March 20, 1962 W. L. TENNEY 3,025,823

OUTBOARD MOTOR CONSTRUCTION

Filed Dec. 29, 1958 3 Sheets-Sheet 1

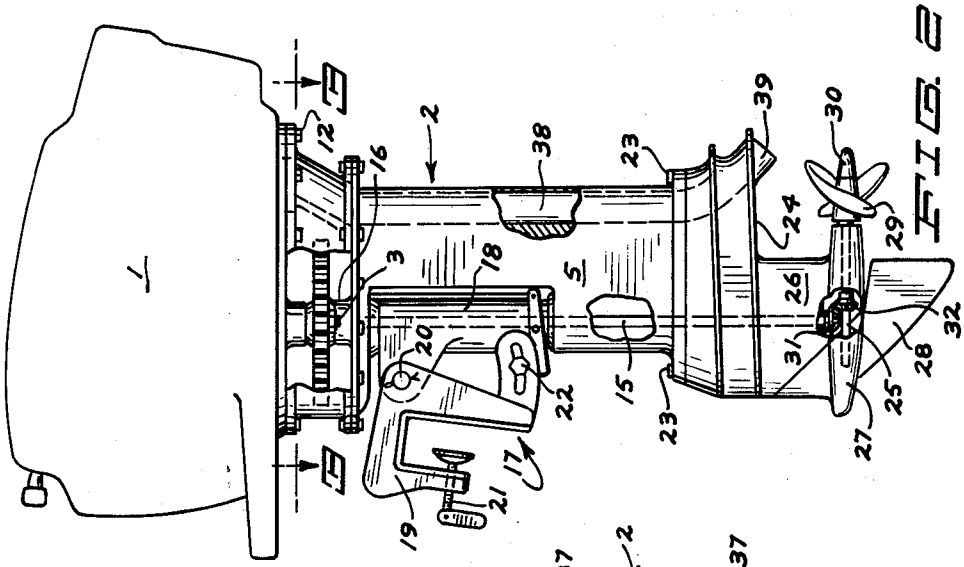


FIG. 2

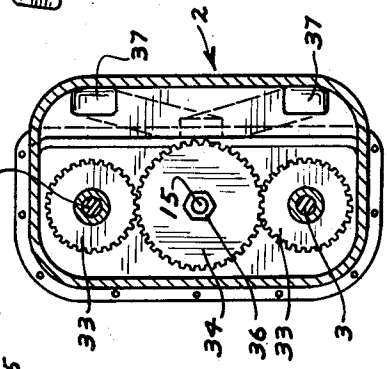


FIG. 3

FIG. 1

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FIG. 4

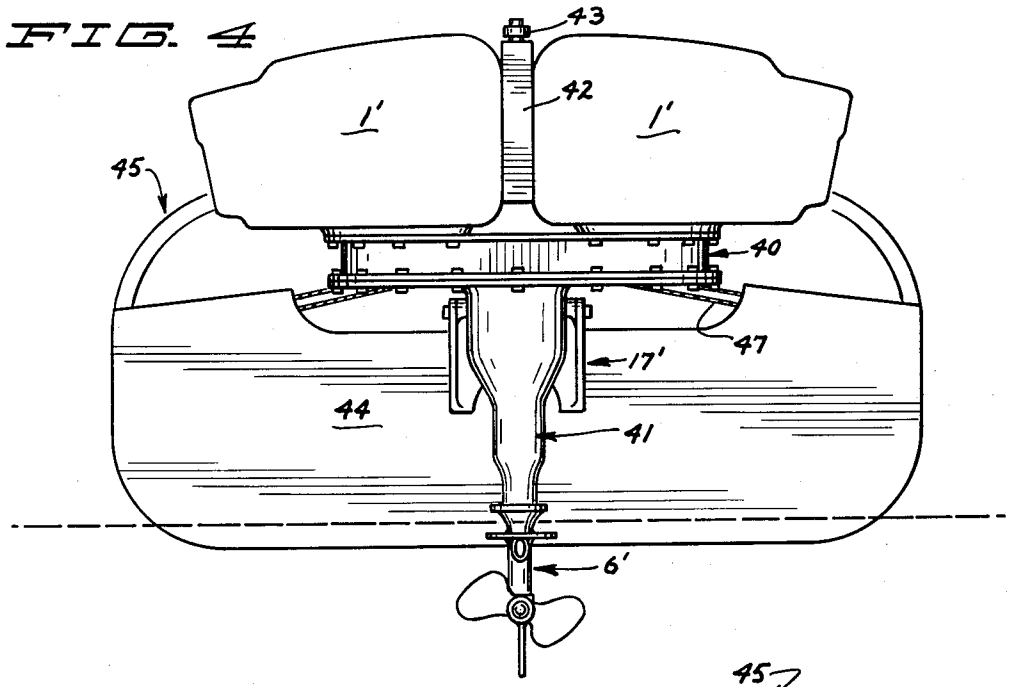
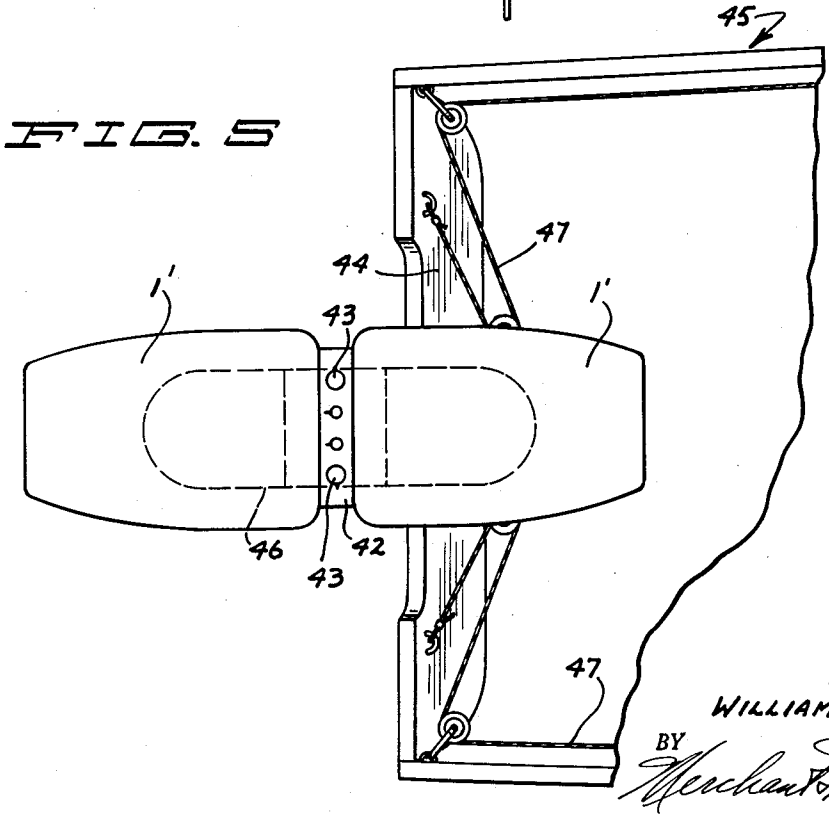


FIG. 5



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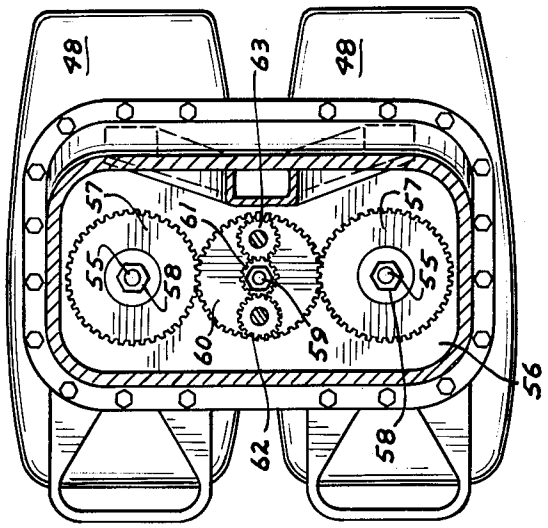


FIG. 7

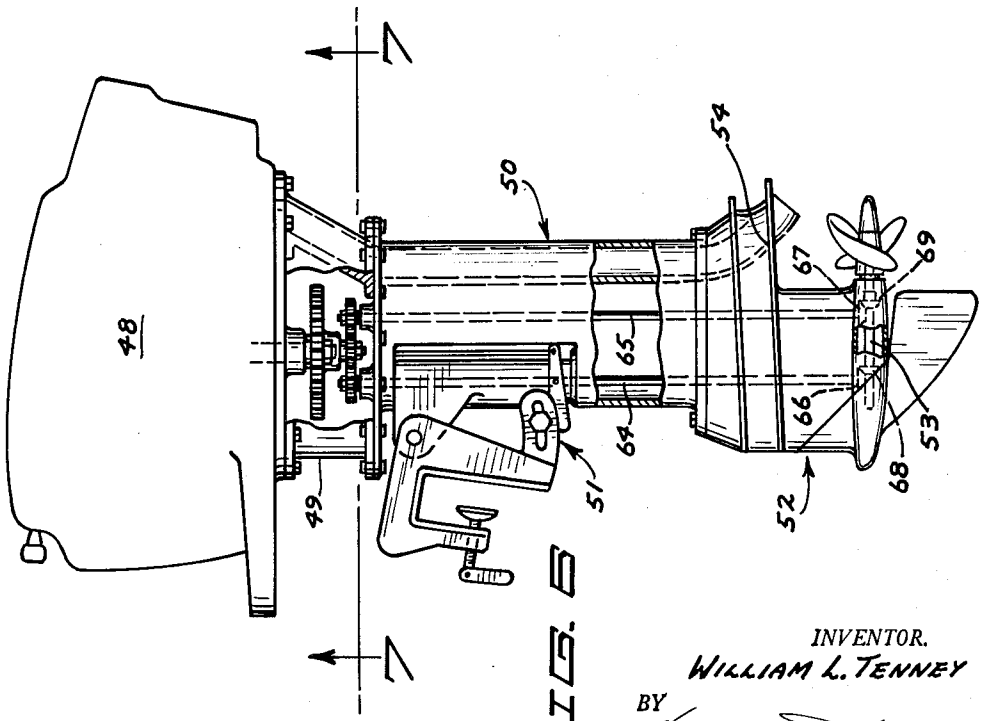


FIG. 6

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OUTBOARD MOTOR CONSTRUCTION

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12 Claims. (Cl. 115—17)

My invention relates generally to marine propulsion motors, and more particularly to improvements in outboard motors of the type which may be removably secured to the transom of a boat.

In many instances, it is common practice to mount two outboard motors on the transom of a single boat for the purpose of providing sufficient power to move the boat at desired speeds. However, it is known to those familiar with high speed outboard motor boating, that the underwater housing portion of an outboard motor is a source of considerable drag against forward movement of a boat at high speeds, and that this drag increases generally as the square of the speed of said movement. Obviously, when two outboard motors are used to propel a boat, the drag produced by the two underwater housing portions is considerably greater than that produced by a single such housing portion. The primary object of my invention is, therefore, the provision of novel means whereby a boat may utilize the advantage of a plurality of outboard motors without encountering the additional resistance to forward movement provided by a plurality of underwater propeller shaft housings. To this end, I provide novel housing means having a single underwater portion and novel means whereby a plurality of power heads or engines above the water line may be operatively coupled to a single propeller shaft in said underwater portion.

Another important object of my invention is the provision of housing means including an underwater propeller shaft housing portion and means above the water line for operatively coupling the drive shaft of a plurality of independent engines to each other and to a single propeller shaft journalled in said underwater housing portion.

Still another object of my invention is the provision of housing means as set forth having means at its upper end for mounting a plurality of independent drive shaft equipped engines, whereby any one of said engines may be easily removed and replaced without affecting the normal operation of any other engine mounted at said upper end of the housing means, and its connection to the propeller shaft.

Another object of my invention is the provision of an outboard motor as set forth having novel gearing between the drive shafts of a plurality of engines, and secondary drive shaft means extending downwardly from said gearing to the underwater portion of the housing and coupled to a single propeller shaft.

The above and still further highly important objects and advantages of my invention will become apparent from the following detailed specification, appended claims, and attached drawings.

Referring to the drawings, which illustrate the invention, and in which like reference characters indicate like parts throughout the several views:

FIG. 1 is a view in rear elevation of an outboard motor made in accordance with my invention, some parts being broken away and some parts shown in section;

FIG. 2 is a view in side elevation of the motor of FIG. 1, some parts being broken away;

FIG. 3 is a horizontal section taken substantially on the line 3—3 of FIG. 2;

FIG. 4 is a view in rear elevation showing a modified arrangement, with the motor being illustrated as mounted on the transom of a boat;

FIG. 5 is a fragmentary view in plan of the rear end

portion of a boat showing a further modified arrangement of my novel outboard motor construction;

FIG. 6 is a view corresponding to FIG. 2 but showing a still further modification, some parts being broken away and some parts being shown in section; and

FIG. 7 is a horizontal section taken substantially on the line 7—7 of FIG. 6.

In the embodiment of the invention illustrated in FIGS. 1–3, an outboard motor is shown as comprising power head means in the nature of a pair of conventional internal combustion engines 1 mounted in side by side relationship on the upper end of housing means, indicated generally at 2. The engines 1 are of the conventional type generally used in outboard motor construction and include downwardly directed primary drive shafts 3. The housing means 2 comprises, an upper housing section 4, an intermediate housing section 5, and a lower or underwater housing section 6. The upper housing section 4 defines the side walls of a chamber 7, and at its upper and lower ends is formed to provide upper and lower flanges 8 and 9 respectively, the upper flange 8 forming the extension of a top wall 10 for mounting the engine 1, the top wall 10 having apertures 11, one of which is shown, through which the drive shafts 3 of the engines 1 extend into the chamber 7. As shown, the engines 1 are secured to the top wall 10 by means of screws or bolts 12. Inasmuch as the working parts of the engines 1 are conventional in nature, further detailed showing and description thereof is not believed necessary. Hence, for the sake of brevity, such further detailed showing and description is omitted.

The intermediate housing section 5 is formed at its upper end to provide a generally horizontal wall or flange 13 which defines the bottom wall of the chamber 7 and which is rigidly secured to the lower flange 9 of the upper housing section 4 by means of nut equipped screws or the like 14. A generally vertically extended secondary drive shaft 15 is journalled in suitable bearings in the intermediate housing section 5 and extends downwardly into the lower housing section 6, the upper end portion of the shaft 15 terminating within the chamber 7. Preferably, the wall or flange 13 is provided with a boss 16 which is adapted to mount one of the bearings, not shown, for the secondary drive shaft 15. The intermediate housing section 5, together with the other portions of the motor, is adapted to be supported on the transom of a boat by bracket means 17 including a pivot bearing element 18 and a clamp 19 which is connected to the pivot bearing element 18 by a horizontally disposed pivot pin 20 for relative swinging movements on a horizontal axis. The pivot bearing element 18 is suitably mounted on the intermediate housing section 5, preferably concentric with the secondary drive shaft 15, to provide for pivotal steering movements of the motor on a generally vertical axis. The clamp 19 is provided with one or more clamping screws 21 by means of which the clamp 19 is releasably secured to the boat transom, not shown. The clamp 19 is further provided with an adjustable stop bolt or the like 22 for limiting swinging movement of the motor and pivot bearing element 18 in one direction about the axis of the horizontal pin 20, in the usual manner.

The lower, or underwater housing section 6 is rigidly secured to the lower end of the intermediate housing section 5 by means of bolts or screws 23, and is formed to provide a generally horizontally disposed anti-cavitation plate 24, which is preferably located at, or just below, the normal working water line of a boat to which the motor is attached. With reference to FIG. 1, it will be noted that the underwater section 6, below the anti-cavitation plate 24, is of considerably less transverse width than

the intermediate housing section 5. In practice, this portion of the lower housing section 6 is only sufficiently wide to enclose the lower end portion of the secondary drive shaft 15 and the lower end bearings therefor, not shown, together with parts hereinafter described. With reference to FIG. 2, it will be noted that the lower housing section 6 is elongated in the direction of travel of the motor, and journals a generally horizontally disposed propeller shaft 25. Further, the lower housing section 6 is formed in two parts, an upper portion 26 with which the anti-cavitation plate 24 is integrally formed, and a lower portion 27, which portion 27 provides a support for the front end of the propeller shaft 25, and which defines a stabilizing fin or skeg 28.

The propeller shaft 25 is journalled in the lower housing section 6 by suitable bearings, not shown, and projects rearwardly of the housing portion 26 and skeg 28 to mount a propeller 29 in the usual manner, the propeller 29 being held in place by the usual rearwardly tapered locking nut 30. A bevel gear 31 is rigidly mounted on the lower end of the secondary drive shaft 15 within the lower housing section 6, and has meshing engagement with a cooperating bevel gear 32 that is keyed or otherwise rigidly mounted on the propeller shaft 25, see FIG. 2.

Power transmission mechanism for imparting rotation to the secondary drive shaft 15 to rotate the propeller 29 comprises a pair of drive gears 33 one each rigidly but releasably mounted on the lower end portion of a different one of the primary drive shafts 3, and a driven gear 34 that is rigidly but releasably mounted on the upper end of the secondary drive shaft 15, within the gear chamber 7. Preferably, the gears 33 and 34 are keyed or splined on their respective shafts 3 and 15, and held against axial movement thereon by respective lock nuts 35 and 36. With reference particularly to FIGS. 1 and 3, it will be seen that the gear 34 has meshing engagement with both of the gears 33, so that both engines 1 cooperate to drive the secondary drive shaft 15, propeller shaft 25 and propeller 29.

The upper housing section 4 is formed to provide a pair of exhaust passages 37 that are adapted to receive the gases of combustion from the overlying engines 1 and direct said gases of combustion to a single exhaust passage 38 in the intermediate housing section 5. The lower end of the exhaust passage 38 is in register with the upper end of a passage 39 in the lower housing section 6, said passage 39 terminating at its lower end just below the rear end of the anti-cavitation plate 24, see FIG. 2.

It will be noted that the drive gears 33 are of somewhat smaller diameter than the driven gear 34, so that the secondary drive shaft 15 rotates at a somewhat slower speed than that of the engine drive shafts 3. In the usual outboard motor construction, such speed reduction is obtained in the gearing within the underwater housing section. By using speed reduction gearing within the gear chamber 7 above the water line of the motor, I am enabled to use a gear ratio of substantially one to one in the propeller shaft housing whereby to maintain the transverse dimension of the under water housing 6 at a minimum, and materially reduce the amount of drag usually associated with the underwater portion of an outboard motor. It will further be appreciated that the upper housing section 4 may be of a size to permit the use of various gear ratios between the gears 33 and 34 so that, if desired, the secondary drive shaft 15 and parts driven thereby may be rotated at slower or faster speeds relative to the speeds of the drive shafts 3. Further, with the above construction, either of the engines 1 may be removed independently of the other thereof for service or repair without rendering the entire motor inoperative; and, by removing the upper housing section 4 from the intermediate housing section 5, the gears 33 and 34 may be easily changed to provide changes in gear ratio, if desired.

In the modified arrangement illustrated in FIG. 4, power head means in the nature of a pair of engines 1' are shown as being mounted in face to face relationship on an upper housing section 40, which in turn is removably mounted on the upper end of an intermediate housing section 41, to the lower end of which is secured a lower, or underwater, housing section 6' identical to the housing section 6 of FIGS. 1 and 2. In this arrangement, the usual controls for the engines 1' are joined within a casing 42 between the adjacent front ends of the engines 1', the engines being controlled by suitable control knobs or the like 43 mounted on the top of the casing 42. The intermediate section 41 is provided with bracket means 17' substantially identical to the bracket means 17, by means of which the motor of FIG. 4 is mounted on the transom 44 of a boat, indicated generally at 45.

In the arrangement shown in FIG. 5, the power heads or engines 1', identical to those of FIG. 4, are disposed relative to each other in the same manner as those of FIG. 4. However, the engines of FIG. 5 are normally positioned at right angles with respect to those of FIG. 4, the upper housing section 46 thereunder, shown in dotted lines, being elongated in the direction of movement of the boat 45 and not transversely thereof, as shown in FIG. 4. Although the arrangement shown in FIG. 5 causes the motor to project rearwardly from the transom 44 further than does that illustrated in FIG. 4, the engine arrangement of FIG. 5 does offer less air resistance than that of FIG. 4 when traveling at higher speeds. In both FIGS. 4 and 5, tiller ropes for steering the motors thereof are indicated at 47. It may be assumed that these tiller ropes are connected to a conventional steering wheel or the like, not shown. It may further be assumed that the upper housing sections 40 and 46 enclose gearing similar to that shown in FIGS. 1–3 for the purpose of driving the propellers thereof from the engines 1' in the manner described with respect to FIGS. 1–3.

In the modified form of the invention illustrated in FIGS. 6 and 7, a pair of power heads or engines 48 are mounted in side by side relation on the upper end of an upper housing section 49. The engines 48 are identical to the engines 1 and are mounted to the upper housing section 49 in the same manner as are the engines 1 on their respective housing sections 4. An intermediate housing section 50 is rigidly but detachably secured at its upper end to the lower end of the housing section 49 similar to the arrangement illustrated in FIGS. 1 and 2, and is provided with bracket means 51 identical to the bracket means 17 of FIGS. 1 and 2. A lower, or underwater, housing section 52 is bolted or otherwise rigidly secured to the lower end of the intermediate housing section 50 and journals a generally horizontally disposed propeller shaft 53 below the anti-cavitation plate 54, similar to that shown in FIGS. 1 and 2. The engines 48 are provided with primary drive shafts 55 which project downwardly into the chamber 56 defined by the upper housing section 49, the primary drive shafts 55 having primary drive gears 57 splined or otherwise rigidly mounted thereon and held against axial movement by lock nuts or the like 58. A counter shaft 59 is suitably mounted in the upper housing section 49 within the chamber 56 and intermediate the primary drive shafts 55, said counter shaft 59 carrying a pair of connected counter shaft gears 60 and 61. The counter shaft gear 60 has meshing engagement with both of the primary drive gears 57, the counter shaft gear 61 having meshing engagement with a pair of spaced secondary drive gears 62 and 63 that are mounted fast on the upper end of secondary drive shafts 64 and 65 which extend generally vertically downwardly through the intermediate housing section 50 and into the lower housing section 52, and suitably journalled in said housing sections 50 and 52 by conventional bearings, not shown. The secondary drive shafts 64 and 65 are parallel and spaced apart longitudinally of the direction of movement of the motor; the lower ends of the secondary drive shafts 64 and 65 being provided with

bevel gears 66 and 67 respectively, said bevel gears having meshing engagement with cooperating bevel gears 68 and 69 respectively, said last mentioned bevel gears being rigidly mounted in axially spaced relationship on the propeller shaft 53. The bevel gears 66—69 are indicated in dotted line in FIG. 6.

By using a pair of spaced secondary drive shafts 64 and 65, in the manner shown in FIGS. 6 and 7, I am enabled to apply the full power of both engines 48 to the propeller shaft 53 with the use of smaller bevel gears 66—69 than has been heretofore practicable. Like the gearing of the motor of FIGS. 1–3, the gears 57 and 60 may be varied in relative size to provide for different speed ratios between the primary drive shafts 55 and the propeller shaft 53, as operating conditions require.

It will be appreciated that various other types of gearing may be utilized to drive a single propeller shaft from a plurality of engines, in addition to the arrangement shown. For instance, independent clutches may be utilized in the gearing to selectively disconnect the power heads from driving engagement with the propeller shaft so that the propeller shaft may be driven by a single engine, if desired; and other modifications may be made without departure from the spirit and scope of the invention, as defined in the claims.

What I claim is:

1. In an outboard motor, power head means comprising a plurality of independent engines each having a vertically disposed downwardly extending drive shaft, housing means underlying said power head means and projecting downwardly therefrom, said engines being removably mounted on said housing means, said housing means defining a chamber at its upper end for reception of the lower ends of said drive shafts, bracket means for mounting said housing means to the transom of a boat for steering movements on a generally vertical axis, a single generally horizontally disposed propeller shaft journalled in the lower end portion of said housing means, a propeller on said propeller shaft, and power transmission mechanism within said housing means and including gearing in said chamber coupling said drive shafts together and to said propeller shaft.

2. In an outboard motor, power head means comprising a plurality of independent engines each having a downwardly projecting drive shaft, housing means underlying said power head means and extending downwardly therefrom, said housing means comprising upper, intermediate and lower housing sections, said engines being removably mounted on said upper housing section, bracket means operatively associated with said intermediate housing section for mounting said housing means to the transom of a boat for steering movements on a generally vertical axis, a single generally horizontally disposed propeller shaft journalled in said lower housing section, a propeller on said propeller shaft, said upper housing section defining the side walls of a chamber for reception of the lower ends of said drive shafts, and power transmission mechanism within said housing means and including gearing within said chamber coupling said drive shafts together and to said propeller shaft.

3. In an outboard motor, power head means comprising a pair of independent engines disposed in side by side relationship, each of said engines having a downwardly projecting primary drive shaft, housing means underlying and supporting said engines and extending downwardly therefrom, said housing means comprising upper, intermediate and lower housing sections, said engines being independently removably mounted on said upper housing section, bracket means for mounting said housing means to the transom of a boat for steering movements on a generally vertical axis, a single propeller shaft journalled in said lower housing section below the working water line of said motor on a generally horizontal axis, a propeller secured to one end of said propeller shaft, said upper housing section defining a gear chamber receiving the primary drive shafts of said engine, a secondary drive shaft extending longitudinally through said intermediate housing section and terminating at its upper end in said chamber and at its lower end in said lower housing section, gearing in said chamber connecting both of said primary shafts to said secondary shaft, and gears in said lower housing section connecting the lower end of said secondary shaft to said propeller shaft.

4. In an outboard motor, power head means comprising a pair of independent engines disposed in side by side relationship, each of said engines having a downwardly projecting primary drive shaft, housing means underlying and supporting said engines and extending downwardly therefrom, said housing means comprising upper, intermediate and lower housing sections, said engines being independently removably mounted on said upper housing section, bracket means for mounting said housing means to the transom of a boat for steering movements on a generally vertical axis, a single propeller shaft journalled in said lower housing section below the working water line of said motor on a generally horizontal axis, a propeller secured to one end of said propeller shaft, said upper housing section defining a gear chamber receiving the primary drive shafts of said engine, a pair of generally vertically disposed parallel secondary drive shafts mounted in said intermediate housing and spaced apart in a direction longitudinally of the direction of travel of said motor, the upper ends of said secondary drive shafts terminating within said chamber, gearing in said chamber operatively coupling said primary shafts together and to said secondary shafts, and gearing in said lower housing section operatively coupling the lower ends of said secondary shafts to said propeller shaft.

5. The structure defined in claim 4 in which said gearing comprises, a pair of primary drive gears one on each of said primary drive shafts, a pair of secondary gears one on the upper end of each of said secondary drive shafts, a counter shaft mounted in said housing means, and a pair of interconnected countershaft gears on said countershaft, one of said countershaft gears having meshing engagement with both of said primary drive gears and the other of said countershaft gears having meshing engagement with both of said secondary gears.

6. In an outboard motor, power head means comprising a plurality of independent engine means each having a generally vertically disposed drive shaft extending downwardly therefrom, a housing means supporting said engine means, said housing means underlying said engine means and projecting downwardly therefrom, said housing means providing a chamber above the water line for the reception of the lower ends of said drive shafts, bracket means for mounting said housing means to the transom of a boat for steering movements on a generally vertical axis, a single generally horizontally disposed propeller shaft journalled in the lower end portion of said housing means, a propeller on said propeller shaft, and power transmission mechanism within said housing means and including gearing in said chamber and coupling the drive shafts of said engine means to said propeller shaft.

7. The structure of claim 6 further characterized in that said engine means are positioned in face to face relation.

8. The structure of claim 6 further characterized in that said engine means are positioned in side-by-side relation.

9. The structure of claim 6 further characterized by each of said engine means being provided with a spur gear, and said power transmission mechanism within said housing comprising a spur gear positioned intermediate the spur gears for said engine means.

10. The structure of claim 6 further characterized by a pair of primary drive gears, one on each of said drive shafts and a pair of secondary gears, one on the upper end of each of a pair of secondary drive shafts, a countershaft mounted in said chamber and a pair of interconnected countershaft gears on said countershaft, one of

said countershaft gears having meshing engagement with both of said primary drive gears and the other of said countershaft gears having meshing engagement with both of said secondary gears.

11. In an outboard motor, power head means comprising a pair of independent engine means, each having a generally vertically disposed drive shaft extending downwardly therefrom, a housing means underlying and supporting said engine means and extending downwardly therefrom, said housing means providing a chamber above the water line for the reception of the lower ends of said drive shafts, bracket means for mounting said housing means to the transom of a boat for steering movements on a generally vertical axis, a single propeller shaft journalled in said housing means below the working water line of said motor on a generally horizontal axis, a propeller secured to one end of said propeller shaft, said housing means defining a gear chamber receiving the drive shafts of said engine means, a pair of generally vertically disposed parallel secondary drive shafts spaced apart in a direction longitudinally of the direction of travel of said motor, the upper ends of said secondary drive shafts terminating within said chamber, gearing in said chamber operatively coupling said drive shafts together and to said secondary shafts, and means operatively coupling the lower ends of said secondary shafts to said propeller shaft.

12. In an outboard motor, power head means comprising a plurality of independent engines each having a vertically disposed downwardly extending drive shaft, housing means underlying said power head means and projecting downwardly therefrom, said housing means defining a chamber at its upper end for reception of the lower ends of said drive shafts, bracket means for mounting said housing means to the transom of a boat for steering movements on a generally vertical axis, a single generally horizontally disposed propeller shaft journalled in the lower end portion of said housing means, a propeller on said propeller shaft, and power transmission mechanism within said housing means coupling the drive shaft to each of said motors to said propeller shaft.

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