the appendant drawings. It will, of course, be understood by reference to the accompanying drawings that they are offered only as an illustration of a preferred embodiment of the invention and what is considered to be the best mode of applying the above principles.

In the preferred form of the invention, a marine outdrive unit is mounted for kickup and trim on a four-bar linkage arrangement, with this four-bar linkage also providing a steering axis angularly disposed to the vertical for steering movement of the outdrive unit. The outdrive unit includes a lower housing means disposed outwardly of the transom of the boat and mounted in a depending fashion relative to the boat and an inner housing means disposed substantially inwardly of the transom of the boat. The lower housing means includes a two-part housing, with the lower housing part mounting the propeller so that it may rotate on a substantially horizontal axis and also includes a shafting and gearing means fixed for rotation within it that transfers power from the shafting and gearing means to the horizontally extending shaft which mounts the propeller. This lower housing part also includes exhaust passageway means disposed above the cavitation plate and is of a generally streamlined shape so as to prevent turbulence as the boat and outdrive unit pass through the water. The upper housing part of the lower housing means is fixedly attached to the lower housing part and encloses within it a pair of universal joints which are attached to the fixed shafting of the lower housing part so as to provide a relative turning movement between the fixed shafting and the upper portion of the driveline.

The upper housing part includes a pivotal mounting means for a hydraulic means which extends outwardly thereto from within the transom of the boat, with the terminating end of the piston rod of the hydraulic means being pivotally attached to this housing part. The upper housing part is attached to the lower housing part by a tilting arrangement so that these parts are rigidly joined together. A sealing means is attached to the upper housing part and extends to the transom to prevent the intrusion of water into the interior of the boat itself, with the driveline extending through the upper housing part and within the enclosure formed by the sealing means.

Inwardly of the boat, an inner or upper housing mounts the remainder of the driveline for the outdrive unit. A pair of universal joints are mounted within this upper housing, with these universal joints being connected to the pair of universal joints in the upper part of the lower housing so as to provide a continuous drive line extending to the propeller. The upper housing is provided with an attaching means for connection to a transmission providing a forward and reverse that is generally conventionally mounted so as to extend from its physical attachment to a marine engine. Thus, the inner housing is rigidly mounted within the boat, while the lower housing is pivotally mounted for kickup and trim relative to the boat.

The upper housing includes, adjacent its upper portion, a pair of supporting arms which extend at a slight angle relative to the axial extent of the upper housing. The hydraulic means is also provided with a pair of supporting arms, with a pair of pivot pins joining the supporting arms of the hydraulic means to the supporting arms of the upper housing so that the hydraulic means may pivot on an axis angularly directed to the vertical, as dictated by the steering arrangement attached thereto (not shown). Thus, movement of the hydraulic means around the axis formed by this pivot means, causes a consequent rotation of the lower housing of the outdrive unit around a point which is substantially centrally located between the pairs of universal joints.

As mentioned above, vertical pivoting of the outdrive unit is provided by the combination of the pivot formed at the end of the piston rod and the pivot formed by the universal joint arrangement. More specifically, a four-bar linkage utilized in the novel arrangement described; one link being formed by the fixed distance between a point at the lower termination of the axis of the cylinder of the hydraulic means and a point at the center of rotation of the outermost universal joint mounted in the upper housing; a second link being formed by the fixed distance between the point at the center of rotation of the uppermost universal joint mounted in the upper part of the lower housing and the point at the center of rotation of the pivot pin carried by the outer end of the piston rod; a third link being formed by the distance between the two centers of rotation of the outer universal joint of the upper housing and the upper universal joint of the upper part of the lower housing, and a fourth oscillating link being formed by the reciprocating piston rod of the hydraulic means. By this arrangement the telescoping location of the piston relative to the cylinder of the hydraulic means dictates the relative angle of the lower housing and its entrance into the water and thereby establishes trim. Upon kickup, of course, the piston of the hydraulic means moves inwardly and permits the marine drive unit to swing out of the way of any given waterborne obstruction, with the hydraulic fluid in the cylinder preventing too rapid a kickup of the outdrive unit.

A better understanding of the invention can be had by reference to the drawings which form a portion of the specification and wherein:

FIG. 1 is a partial vertical cross-sectional view of the outdrive unit as mounted in the transom and showing the outdrive unit in kickup position in dashed lines;

FIG. 2 is a vertical cross-sectional view similar to FIG. 1 but showing only the upper portions of the outdrive unit and its relation to the transom;

FIG. 3 is also a view similar to FIG. 1 but showing only the lower part of the lower housing of the outdrive unit;

FIG. 4 is an end view of the upper part of the lower housing taken substantially on line 4—4 of FIG. 2;

FIG. 5 is a cross-sectional view of the upper part of the lower housing taken substantially on line 5—5 of FIG. 4;

FIG. 6 is an end view of the lower housing taken looking generally towards the transom of the boat and,

FIG. 7 is a cross-sectional view of the lower part of the lower housing taken substantially on line 7—7 of FIG. 3.

Referring now more specifically to the drawings, it can be seen in FIGS. 1–3 that a marine outdrive unit 10 is provided extending through a transom 12 of the boat so as to depend downwardly from the boat below its waterline. A propeller 14 is mounted on the lower end of the marine outdrive unit 10 to serve as a propulsion means for propelling the boat through the water. A drive-attaching portion 16 of an inner or upper housing member 18 of outdrive unit 10 is adapted for rigid connection to a transmission unit (not shown) containing, for example, a forward and reverse gearing mechanism. A marine engine (not shown) is generally located inboard of the transmission unit and rigidly affixed to it and the supporting structure forming the frame of the boat so that the upper housing 18 is rigidly attached relative to the boat. A lower housing 20 is disposed outwardly of the transom 12 to mount the propeller 14 at its lower end. This lower housing comprises an upper part 22 and a lower part 24 joined together by a series of bolts 26 so as to provide an entire enclose housing for the operating elements contained therein. The upper housing 18, although primarily disposed within the boat does extend partially outwardly therefrom, and, disposed between it and the lower housing 20, a bootlike seal element 28 is located, formed from a very resilient material such as thick neoprene or the like. This boot provides a watertight seal between the upper housing 18 and the lower housing 20 and helps prevent the entrance of water into the internal confines of the boat.

The upper housing 18 is conventionally formed by utilizing a casting or the like and includes a bell-like portion 30 at its most inward extension into the boat, this bell-like portion terminating in the drive-attaching portion 16 formed by a flange 32 extending around the inward termination of the periphery of portion 30. Outwardly, the bell-like portion 30 of the upper housing 18 merges into a necked-down portion 34 of smaller cross-sectional size than the bell-like portion 30. A rim portion 36 is attached integrally to the outer extent of the necked-down portion and has a cross section of much larger extent than the cross section of the bell-like portion so that it forms the major breath and height of the upper housing 18. Adjacent the top of the bell-like portion 30 an integral, outwardly and rearwardly angularly extending lug 38 is provided, with this lug being substantially intermediate the said major height. The purpose of this lug will become apparent as the description of the outdrive unit 10 proceeds. At the very top portion of the upper housing 18, a second lug 40 is formed integrally with the rim portion 36. Lug 40 extends both axially inwardly and downwardly relative to the linear extent of the upper housing 18 to be in substantial parallelism with the linear extent of the lug 38. The general shape and formation of the casting for the upper housing 18 is completed by generally annular portion 42 of somewhat limited length which is integral with and extends substantially at a right angle to the rim portion 36.

The generally annular portion 42 of upper housing 18 extends through similarly shaped aperture 44 in the transom 12 to have attached to it an outer transom flange member 46. This member is of similar shape as the aperture 44, in end view, and is T-shaped in cross section to provide a flat face 48 adjacent and parallel to the surface of the transom and a rim extension 50 to which one end of the bootlike seal 28 may be attached by any conventional method. Between a backface 52 formed on the rim portion 36 and an inboard surface 53 of the transom and between the face 48 of the outer transom flanged member 46 and an outboard surface 55 of the transom 12, a pair of wedging members 54, 54 are located. Each of these generally annular members has an inner extent dimensioned so that a portion of the wedging member extends in overlapping relationship over a portion of the aperture 44 passing through the transom 12 and an outer dimension of sufficient size that a portion of the wedging member 54 is disposed in abutting relationship with the surface of the transom 12 surrounding the aperture 44. Disposed within the aperture 44 is a doughnut-shaped sealing element 56 made of hard rubber or the like, this sealing element having a slightly greater length, in uncompressed condition, than the length of aperture 44. A series of bolts 58 removably attach the other transom flange member 46 to the generally annular portion 42 of the upper housing 18. As the generally annular portion 42 is tightened against the outer transom flange member 46 by these bolts, the wedge members 54, 54 compressingly engage the doughnut-shaped ceiling element 56, expanding it in a general diametrical direction, until they abut the opposite inboard and outboard surfaces 53 and 55 of the transom 12. Thus, a positive sealing means is formed between the transom 12 and the upper housing 18 and the outer flange member 46 to prevent the intrusion of water into the interior of the boat.

As previously set out, the bootlike seal 28 also serves as a sealing means for the outdrive unit 10, this bootlike seal extending, specifically, from the rim extension 50 of the outer transom flange to a shoulder 60 extending peripherally about the upper portion of upper part 22 of lower housing 20.

This upper portion of upper part 22 terminates in an end 62 of general elliptical shape disposed adjacent to transom, with the shoulder 60 forming a border around its periphery. A generally cylindrical portion 64 forms the main body of the upper part 22 and extends from the end 62 to terminate in a circular end 66. The general outer shape of upper part 22 is completed by a rib 68 that extends outwardly from elliptical end 62 towards circular end 66 but merges with cylindrical portion 64 at a location slightly short of end 66, with this rib being smoothly tapered between these two locations.

The lower part 24 of lower housing 20 includes a generally dished-shaped portion 70 at its upper, inner end. On the inner periphery of this dished-shaped portion, a circular depression 72 is formed, with this circular depression terminating in a circular face 74. The face 74 abuts against a face 76 formed on the circular end 66 of the upper part 22 when the upper and lower parts 22, 24 of the lower housing 18 are assembled. In this assembled condition, the lower extent of cylindrical portion 64 extends into the circular depression 72. As previously mentioned, bolts 26 rigidly hold these two parts of the lower housing 20 together.

The dished-shaped portion 70, at its lower outer end smoothly merges into a depending portion 78 which is substantially rectangular in cross section with slightly curved sides and with a streamlining V formed at its front (FiG. 7) to provide a leading edge to eliminate turbulence as the marine outdrive unit 10 proceeds through the water. Intermediate its ends, the depending portion 78 has a branch that forms a cavitation plate portion 80 of generally rectangular cross section, extending horizontal to the waterline. At the lower termination of depending portion 78, it smoothly merges into a barrel portion 82 having a general circular cross section with this barrel portion also extending horizontal to the waterline and therefore substantially parallel to cavitation plate portion 80. Below the barrel portion 82, the lower part 24 of lower housing 20 is completed by a tear-shaped portion 84 that forms, at its front leading edge a knife edge that extends upwardly and smoothly merges into the knife edge formed by the V of the depending portion 78. By this arrangement it should be clear that the lower housing 20 provides a streamlined shape which smoothly knifes through the water eliminating all but minor turbulence.

A power train means 86 extends through upper and lower housings 18 and 20, respectively, to provide a power flow to propeller 14 from the transmission yielding forward and reverse (not shown). Propeller 14 is fixedly mounted for rotation by means of a series of splines 90 or the like on a horizontally disposed shaft 88 extending outwardly of barrel 82. Inwardly of the outer periphery of the barrel portion 82, shaft 88

is disposed in an elongated cavity 92 and is conveniently pilotingly received in bearings 94 and 96 mounted in this cavity. Also disposed within this cavity is a bevel gear means 98, with this gear means fixedly mounted on the shaft 88 by splines 100 or the like so that bevel gear 98 rotates with the shaft 88. A second shaft 102, mounting a bevel gear 104 by a series of splines 101 extends angularly relative to shaft 88 through the depending portion 78 of lower part 24 in a cavity 103 thereof so that the bevel gear 104 is in constant mesh with bevel gear 98. Shaft 102 is rotationally and pilotingly received by bearings 108 and 110 disposed within the cavity 103 of depending portion 78.

The upper end of shaft 102 includes a series of splines forming a splined portion 112, this portion being inserted in nesting engagement into internal splined portion 114 formed in a shaft extension 116 of a yoke 118 that extends angularly downwardly into cavity 103 from upper part 22 for this purpose. The yoke 118 is rotationally mounted to a universal joint 120 disposed within a cavity 119 of upper part 22, with this universal joint, in turn, rotationally mounted with a yoke 122. Yoke 122 includes a stem portion 124 extending axially and angularly relative to the vertical and having a series of splines 126. A yoke 128 includes a series of internal splines 130 that receive by means of a press fit the stem portion 124 of yoke 122, so that the yoke 128 rotates with the yoke 122 and is not capable of sliding axially relative thereto. A bearing means 132 disposed in cylindrical portion 64 of upper part 22 provides an alignment and piloting means for ease in rotation of the combined yokes 122 and 128.

At its upper end, the yoke 128 mounts a universal joint 134, with a portion of this universal joint being disposed in lower housing 20 and a portion disposed between the lower housing 20 and transom 12. The universal joint 134 is mounted upwardly to a double trunnion member 136 so that the double trunnion member extends angularly upwardly for rotational connection, at the opposite end of this trunnion member, to a universal joint 138. Piloting received in upper housing 18 by means of bearing means 140 is a yoke member 142. The arms of this yoke member extend to and are rotationally connected to universal joint 138 so that the double trunnion member 136 is located between the upper and lower housings. A yoke member 144, including a series of external splines 146, is received at the opposite end of yoke member 142 into yoke member 142 and held therein by a press fit with a series of splines 148 of yoke member 142 preventing relative rotation between these two yoke members. Another universal joint 150 is rotationally mounted at the upper angularly extending end of yoke 144 and has rotationally attached to it a stub shaft extension 154 which may be conveniently attached to the power shafting extending from the transmission (not shown).

From the foregoing description, it should be clear that a power train means 86 is provided disposed within the upper and lower housings 18, 20 for outdrive unit 10 which conveniently and advantageously transfers the power drive from a transmission having forward and reverse to the propeller 14 of the outdrive unit. Furthermore, because of the disposition of the double trunnion member 136 in an interposed relationship between upper housing 18 and the lower housing 20, this member provides a pivoting link means 156 around which the lower housing 20 pivots for trim or kickup.

In order to prevent undesired kickup and also provide desired trim for the outdrive unit 10, a hydraulic means 158 is mounted to the upper housing 18 and connected between it and the lower housing 20. More specifically, the hydraulic means 158 comprises a cylinder 160 which telescopically receives a piston 162. Movement of the piston 162 relative to the cylinder 160 is conventional, fluid flow into the upper end of the cylinder 160 causing the piston 162 to move away from the upper end of the cylinder 160 in an extension movement and fluid flow into the lower end of cylinder 160 causing the piston 162 to move inwardly of the cylinder. A piston rod 164 of piston 162 thereby telescopingly moves inwardly and outwardly of cylinder 160.

The hydraulic means 158 is mounted to the upper housing 18 by means of generally parallel arms 166 and 168 extending angularly from the periphery of cylinder 160 and integral with it. Upper arm 166 includes a bore 170 extending through it near its radial outward termination, with the axis of this bore extending perpendicular to the major portion of the body of the arm and generally angularly relative to the vertical. A pivot pin 172 is fixedly mounted in this bore by a pin means 174 extending transverse to the axis of the bore 170 and passing through the arm 166 and pivot pin 172. The pivot pin 172 is of sufficient length to extend outwardly and downwardly of the arm 166 and into a bore 176 to provide a pivotal bearing means therebetween. The bore 176 is disposed in the lug 40 integral with the upper housing 18, with this lug being parallel to the upper arm 166 and with the axis of its bore 176 being aligned with the axis of pivot pin 172. A bearing means 178 is disposed in bore 176 to aid in the pivotal turning of the pivot pin 172 therein.

The lower arm 168 also contains a bore 180 with a pivot pin 182 extending in and pinned in this bore in a manner similar to the pivot pin 172. Pivot pin 182 also extends outwardly and downwardly of lower arm 168 so as to be received in a bore 184 formed in the lug 38 that extends parallel to lower arm 168. A bearing means 186, mounted in this bore, aids in pivotal turning movement of pivot pin 182 relative to the lug 38. It should be pointed out that the axes of pivot pins 172 and 182 are centrally and axially aligned so as to form a turning axis A—A and that this axis A—A intersects the center of double trunnion member 136 (indicated by 137).

The arrangement just described advantageously provides steering for the outdrive unit 10. The axis A—A represents the axis about which the lower housing 20 turns, with the universal joints 134 and 138 turning relative to their mounting yokes 128 and 142 so as to movingly permit the power train means 86 to accommodate steering. Movement of the hydraulic means 158, then, pivotally relatively to axis A—A in pivot pins 172, 182 causes a consequent pivotal movement of the lower housing 20 as urged by the piston 162 to move the outdrive unit 10 for steering. Any conventional means such as cables or the like (not shown) may be attached to the hydraulic means 158 inwardly of the transom to actuate the steering movement.

The hydraulic means 158 is also pivotally attached to the lower housing 20. Proximate the end of piston rod 164 that is most remote from hydraulic cylinder 160, the piston rod 164 includes a bore 188 that extends transversely through the piston rod and mounts a pivot pin 190. The pivot pin 190 is pinned in the bore 188 (not shown) in a manner similar to the pinned pivot pin 176. An end ear 192, integral with upper part 22, extends from the shoulder 60 of this part of lower housing 20. It includes a bore 194 extending transversely therethrough and axially aligned with the bore 188. Pivot pin 190 extends outwardly of bore 188 and into this bore and is pivotally bearingly received by a bearing means 196 also disposed in bore 194 so that the lower housing 20 may pivot relative to the hydraulic means 158.

By the just-described arrangement, trim and pickup for the marine outdrive unit 10 is provided, the outdrive unit turning about the link 156 formed by the double trunnion 136 as dictated by the telescoping movement of the piston rod 164 within the cylinder 160, while relative pivotal movement between this piston rod and the lower housing 20 is accommodated by the pivot pin 190. The outdrive unit 10 may thereby be set at a particular angle to the vertical so as to provide its desired angle of contact to the waterline (trim) by moving the piston rod 164 by hydraulic pressure relative to the cylinder 160. At the same time, upon the outdrive unit 10 encountering a waterborne obstruction, the lower housing 20 is free to pivot upwardly as the piston 162 moves inwardly with hydraulic fluid pressure exerted on the piston 162 cushioning such movement and preventing too rapid kickup.

A water intake means 198 and a water exhaust means 200 are included within the outdrive unit 10 to provide for the en-

trance and exhaust of cooling water for the marine engine. A series of water intakes **202**, disposed on each side of the lower part **24** of the lower housing **20**, are shaped as elongated extending rectangles having curved ends. The water intakes **202** extend from adjacent the leading edge of the lower unit **24** rearwardly towards the propeller, with these inlet openings staggered from top to bottom so as to provide only slight turbulence and efficient ingress of water therein. Water intakes **202** open from each side of lower part **24** into an inlet channel **204** that extends upwardly medially in lower part **24**, substantially parallel to the shaft **102**. Inlet channel **204** is in communication with an inlet channel **208** disposed in the upper part **22** and extending adjacent to the periphery of the upper part **22** by means of an elbow portion **206** (FIG. 3) connected to channel **204** in lower part **24** this elbow portion extending from channel **204** from substantially the location of line 7—7 and mating with channel **208** at the flange face **74** and the termination of end **66**. Inlet channel **208** extends upwardly in part **24** and includes an elbowed arrangement so that this channel has a general right-angled bend in it so that this channel includes an outwardly extending portion **210** terminating in a flange **212** outwardly of the periphery of the cylindrical portion **64**. Flange **212** provides an easy and convenient means for the connection of a hose or the like (not shown) which passes through the transom **12** of the boat inwardly of the bootlike seal **28** so thus it may be connected to the transmission providing forward and reverse (not shown). The flow of cooling water is led from it to a conventional water pump (not shown) mounted on the marine engine (not shown) for cooling purposes.

Cooling water is discharged from the marine engine into its exhaust manifold (not shown) so as to cool these gases and prevent the requisite passage of hot exhaust gases within the boat. The flow of the combined cooling water and exhaust gases is split in the exhaust manifold and flows into a hose means or the like (not shown) which extends rearwardly through the transom and within the sealed enclosure provided by the bootlike seal **28**. At the rearward termination of these hoses, they are connected to outwardly extending portions **214**, **214** of an exhaust passageways **215**, **215** formed in the upper part **22** of the lower housing **20**, the terminations of the said portions **214**, **214** being outwardly of the periphery of cylindrical portion **64**. A major portion **216** of each of the exhaust passageways then extends generally downwardly parallel to the axial extent of the upper part **22** so that each of the passageway **215** has an elbow formed thereby by the outer extending portion **214** and the major portion **216** of the exhaust passageway. The lower termination of each exhaust passageway **215**, **215** communicates with exhaust passageway **218** formed in the lower housing part **24** by the aforesaid abutting relationship of the flange **74** and the termination of end **66**. Passageways **218**, **218** extend generally parallel to the shaft **102** and open into a passageway **220** disposed in cavitation plate portion **80**. This passageway is generally parallel to the major extent of the cavitation plate and thereby substantially horizontal to the waterline so that exhaust water, in conjunction with the mixed exhaust gases will be discharged rearwardly of the boat so as to not create any undesired turbulence in the area of operation of the propeller **14**.

The general operation of the outdrive unit **10** as it propels a boat through the water should now be readily apparent. However, an additional description is deemed necessary for the four-bar linkage means **222** formed for vertical pivoting of the lower housing **20**. More specifically, this four-bar linkage comprises: a fixed link extending between a center of rotation of universal joint **134** and center of rotation of pivot pin **190**. A second fixed link is provided between the center of rotation **226** of universal joint **138** and a point **228** lying at the intersection of the axis of the piston **162** and the lower termination of the cylinder **160**. The movable links are comprised of the oscillating piston rod **164** pivoted to the lower housing **20** by the pivot pin **190** and the double trunnion **136** pivoted to universal joints **134** and **138**.

It should be clear from the foregoing that a marine drive has been described which fulfills the objects of the invention and has all the attendant advantages thereof. However, it is to be understood that the specific construction described is only exemplary and that many obvious alternatives for fulfilling the same functions as the instant invention will obviously occur to one skilled in the art without the exercise of inventive skill.

What is claimed is:

1. A marine outdrive unit having (a) an upper housing fixed inboard relative to a boat transom, (b) a lower housing disposed in depending relationship and pivotally movable relative to said upper housing and said boat transom, (c) a hydraulic means mounted with said upper housing including a movable piston means, (d) said movable piston means including pivot means attached to said lower housing at it inner end, (e) a power train means extending through said upper and lower housings for rotationally driving a propeller for said marine outdrive unit, (f) said power train means including at least a pair of universal joint means, one of said universal joint means disposed in an outward portion of said upper housing and one of said universal joint means disposed in the upper portion of said lower housing, (g) a link means forming a portion of said power train means, positioned between said pair of universal joint means and pivotally attached to each, (h) said link means and said piston means providing for the sole support for said lower housing in said depending relationship with said upper housing and (i) said link means and said movable piston means furnishing solely for the pivoting of said lower housing relative to said upper housing and boat transom.

2. A marine outdrive unit having; (a) an upper housing fixed inboard relative to a boat transom, (b) a lower housing disposed outboard of said boat transom, (c) a cylinder and piston means mounted with said upper housing, (d) said pivot piston means pivotally attached to said lower housing for vertical pivoting of said lower housing, (e) a power train means disposed below said cylinder and piston means and extending through said upper housing, said transom and said lower housing for rotationally driving a propeller mounted at the rearward end of said lower housing, (f) said power train means including at least a pair of universal joint means, one disposed in said upper housing and one disposed in said lower housing, (g) a double trunnion means extending between said universal joint means and rotationally mounted to each for vertical pivoting, (h) said cylinder and piston means being pivotally mounted on said upper housing for substantially horizontal pivoting on an axis, (i) said axis, extended, intersecting the center of said double trunnion means, (j) whereby said lower housing is pivotally attached relative to said boat transom for trim, kickup and steering.

3. The combination set out in claim 2 wherein said power train means includes; (a) a second pair of universal joint means, one of said universal joint means of said second pair being disposed at the inner end of said upper housing and one of said universal joint means of said second pair being disposed below said first pair of universal joint means in said lower housing, (b) said second pair of universal joint means providing for a uniform flow of power through the remainder of said power train means.

4. The combination set out in claim 3 wherein; (a) said lower housing has split upper and lower halves, (b) said upper half of said lower housing mounting two of said universal joint means, (c) said lower half of said lower housing mounting an angularly depending shaft means having a gear means fixed to its lower end, (d) said gear means meshing with another gear means mounted on a horizontal extending shaft, (e) said horizontal extending shaft mounting said propeller at it s outer end.

5. The combination set out in claim 2 wherein said pivot means providing for substantially horizontal pivoting of said cylinder and piston means is provided by (a) lug means attached to said cylinder means and having pivot pin means fixedly attached thereto and (b) lug means attached to said upper housing and having a bore within which said pivot pin means is disposed.

6. The combination set out in claim 5 wherein; (a) said upper housing includes a portion extending through said transom, (b) a flange means is boltingly attached to said portion outwardly of said transom, (c) wedging means are disposed between said flange means and said transom and, (d) sealing means are compressingly held between said portion and said transom by said flange means and said wedging means.

7. The combination set out in claim 6 wherein a bootlike sealing element is disposed between said lower housing and said flange means to sealingly enclose the space between said lower housing and said flange means.

8. The combination set out in claim 2 wherein said axis is angularly disposed relative to the vertical.

9. The combination of a marine outdrive unit and boat transom having; (a) an upper and lower housing, (b) said upper housing being disposed inboard and fixed relative to a boat transom, (c) said lower housing being disposed outboard of said transom, (d) a hydraulic piston means telescopically received in a hydraulic cylinder means extending through said transom and including means for fixing it to said upper housing and means for pivoting it to said lower housing to provide a pivot center of rotation, (e) a power train means extending through said upper housing, said transom and said lower housing, (f) said power train means including first universal joint means mounted in said upper housing for providing a first center of rotation and second universal joint means mounted in said lower housing providing for a second center of rotation, (g) a connecting means pivotally attached to said first and second universal joint means for rotation around said first and second centers of rotation, (h) said second center of rotation being spacedly displaced a distance from said pivot center of rotation for said means for pivoting said hydraulic piston means to said lower housing and (i) said first center of rotation spacedly displaced a distance from a point on said hydraulic piston means at its entrance into said hydraulic cylinder means, (j) whereby a four-bar linkage is provided for pivotally mounting said lower housing relative to said upper housing consisting of (1) a pivotal link provided by said connecting means pivoted between said first and second centers, (2) a movable and pivotal link formed by said hydraulic piston means, (3) a fixed link provided by said distance between said second center of rotation and the pivot center of rotation of said means for pivoting said hydraulic piston means to said lower housing and (4) a fixed link furnished by said distance between said first center of rotation and said point on said hydraulic piston means.

10. A marine outdrive unit having; (a) a means fixed inboard relative to a boat transom, (b) a housing means disposed in depending relationship and pivotally movable relative to said means fixed inboard relative to said boat transom, (c) a hydraulic means mounted with said means fixed inboard relative to said boat transom including a movable piston means, (d) said movable piston means including pivot means attached to said housing at its inner end, (e) a power rain mean extending through said housing and said transom for rotationally driving a propeller for said marine outdrive unit, (f) said power train means including at least a pair of universal joint means, one of said universal joint means disposed adjacent an outward portion of said means fixed inboard relative to said boat transom and one of said universal joint means disposed in the upper portion of said housing means, (g) a connecting means forming a portion of said power train means, positioned between said pair of universal joint means and pivotally attached to each, (h) said connecting means and said movable piston means providing for sole support for said housing means in said depending relationship relative to said means fixed inboard relative to said boat transom and (i) said link means and said movable piston means solely furnishing the pivoting of said housing means relative to said means fixed inboard relative to said boat transom.

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