March 21, 1967 W. J. SHIMANCKAS 3,310,021

ENGINE

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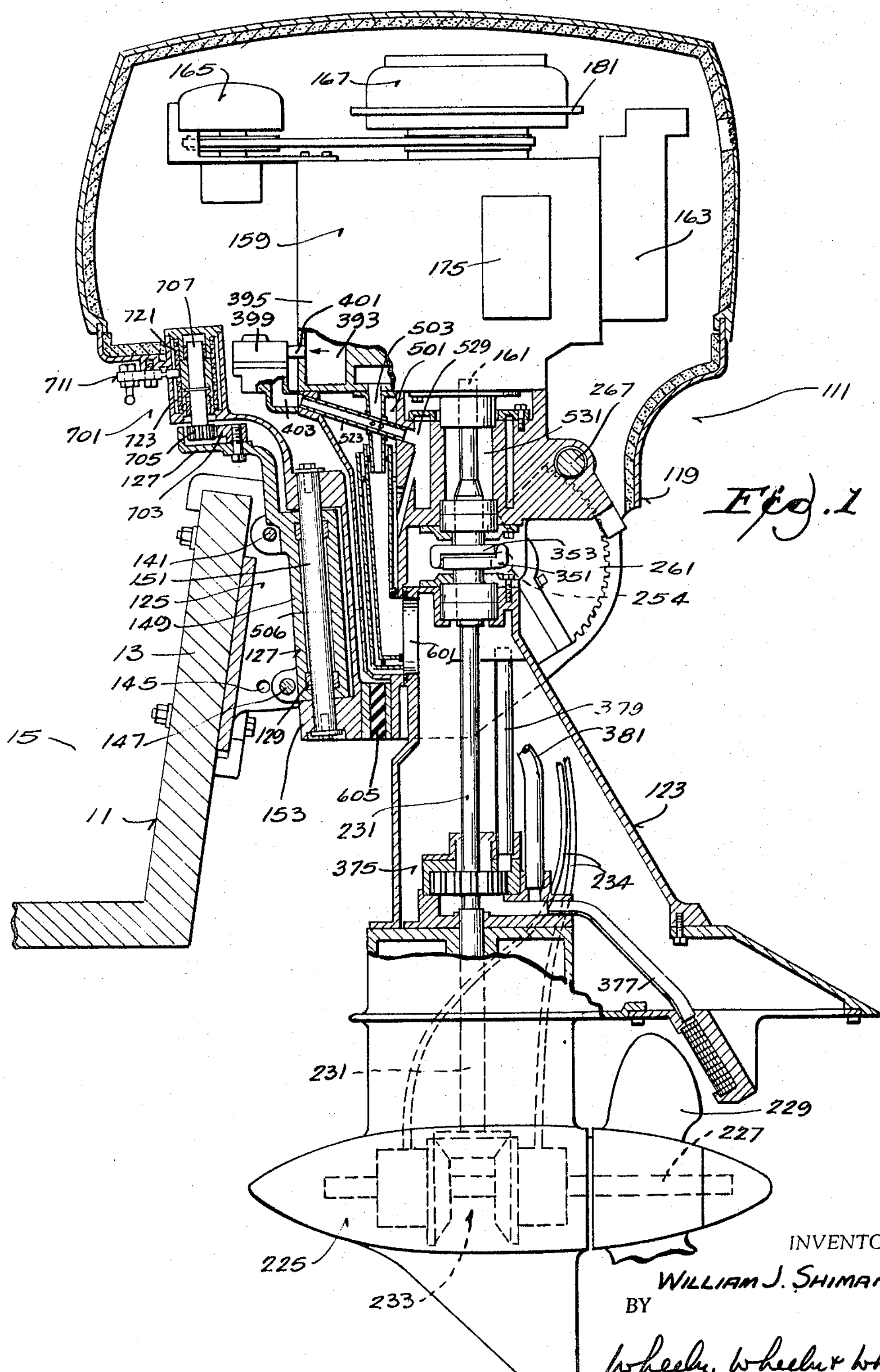

FIG. 1

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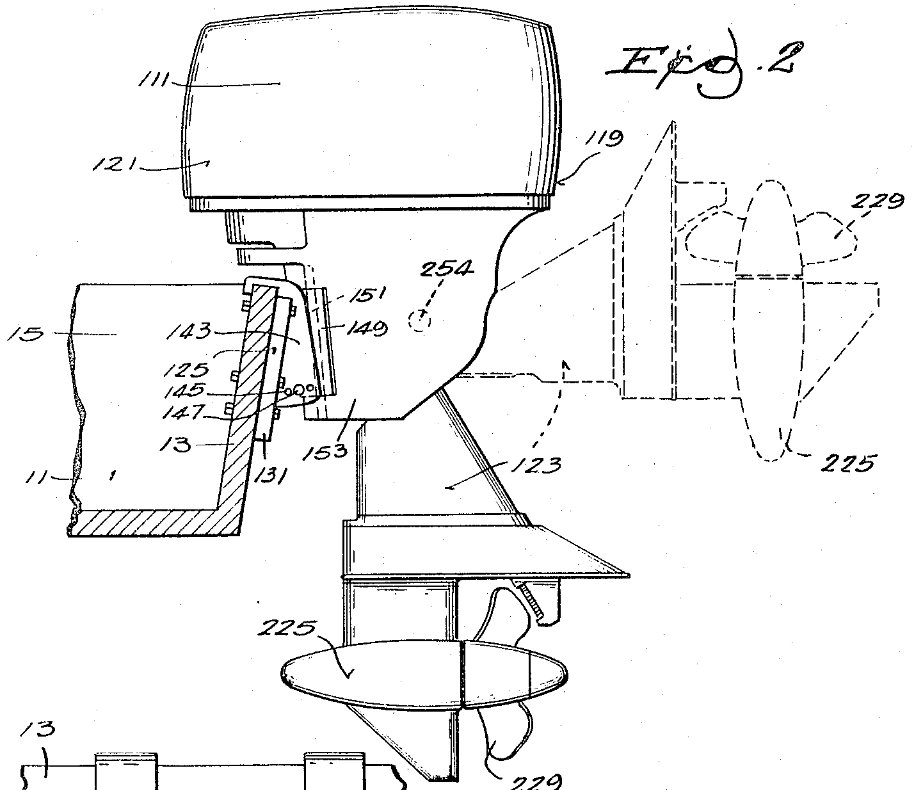

Fig. 2

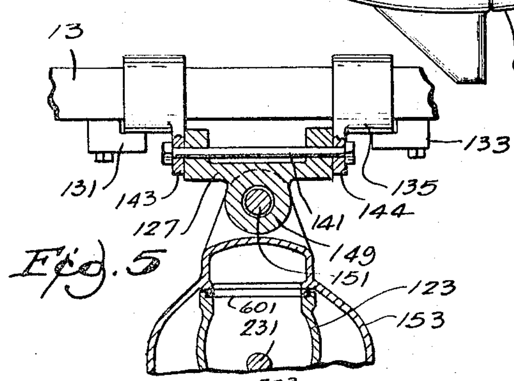

Fig. 5

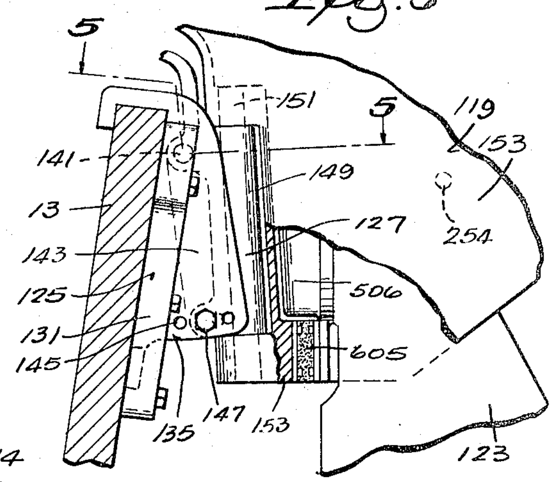

Fig. 3

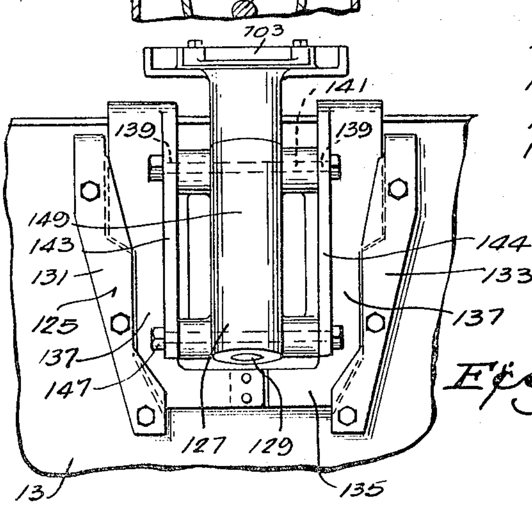

Fig. 4

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Fig. 6

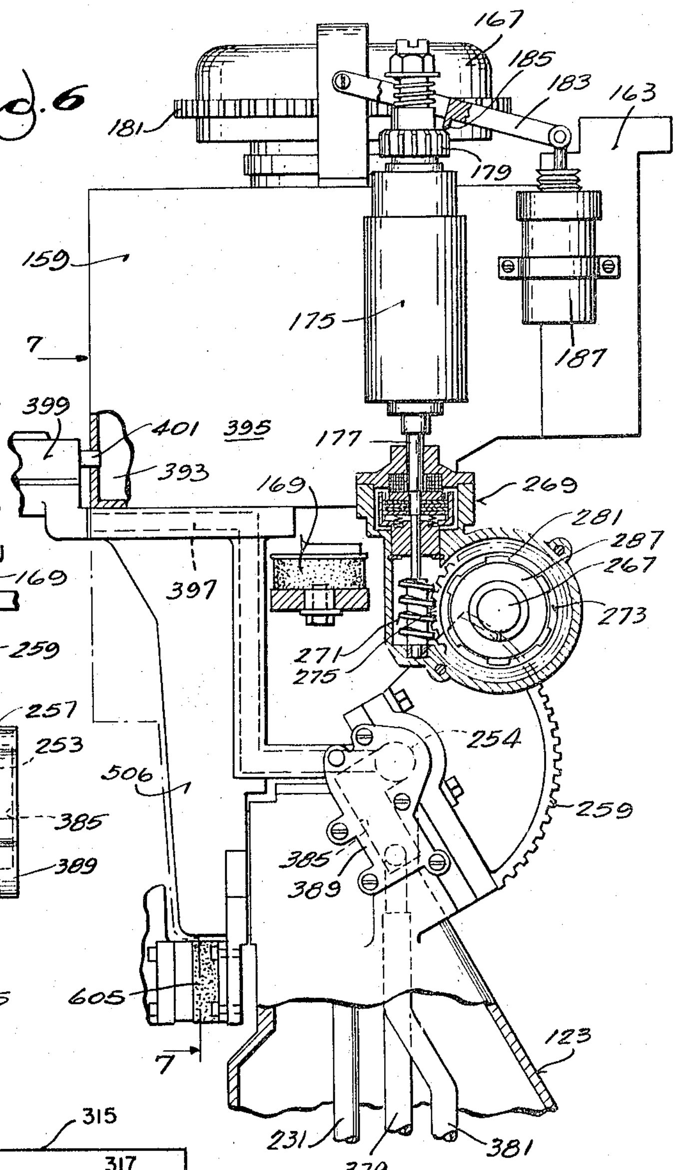
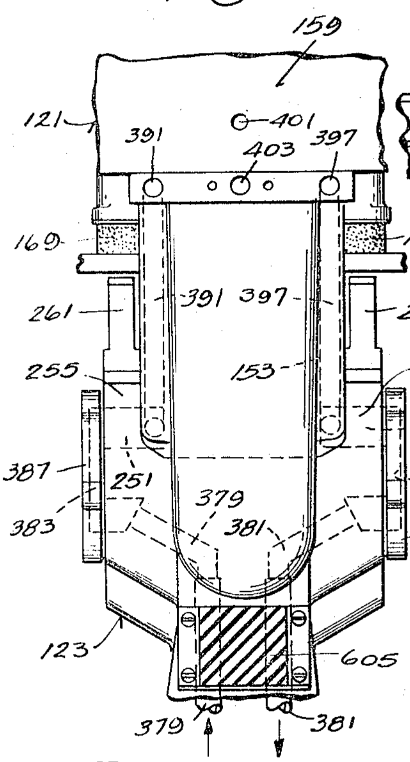


Fig. 7



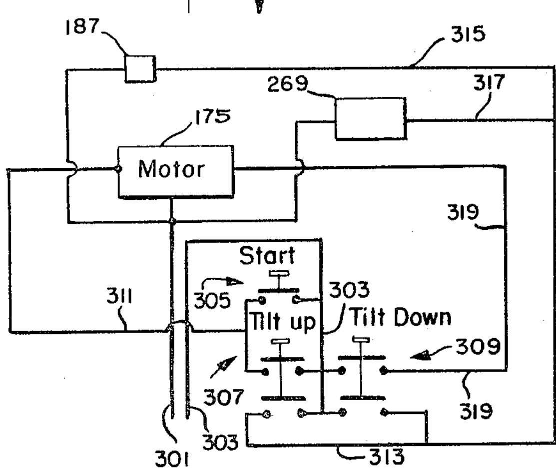


Fig. 8

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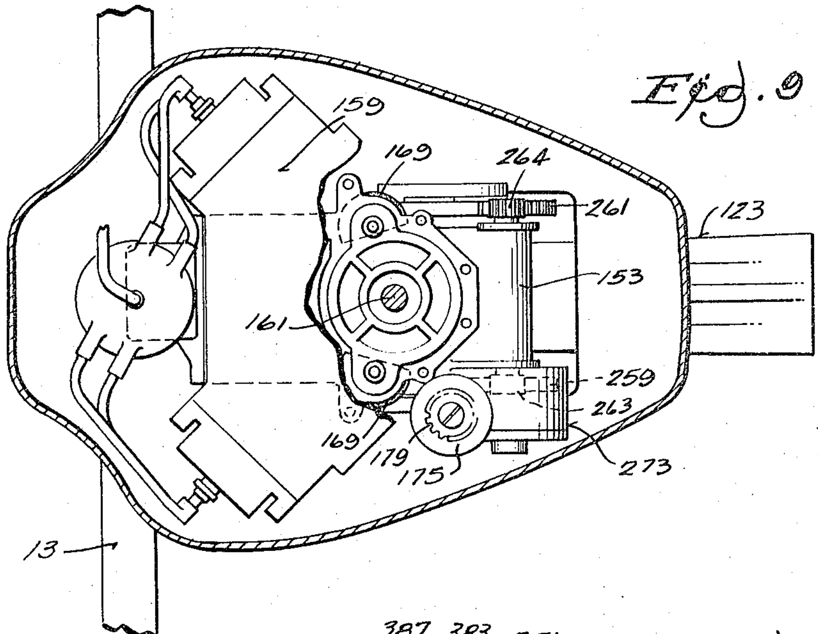

Fig. 9

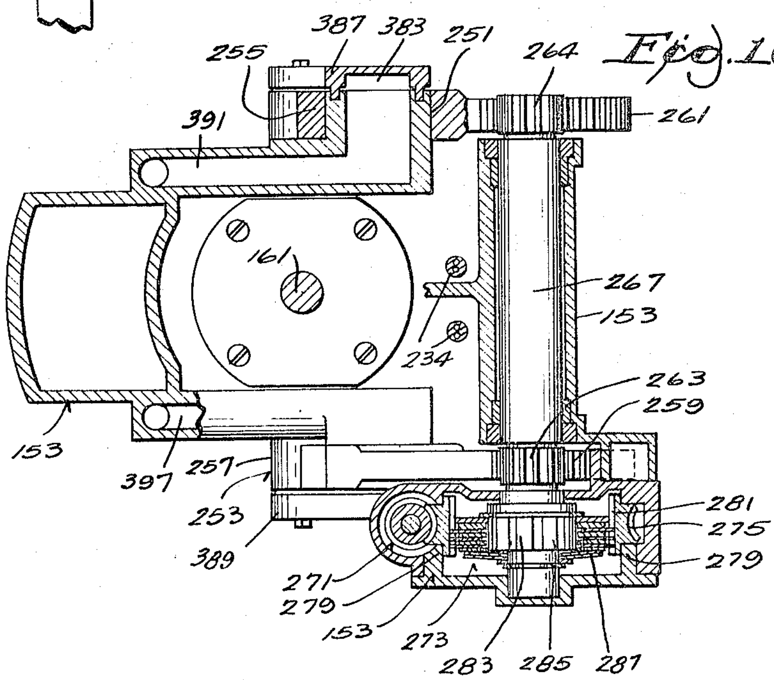

Fig. 10

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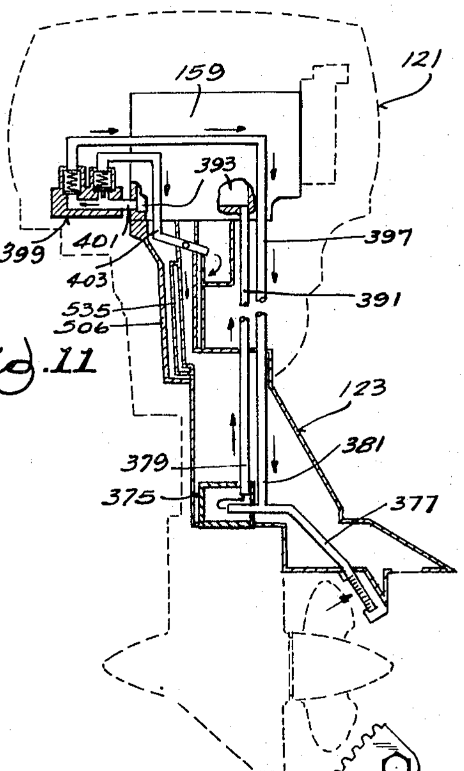


Fig. 11

Fig. 12

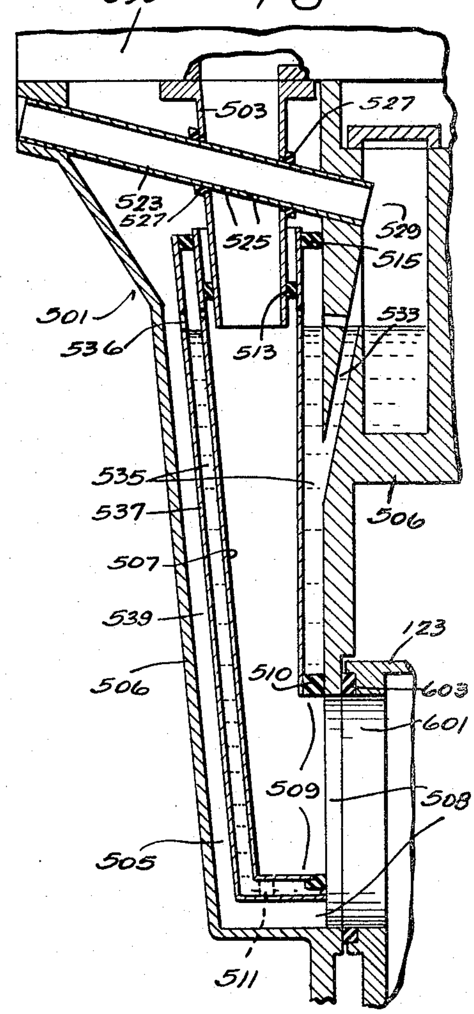
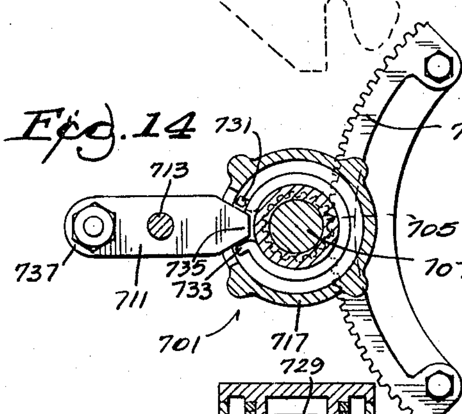


Fig. 14



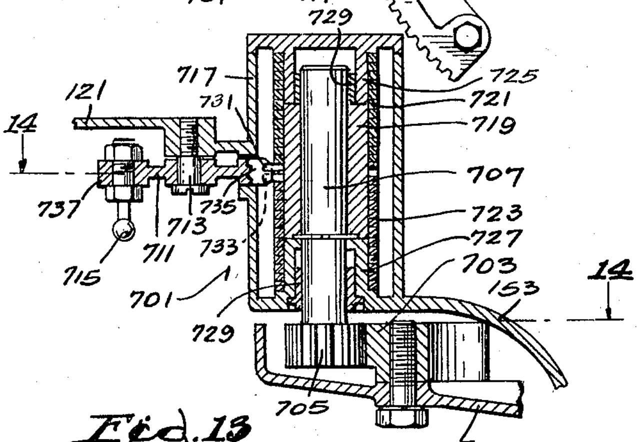


Fig. 13

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United States Patent Office

3,310,021
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ENGINE

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Filed Apr. 27, 1965, Ser. No. 451,117
20 Claims. (Cl. 115—17)

The invention relates generally to marine propulsion device, such as outboard motors.

The invention provides a marine propulsion device which is adapted to be removably attached to the transom of a boat and which includes a steerable propulsion unit including a non-tiltable power head and a connected lower unit which is tiltable relative to the power head from a normal operating position in response to the striking of an underwater obstacle or at other desirable times. In the preferred construction, under normal operating conditions, the power head output shaft is located in a generally vertical position and the lower unit includes a driveshaft which is in axial alignment with the output shaft. The output shaft and driveshaft include cooperating gears which are retained in meshed driving engagement notwithstanding tilting of the lower unit relative to the power head.

Means are also provided for conducting engine cooling water to and from between the power head and the lower unit notwithstanding tilting of the lower unit relative to the power head. Also included are releasable means for preventing propulsion unit steering oscillation in the event of a steering control failure. Still further, the invention also includes an arrangement whereby a reversible starting motor is alternatively employed to afford power tilting of the lower unit in either direction, or to start the engine.

A marine propulsion device in accordance with the invention, i.e., a device including a steerable propulsion unit comprising a non-tilting power head and a tilting lower unit, generally affords the advantages of a conventional outboard motor. As the power head of such a propulsion device does not tilt toward the boat and is supported substantially aft of the transom, a greater useful area is available within the boat for occupancy by passengers or for other purposes. In addition, simplified stern bracket construction and lower silhouette advantages can be achieved. As only the lower unit tilts in response to the striking of an underwater obstacle, there is less tilting inertia than with conventional outboard motor constructions. This advantage affords use of larger and heavier motors.

A marine propulsion device in accordance with the invention, also generally affords the advantages of a conventional stern drive unit. In addition, such a propulsion device avoids any piercing of the transom, and provides greater useful area in the boat by removing the engine to a position substantially behind the transom. In addition, the proposed device is mountable on any boat having a standard transom. In addition, a marine propulsion device in accordance with the invention affords the advantages of lower cost as compared to a stern drive unit due, at least in part, to the elimination of the stern drive unit upper gear box, to the elimination of a trim tab or worm steering device, and to simplified installation. Still further, a marine propulsion device in accordance with the invention is more readily steerable than some stern drive units as there is no need to counter torque reaction when steering.

In addition to all the foregoing, a marine propulsion device in accordance with the invention can be interchangeably used with a conventional outboard motor. Still further, the features of the invention are usable in

connection with either a propeller drive or a reaction jet drive.

Other objects and advantages of the invention will become known by reference to the following disclosure and the accompanying drawings in which:

FIGURE 1 is an elevational view, partially broken away and in vertical section, of an outboard motor in accordance with the invention;

FIGURE 2 is an elevational view partially in section of the engine shown in FIGURE 1, with the lower unit shown, in dotted outline, in its tilted or elevated position;

FIGURE 3 is an enlarged view, partially broken away and in section, of a portion of the outboard motor as shown in FIGURE 2;

FIGURE 4 is a rear elevational view of the portion of the outboard motor shown in FIGURE 3 with the dirigible propulsion unit removed;

FIGURE 5 is a fragmentary plan view partially broken away and in section, taken generally along line 5—5 of FIGURE 3;

FIGURE 6 is an enlarged view, partially broken away and in section, of a portion of the outboard motor shown in FIGURE 1;

FIGURE 7 is a fragmentary view taken generally along line 7—7 of FIGURE 6;

FIGURE 8 is an electrical wiring diagram including various of the components shown in FIGURE 6;

FIGURE 9 is a plan view, partially broken away and partially in section, of the outboard motor shown in FIGURE 1;

FIGURE 10 is a partially broken away and sectioned view of a portion of the outboard motor shown in FIGURE 1;

FIGURE 11 is a diagrammatic view of the cooling system of the engine shown in FIGURE 1;

FIGURE 12 is an enlarged view partially in section of a portion of the engine shown in FIGURE 1;

FIGURE 13 is an enlarged fragmentary view partially in section of another portion of the engine shown in FIGURE 1; and

FIGURE 14 is a sectional view taken generally along line 14—14 of FIGURE 13.

Shown in FIGURE 1 is a boat **11** which includes a transom **13** and a passenger well or cockpit **15** extending forwardly from immediately in front of the transom **13**. Mounted on the transom **13** is a marine propulsion device **111** including a propulsion unit **119** and means for supporting the propulsion unit from the boat transom **13** for swinging movement about a generally vertical axis. Included in the propulsion unit is a power head **121** and a lower unit **123** which is supported from the power head **121** for swinging movement about a generally horizontal axis.

The means for supporting the propulsion unit **119** comprises generally a transom bracket assembly **125** which can be connected to the boat transom **13** and which can be constructed in various ways. In the specifically disclosed construction, as shown best in FIGURES 3, 4, and 5, the transom bracket assembly **125** includes a swivel member, support, or bracket **127** carrying one or more vertical bearings **129** affording horizontal swinging movement of the propulsion unit **119**, together with means affording angular adjustment in a vertical plane of the swivel member **127** to locate the propulsion unit **119** at its optimum position for boat propulsion, notwithstanding variation in transom angles of different boats.

More specifically, the transom bracket assembly **125** includes a pair of fittings **131** and **133** which can be constructed in general accordance with the fittings identified by numerals 8 and 9 in the United States Conover Patent 3,061,250, issued October 30, 1962. Telescopically receivable in the fittings **131** and **133** is a member or bracket 135 which can be constructed in general accordance with the construction of the transom bracket 20 identified in the Conover Patent 3,061,250. As shown in said Conover patent, the bracket 135 comprises (see FIGURE 4) a pair of laterally spaced portions 137 each including, at the upper part thereof, an upper transverse bore 139.

The swivel member 127 is connected to the bracket 135 by means, including a horizontal pivot or pintle 141 extending through the bores 139, affording angular adjustment of the propulsion unit 119 in a vertical plane with respect to the boat transom 13 to obtain optimum propulsion efficiency. In addition, the bracket 135 and swivel member 127 includes cooperating means affording positive, non-tilting disposition of the swivel member 127 relative to the bracket 135 after proper angular adjustment has been accomplished. Such cooperating means comprises, on each of the bracket 135 and swivel member 127, respective pairs of laterally spaced ribs or portions 143 and 144 which project in adjacent relation to the oppositely extending ribs. Included in each of the ribs 143 and 144 is an arcuate series of holes 145 located at a common radius from the horizontal pivot 141. Also provided is means in the form of a locking bolt or bar 147 which is passable through aligned ones of the holes 145 in the ribs 143 and 144 to positively prevent vertical tilting of the swivel member 127 relative to the bracket 135 after proper angular adjustment therebetween. Suitable means can be provided to prevent accidental displacement of the locking bolt 147 from its position preventing relative angular movement between the bracket 135 and the swivel member 127.

The swivel member or support 127 can be constructed in various ways to provide the aforementioned vertical bearing 129 and to afford angular adjustment of the upright bearing axis with respect to the boat transom 13 to which the bracket assembly 125 is attached. Specifically, in the disclosed construction, the swivel member 127 includes a sleeve 149 having therein the vertical bearing 129.

As shown best in FIGURE 1, the swivel member 127 dirigibly supports the propulsion unit 119 by means including a king pin 151 supported by bearing 129. Connected to the king pin 151 for angular movement about a generally vertical axis and relative to the swivel member 127 is a die cast or otherwise fabricated supporting element or member 153.

Supported from the member 153 is an internal combustion engine assembly comprising an engine 159 including a vertically extending crankshaft 161 and various connected accessories such as a carburetor 163, ignition system 165, flywheel 167, etc. Interposed between the engine assembly and the member 153 are means for excluding transmission of vibration from the engine 159 to the member 153. In the disclosed construction, (see FIGURES 6 and 7) such means includes a pair of elastomeric cushions 169 which are located on opposite sides of the engine 159 in symmetrical relation to the engine fore and aft center line. The cushions 169 serve to support the weight of the engine 159 and connected accessories and to absorb torsional and shaking vibrations.

Also included in the power head 121 is an electric starting motor 175 which is supported by the member 153 or by the engine 159 and which has an output shaft 177 preferably extending in generally parallel relation to the crankshaft 161. At its upper end, the output shaft 177 carries a so-called "Bendix drive" including a pinion 179 which is meshable with a ring gear 181 carried on the engine flywheel 167 to rotate the engine 159 for starting purposes. As will be explained hereinafter, the starting motor 175 is preferably a reversible motor and is preferably also utilizable to tilt the lower unit 123 relative to the power head 121.

There is also preferably provided means for selectively preventing meshing engagement of the pinion 179 with the flywheel ring gear 181 when the starting motor 175 is being used to effect lower unit tilting. Such means can include a rockably mounted lever 183 which includes an arm 185 movable to a position interfering with engagement of the pinion 179 with the ring gear 181 on the flywheel. Movement of the arm 185 to its interfering position can be accomplished by means in the form of a spring biased solenoid 187 which is connected to the outer end of the lever 183, which normally affords positioning of the lever 183 to permit engagement of the pinion 179 with the ring gear 181, and which, when actuated, rocks the lever 183 in the clockwise direction as seen in FIGURE 6 to prevent engagement of the pinion 179 with the ring gear.

As shown best in FIGURE 1, the lower unit 123 includes a gear box section 225 including a propeller shaft 227 which is supported by suitable bearings and which, exteriorly of the gear box section 225, supports a propelling element such as a propeller 229. Supported in the lower unit 123 is a driveshaft 231 which is coupled to the propeller shaft 227 by clutch means 223 and which, when the lower unit is in its normal operating position, is in vertical alignment with the crankshaft 161, or an extension thereof. Any suitable clutch means can be employed. However, it is preferred to use an electrically operated clutch in order to utilize the flexibility of electrical control cables, such as are shown at 234, to accommodate tilting of the lower unit 123 relative to the power head 121. One example of such a clutch means is disclosed in my copending application Serial No. 143,773, filed October 9, 1961. A mechanically or hydraulically operated clutch can also be employed. If desired, flexible pressure fluid conduits can also be employed to control the clutch means.

The power head 121 and lower unit 123 includes, as shown in FIGURES 6, 7, and 10, cooperating means for tiltably supporting the lower unit 123 from the power head 121, for effecting selective tilting of the lower unit 123 to any given position relative to the power head 121 within the tilting range, and for affording tilting of the lower unit 123 relative to the power head 121 in the event of the striking of an underwater obstacle by the lower unit 123. The tiltable supporting means includes (as seen in FIGURE 7), a pair of aligned, hollow trunnions 251 and 253 extending from the member 153, which trunnions 251 and 253 defined an axis of tilt 254 indicated in FIGURE 2, and are received in respective bearings 255 and 257 (see FIGURE 7) supported by the lower unit 123.

The means for effecting tilting of the lower unit 123 relative to the power head 121 includes (see FIGURE 10) a pair of laterally spaced gear segments 259 and 261 which are mounted on the lower unit 123 with their centers coinciding with the axis 254 (see FIGURE 2) of the trunnions 251 and 253 (see FIGURE 10). Respectively enmeshed with the gear segments 259 and 261 are gear members or pinions 263 and 264 carried by a cross shaft 267 rotatably supported by the member 153. In turn, the cross shaft 267 is drivable (see FIGURE 6) by the reversible starting motor 175 through a suitable tilting drive clutch 269, a non-reversible drive 271, and a friction or slip clutch 273 to effect either upward or downward tilting of the lower unit 123 relative to the power head 121 depending upon the direction of operation of the starting motor 175. Apart from the integration of the operation of the drive clutch 269 with other components of the lower unit tilting means, the details of the tilting drive clutch 269 form no part of the present invention. Although various clutch constructions can be employed, it is preferred to use an electrically operated clutch to facilitate operational integration of the clutch in a control circuit 274 (see FIGURE 8) which is also a part of the lower unit tilting means. In the specifically disclosed construction, the clutch 269 is normally disengaged and is engaged only upon energizing thereof.

The slip clutch constitutes means affording upward tilting of the lower unit 123 in response to the sudden striking of an underwater object and means for reliably holding the lower unit in any position within the tilting range regardless of how this position is achieved.

Shown in FIGURE 8 is a wiring diagram of the control circuit 274 providing for operation of the starting motor 175 to selectively and alternatively afford engine starting and lower unit tilting. As shown, the circuit 274 includes a pair of leads 301 and 303 extending from a suitable source of electrical energy which can be either an alternator or a battery. One lead 301 is connected to each of the motor 175, the solenoid 187, and the tilting drive clutch 269. The other lead is connected to each of three switches 305, 307, and 309. The engine starting switch 305 is operable to connect the lead 303 to a lead 311 connected to the starting motor 175 to afford engine operation.

The tilt up switch 307 is constructed to afford connection of the lead 303 with the lead 311 so as to afford motor operation in the same direction as when starting the engine and to connect lead 303 to a lead 313 having branches 315 and 317 respectively connected to the solenoid 187 and the clutch 269, whereby the solenoid is actuated to prevent engegement of the pinion 179 with the ring gear 181 on the flywheel and to effect engagement of the clutch to afford raising of the lower unit 123.

The other or tilt down switch 309 is constructed to afford connection of the lead 303 with a lead 319 extending to the starting motor 175 so as to afford motor operation in the opposite direction to that afforded by operation of the switches 305 and 307 and so as to connect the lead 303 with the lead 313 connected to each of the solenoid 187 and the clutch 269, whereby also to prevent meshed engagement of the pinion 178 with the ring gear 181 on the flywheel and to engage the clutch 269 so as to afford lowering of the lower unit 123. In another form, the invention also contemplates hydraulic tilting of the lower unit 123 by means of a suitably connected pressure fluid cylinder. In this regard, a pressure fluid pump and an actuating circuit as disclosed in the Ziegler application Serial No. 154,420, filed November 24, 1961, can be employed.

In the disclosed construction, the slip clutch 273 (see FIGURE 10) is interposed between the cross shaft 267 and a worm wheel 275 which includes a pair of spaced annular bearing surfaces 279 supported by the member 153 so as to afford worm wheel rotation about the axis of the cross shaft 267. In addition to affording worm wheel rotation, the bearing surfaces 279 also serve as thrust bearings to prevent worm wheel displacement in a direction axially of the cross shaft 267. The worm wheel 275 is generally in the form of a ring having along the inner surface thereof a series of splines 281 extending axially of the cross shaft 267. Non-rotatably mounted on the cross shaft 267 exteriorly of the worm wheel 275 is a hub 283 having a plurality of splines 285. Extending between the hub 283 and the inner ring surface of the worm wheel 275 in engaged relation with one another and interacting with the splines 281 and 285 are clutch plates in the form of bevel washers 287. Accordingly, cross shaft rotation relative to the worm wheel 275 is provided for, thereby affording upward tilting of the lower unit 123 in response to the striking of an underwater object.

Rotation of the worm wheel 275 in response to the striking of an underwater obstacle is prevented by the non-reversible drive 271 which includes a worm 289 drivingly connected to the tilting drive clutch 269 and meshed with the worm wheel 275.

Means are provided for drivingly connecting the engine crankshaft 161 or an extension thereof, to the driveshaft 231 in the lower unit 123, notwithstanding tilting of the lower unit 123. In this regard, the crankshaft 161, or an extension thereof, and the driveshaft 231 respectively include gearing which, in the disclosed construction, as shown in FIGURE 1, is in the form of ball gears 351 and 353 meshed along a pitch circle tangent to the axis of the trunnions 251 and 253. Accordingly, meshing engagement of the driveshaft 231 and crankshaft 161 is afforded notwithstanding tilting of the lower unit 123 with relation to the power head 121. This is important as it is desirable to maintain water coolant supply to the engine, whenever possible, notwithstanding displacement of the lower unit 123 from its normal operating position.

Supported in the lower unit 123 and driven by the driveshaft is a water pump 375. Communicating with the water pump is a water inlet line 377, a water discharge line 379, and a recirculating line 381 which merges with the inlet line 377. Both the water discharge line 379 and the recirculating line 381 extend upwardly in the lower unit 123, communicating, as shown in FIGURES 6 and 7, with respective interior recesses 383 and 385 in respective cap members 387 and 389 which are movable with the lower unit 123, enclose the outer ends of the respective trunnions 251 and 253, and communicate with the hollow interior of the trunnions. In turn, a water supply conduit 391 communicating with the hollow interior of the trunnion 251 extends to a water jacket 393 (see FIGURE 1) in the engine block 395.

Communicating with the hollow interior of the other trunnion 253 (see FIGURES 7 and 10) is a recirculating water conduit 397 which extends to a thermostatic control 399 (see FIGURE 1) connected to a water jacket discharge pipe 401. The control 399 apportions discharge coolant flow from the engine between the recirculating conduit 397 and a discharge pipe 403 through which the discharge coolant flows to an arrangement or means which cooperates with an exhaust gas discharge arrangement 501 and which substantially reduces sound transmission from the propulsion unit.

Specifically (as shown in FIGURE 12), the engine exhaust gas arrangement 501 includes a member or casting 506 attached to the engine block 395, and an engine exhaust port which includes, in part, a tuning tube 503 extending downwardly into the member 506. Resiliently supported in a cavity 505 in the member 506 is an exhaust gas passage tube 509 which extends upwardly from a rearwardly facing opening 508 in the member 506 below the horizontal pivot 254 to a position in surrounding telescopic relation to the tuning tube 503.

The exhaust gas passage tube 507 is resiliently mounted at its lower end by an annular elastomeric cushion 509. If desired, an auxiliary elastomeric support 511 can also be employed. At its upper end, an elastomeric spacer or cushion 513 is located betweeen the tuning tube 503 and the exhaust gas passage tube 507. If desired, auxiliary support for the upper end of the tube 507 can be provided in the form of an elastomeric mounting 515 extending between the member 506 and the tube 507. The mounting 515 is preferably discontinuous in order not to block coolant water flow.

The pipe 403 (see FIGURE 1) which extends from the thermostatic control 399 includes (see FIGURE 12) a tube or conduit section 523 which traverses the exhaust gas tuning tube 503 and includes, in its underside, one or more relatively small openings 525. Preferably, the openings 525 afford limited discharge into the exhaust gas tube in order to effect lowering of the exhaust gas temperature and comprise orifices for spraying the discharge water into the tuning tube 503. In order to minimize any possibility of vibrational transmission, elastomeric gaskets or grommets 527 are located betweeen the conduit section 523 and the exhaust gas tuning tube 503.

At its end remote from the thermostatic control 399, the conduit section 523 empties into a cavity 529 in the member 506, which cavity is located (see FIGURE 1) in generally surrounding relation to a void 531 in which the crankshaft 161 or extension thereof is journalled. From the cavity 529 (see FIGURE 12) the discharge water flows through a passage or bore 533 into a water jacket 535 surrounding the exhaust gas tube 503. The water jacket 535 is defined by the member 506 and by a partition 537 which can be integrally formed in the member 506 or which can be secured thereto. The water level in the jacket 535 is determined by discharge through an aperture 536 near the top of the partition 537, after which such discharged water travels through a passage 539 to the opening 508.

The lower unit 123 includes a forwardly facing opening 601 which registers with the opening 508 in the member 506 to receive coolant water discharge and exhaust gas discharge from the power head 121 when the lower unit 123 is in a normal operating position. A resilient gasket or seal 603 which can be carried by either the member 506 or the lower unit 123 is employed to effect a seal around the passage defined by the registered openings 508 and 601 and to transmit thrust to the lower part of the member 506. Propelling thrust is resiliently transmitted from the member 506 to the member 153 through a cushion or pad 605 (see FIGURES 1, 3, 6, and 7) which connects the member 153 and the member 506.

Means 701 are provided (as shown best in FIGURES 13 and 14) for locking the propulsion unit 119 against unwanted steering movement in the event of a failure in the steering connections to the propulsion unit. In the disclosed construction, such means includes a gear member in the form of an arcuate gear segment 703 extending from the bracket 117 about a center in alignment with the axis of the king pin 151 (see FIGURE 1). In mesh with the gear segment 703 (see FIGURES 13 and 14) is a gear member in the form of a pinion 705 which is carried by a shaft 707 rotatably supported by the power head 121. Accordingly, power head movement about the king pin axis necessitates travel of the pinion 705 along the arcuate gear segment 703.

Means are provided for releasably preventing rotation of the pinion 705 and shaft 707 to thereby lock the propulsion unit 119 against dirigible movement. Means are also provided for releasing said pinion rotation preventing means in the event of normal steering actuation by a steering connection. More specifically, there is provided a lever or arm 711 which is mounted, intermediate its ends, on a pivot member 713 supported by the power head 121 and which includes, at its forward end, a fitting 715 adapted for coupling to a steering connection. At its rearward end, the lever 711 extends into a housing 717 which is formed on the member 153 and which rotatably contains and supports the shaft 707. Engaged with an enlarged central hub 719 fixed to the shaft 707 are a pair of clutches in the form of reversely curved wrap springs 721 and 723 which respectively grip the shaft 707 to prevent rotation thereof in both directions. The upper wrap spring 721 extends from and is fixed to a sleeve 725 extending into the housing 717. The lower wrap spring 723 extends from and is fixed to another sleeve 727 extending into the housing. As can be seen, the sleeves 725 and 727 are bored and contain bearings 729 supporting the shaft 707.

The adjacent ends of the wrap springs 721 and 723 terminate in respective radially extending tabs on ears 731 and 733 located in laterally spaced relation to each other on opposite sides of, and in position for engagement by, the rearward end 735 of the lever 711. Accordingly, when the forward end 737 of the lever 711 supporting the fitting 715 is displaced upwardly as seen in FIGURE 14, the lever 711 is initially swung in the clockwise direction to engage the tab 733 and to displace the tab in the counterclockwise direction, thereby releasing the grip of the spring 723 on the shaft 707 and permitting swinging of the propulsion unit 119 in the clockwise direction about the king pin 151. Continued movement of the steering connection to displace the lever upwardly, as seen in FIGURE 14, will result in maintaining the wrap spring 723 in released condition and pivoting the propulsion unit in the clockwise direction as seen in FIGURE 14.

Likewise, when the forward end 737 of the lever 711 is urged downwardly by the steering connection, as seen in FIGURE 14, the lever 711 is initially pivoted in the counterclockwise direction, whereby the tab 731 is engaged and displaced to release the grip of the spring 721 on the shaft 707 and to afford counterclockwise movement of the propulsion unit 119 about the king pin 51. In the absence of any force tending to displace the lever 711 from a centered position between the tabs 731 and 733, the resiliency of the springs 721 and 723 serves to return the lever 711 to its centered position, and thereby regripping the shaft 707 to prevent rotation thereof so as to lock the propulsion unit 119 in the then existing horizontal angular relation to the bracket 127.

While the foregoing disclosure has been generally directed to a dirigible marine propulsion unit including an engine, various of the features of the invention are also applicable to outboard marine propulsion devices in which the power head or engine is stationary and the lower unit is both vertically tiltable and horizontally steerable with respect to the power head or engine.

Reference is hereby made to my prior copending applications: Serial No. 143,773, filed October 9, 1961; Serial No. 143,865, filed October 9, 1961; Serial No. 295,504, filed July 10, 1963, and Serial No. 434,489, filed February 23, 1965.

Various of the features of the invention are set forth in the following claims.

What is claimed is:

1. The combination in an outboard motor of a swivel bracket, means connected to said swivel bracket for positively fixing said swivel bracket relative to the transom of a boat, a propulsion unit carried by said swivel bracket for dirigible movement about an axis which is generally upright when said swivel bracket is fixed to the boat transom, said propulsion unit including a power head, a lower unit, and means pivotally connecting said power head and said lower unit for tilting of said lower unit relative to said power head.

2. The combination in an outboard motor of a swivel bracket, means connected to said swivel bracket for positively fixing said swivel bracket relative to the transom of a boat, a propulsion unit carried by said swivel bracket for dirigible movement about an axis which is upright when said swivel bracket is fixed relative to the boat transom, said propulsion unit including a supporting member, an internal combustion engine assembly, and resilient means interposed between said supporting member and said engine assembly for support of said engine assembly, a lower unit, and means pivotally connecting said lower unit to said engine assembly for tilting of said lower unit relative to said power head.

3. The combination in an outboard motor of an engine mounting bracket, means connected to said engine mounting bracket for angularly adjusting said engine mounting bracket in a vertical plane and for positively fixing said engine mounting bracket in a selected adjusted condition, a power head including an engine carried by said engine mounting bracket, a lower unit, and means pivotally connecting said power head and said lower unit for tilting of said lower unit relative to said power head.

4. The combination in an outboard motor of a swivel bracket, means connected to said swivel bracket for positively fixing said swivel bracket relative to the transom of a boat, a power head carried by said swivel bracket for dirigible movement about an axis which is generally upright when said swivel bracket is fixed to the boat transom, a lower unit, and means pivotally connecting said power head and said lower unit for tilting of said lower unit relative to said power head.

5. The combination in an outboard motor of a swivel bracket, means connected to said swivel bracket for positively fixing said swivel bracket relative to the tran-

som of a boat, a power head carried by said swivel bracket for dirigible movement about an axis which is upright when said swivel bracket is fixed to said transom, said power head including a supporting member, resilient mounts carried by said supporting member, and an internal combustion engine assembly suspended by said resilient mounts, a lower unit, and means pivotally connecting said lower unit to said engine assembly for tilting of said lower unit relative to said power head.

6. The combination in an outboard motor of a swivel bracket, means connected to said swivel bracket for positively fixing said swivel bracket relative to the transom of a boat, a power head carried by said swivel bracket for dirigible movement about an axis which is upright when said swivel bracket is fixed to said transom, said power head including a supporting member, an internal combustion engine assembly, and resilient means interposed between said supporting member and said engine assembly for support of said engine assembly, a lower unit, and means pivotally connecting said lower unit to said engine assembly for tilting of said lower unit relative to said power head.

7. The combination in an outboard motor of a transom bracket adapted to be secured to the transom of a boat, a swivel member connected to and positively fixed relative to said transom bracket, a propulsion unit carried by said swivel member for dirigible movement about an axis which is generally upright when said swivel member is fixed to the boat transom, said propulsion unit including a power head, a lower unit, and means pivotally connecting said power head and said lower unit for tilting of the lower unit relative to said power head.

8. A marine propulsion unit comprising a power head having an output shaft, means for mounting said power head on the transom of a boat with said output shaft in a generally upright position, a lower unit having a propelling element, a rotatably mounted shaft supporting said propelling element, a driveshaft, and electrically operated clutch means for drivingly connecting said driveshaft to said shaft supporting said propelling element, gearing on said output shaft and said driveshaft, means pivotally connecting said power head and said lower unit for pivotal movement of said lower unit relative to said power head from a position in which said output shaft and said driveshaft are in axial alignment with said gearing in meshed engagement and for affording retention of said meshed engagement of said gearing notwithstanding pivotal movement of said lower unit relative to said power head, and flexible electrical connections extending between said lower unit and said power head and connected to said clutch means for operation thereof notwithstanding pivotal movement of said lower unit relative to said power head.

9. A marine propulsion device comprising a power head having an output shaft, a water jacket, and a water conduit communicating with said water jacket, means for mounting said power head on the transom of a boat with said output shaft in a generally upright position, a lower unit having a rotatable propelling element, a water pump, a water line leading from said pump, and a driveshaft drivingly connected to said propelling element and to said water pump, gearing on said output shaft and said driveshaft, means pivotally connecting said power head and said lower unit for pivotal movement of said lower unit relative to said power head from a position in which said output shaft and said drive shaft are in axial alignment with said gearing in meshed engagement and for affording retention of said meshed engagement of said gearing notwithstanding pivotal movement of said lower unit relative to said power head, and means on said power head and said lower unit affording communication between said water conduit and said water line, notwithstanding pivotal movement of said lower unit relative to said power head.

10. A marine propulsion device comprising a power head including an internal combustion engine having an output shaft, and a starter motor connected to said engine, means for mounting said power head to the transom of a boat with said output shaft in a generally upright position, a lower unit having a rotatable propelling element and a driveshaft drivingly connected to said propelling element, gearing on said output shaft and said driveshaft, means pivotally connecting said power head and said lower unit for pivotal movement of said lower unit relative to said power head from a position in which said output shaft and said driveshaft are in axial alignment with said gearing in meshed engagement and for affording retention of said meshed engagement of said gearing notwithstanding pivotal movement of said lower unit relative to said power head, a gear segment on said lower unit, a pinion rotatably mounted on said power head in meshed relation with said gear segment, and means on said power head for drivingly connecting said pinion and said starting motor, whereby to rock said lower unit relative to said power head in response to operation of said starter motor.

11. A marine propulsion device comprising a power head including an internal combustion engine having an output shaft, and a starter motor connected to said engine, a lower unit having a rotatable propelling element and a driveshaft drivingly connected to said propelling element, means pivotally connecting said power head and said lower unit for pivotal movement of said lower unit relative to said power head from a position in which said output shaft and said driveshaft are in axial alignment, a gear segment on said lower unit, a pinion rotatably mounted on said power head in meshed relation with said gear segment, and means on said power head for drivingly connecting said pinion and said starting motor, whereby to rock said lower unit relative to said power head in response to operation of said motor.

12. A marine propulsion device comprising a power head including an internal combustion engine having an output shaft, and a reversible starter motor connected to said engine, a lower unit, a pivot connecting said power head and said lower unit for pivotal movement of said lower unit relative to said power head, a gear segment on said lower unit, a pinion rotatably mounted on said power head in meshed relation with said gear segment, and means on said power head for drivingly connecting said pinion and said starting motor.

13. A marine propulsion device comprising a power head including an internal combustion engine having an output shaft, a reversible starter motor, and means for drivingly connecting said motor and said engine, a lower unit, a pivot connecting said power head and said lower unit for pivotal movement of said lower unit relative to said power head, a gear segment on said lower unit, a pinion rotatably mounted on said power head in meshed relation with said gear segment, clutch means on said power head for drivingly connecting said pinion and said starting motor, and means for selectively and alternatively effecting connection of said motor to one of said engine and said pinion.

14. A marine propulsion device comprising a power head including an internal combustion engine having an output shaft, and a reversible starter motor connected to said engine and having a rotor, means for mounting said power head on the transom of a boat, a lower unit, a pivot connecting said power head and said lower unit for pivotal movement of said lower unit relative to said power head, a gear segment on said lower unit and a pinion rotatably mounted on said power head in meshed relation with said gear segment, an electrically operated clutch connected to said rotor, a friction clutch connected to said pinion, and a connection between said electrically operated clutch, and said friction clutch, said connection including means preventing feed back from said friction clutch to said electrically operated clutch.

15. A marine propulsion device comprising a power head including an internal combustion engine comprising an output shaft and a reversible starter motor having a

rotor, a lower unit, a pivot connecting said power head and said lower unit for pivotal tilting movement of said lower unit relative to said power head, a first gear member on one of said lower unit and said power head, a second gear member rotatably mounted on the other of said lower unit and said power head in meshed relation with said first gear member, a tilting drive clutch connected to said rotor, a friction clutch connected to said second gear member, a connection between said tilting drive clutch and said friction clutch including means for preventing feed back from said friction clutch to said tilting drive clutch, and means for selectively and alternatively effecting driving connection of said rotor to said output shaft to afford engine starting and to said second gear member to afford lower unit tilting.

16. A marine propulsion device comprising a power head including an internal combustion engine comprising an output shaft and a reversible starter motor having a rotor, means for mounting said power head on the transom of a boat, a lower unit, a pivot connecting said power head and said lower unit for pivotal movement of said lower unit relative to said power head, a gear segment on said lower unit, a pinion rotatably mounted on said power head in meshed relation with said gear segment, a normally non-driving electrically operated clutch connected to said rotor, a friction clutch connected to said pinion, a connection between said electrically operated clutch and said friction clutch including means for preventing feed back from said friction clutch to said electrically operated clutch, and means for selectively and alternatively effecting driving connection of said rotor to said engine and to said pinion.

17. A marine propulsion device comprising a power head including an internal combustion engine comprising an output shaft and a reversible starter motor having a rotor, means for mounting said power head on the transom of a boat with said output shaft in a generally upright position, a lower unit having a rotatable propelling element and a driveshaft drivingly connected to said propelling element, a pivot connecting said power head and said lower unit for pivotal movement of said lower unit relative to said power head from a position in which said output shaft and said driveshaft are in axial alignment, gearing on said output shaft and said driveshaft having gear means retained in meshed driving relation when said lower unit is in said one position, said gearing including means affording retention of said meshed driving relation, notwithstanding pivotal movement of said lower unit relative to said power head, a gear segment on said lower unit, a pinion rotatably mounted on said power head in meshed relation with said gear segment, a normally non-driving electrically operated clutch connected to said rotor, a friction clutch connected to said pinion, a connection between said electrically operated clutch and said friction clutch including means for preventing feed back from said friction clutch to said electrically operated clutch, and means for selectively and alternatively effecting driving connection of said rotor to said engine and to said pinion.

18. The combination in an outboard motor of a swivel bracket, means adapted for fixedly locating said swivel bracket relative to the transom of a boat, a propulsion unit including a power head, a lower unit, and means tiltably connecting said lower unit to said power head, means including a king pin connecting said propulsion unit to said swivel bracket for dirigible propulsion unit movement relative to said swivel bracket, a stationary gear segment on said swivel bracket, said segment extending about a center in alignment with the axis of said king pin, a pinion in meshed engagement with said gear sector, a shaft carrying said pinion, means on said propulsion unit rotatably mounting said shaft about an axis in parallel relation to said king pin axis, separate oppositely acting one way releasably engaged clutches connecting said shaft and said propulsion unit for preventing rotation of said shaft in both directions, whereby said propulsion unit is locked with respect to said swivel bracket, a lever having means adapted for connection to a remote steering control, means mounting said lever on said propulsion unit for limited pivotal movement, and means on said lever engageable with said clutches for releasing said clutches in response to displacement of the steering control affording pivotal movement of said lever.

19. The combination in a marine propulsion device of a bracket adapted to be fixed to a boat, a lower unit, means including a king pin for connecting said lower unit to said bracket for dirigible lower unit movement relative to said bracket, a stationary gear member connected to one of said bracket and said lower unit, said gear member extending about a center in alignment with the axis of said king pin, a second gear member in meshed engagement with said first gear member, means connected to the other of said bracket and said lower unit for rotatably mounting said second gear member about an axis in parallel relation to said king pin axis, clutch means connecting said second gear member and said other of said lower unit and bracket for respectively preventing rotation of said second gear member with respect to said other of said lower unit and bracket, whereby said lower unit is locked with respect to said bracket, a lever having means adapted for connection to a remote steering control, means connected to the other of said lower unit and said bracket for pivotally mounting said lever for limited pivotal movement with respect to the other of said lower unit and said bracket, and means on said lever engageable with said clutch means for releasing said clutch means in response to displacement of the steering control affording pivotal movement of the said lever.

20. The combination in a marine propulsion device of a swivel bracket, means adapted for mounting said swivel bracket on the transom of a boat, a propulsion unit including a lower unit, means including a king pin for connecting said propulsion unit to said swivel bracket for dirigible propulsion unit movement relative to said swivel bracket, a stationary gear segment on said swivel bracket, said segment extending about a center in alignment with the axis of said king pin, a pinion rotatably carried on said propulsion unit in meshed engagement with said gear sector, clutch means connecting said pinion and said propulsion unit for preventing rotation of said pinion in both rotative directions, whereby said propulsion unit is locked with respect to said swivel bracket, a lever having means adapted for connection to a remote steering control, means pivotally mounting said lever on said propulsion unit for limited pivotal movement, and means on said lever engageable with said clutch means for releasing said clutch means in response to displacement of the steering control affording pivotal movement of the said lever.

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