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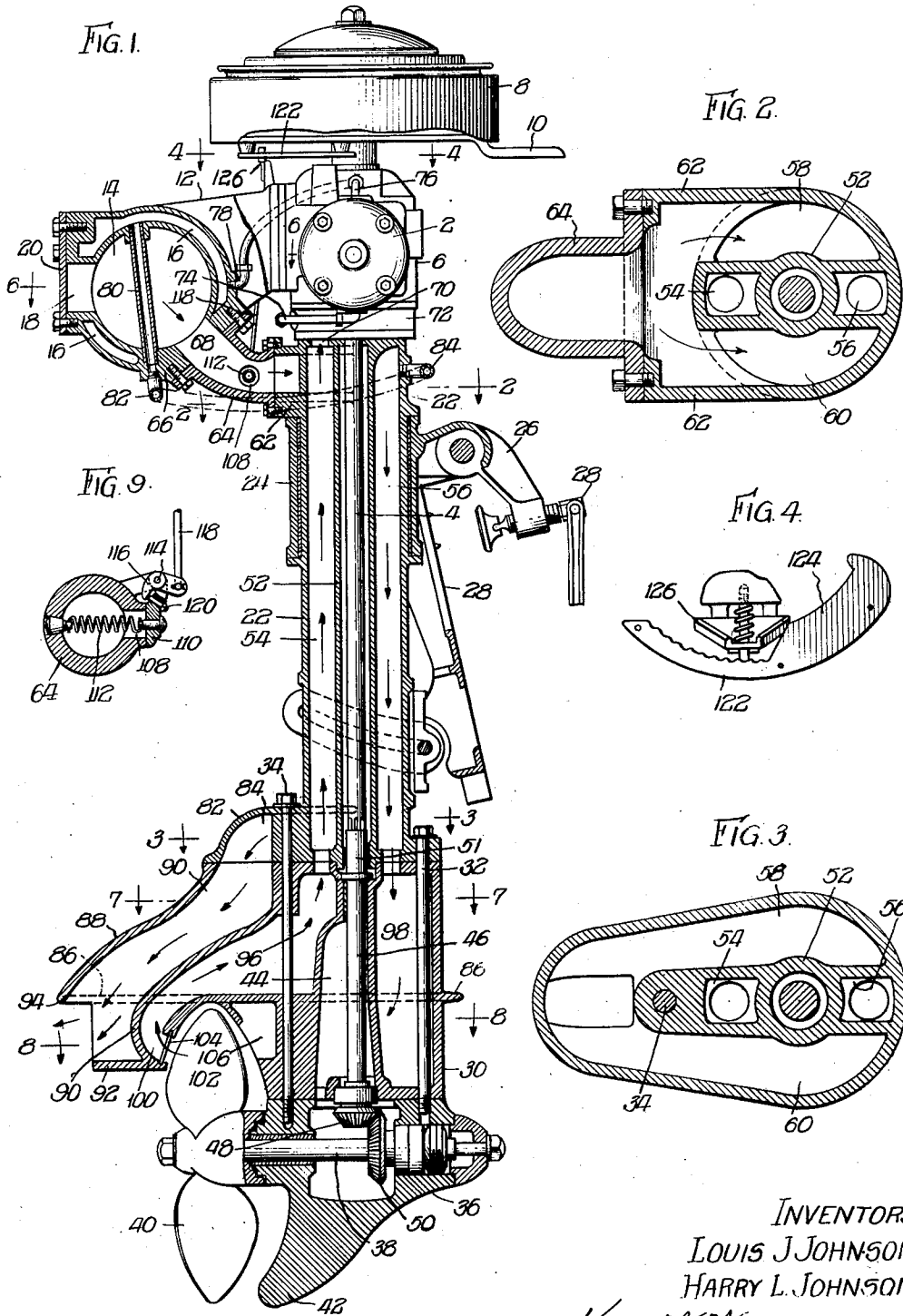
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1,824,739

OUTBOARD MOTOR ASSEMBLY

Filed June 27, 1929

2 Sheets-Sheet 1



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FIG. 5.

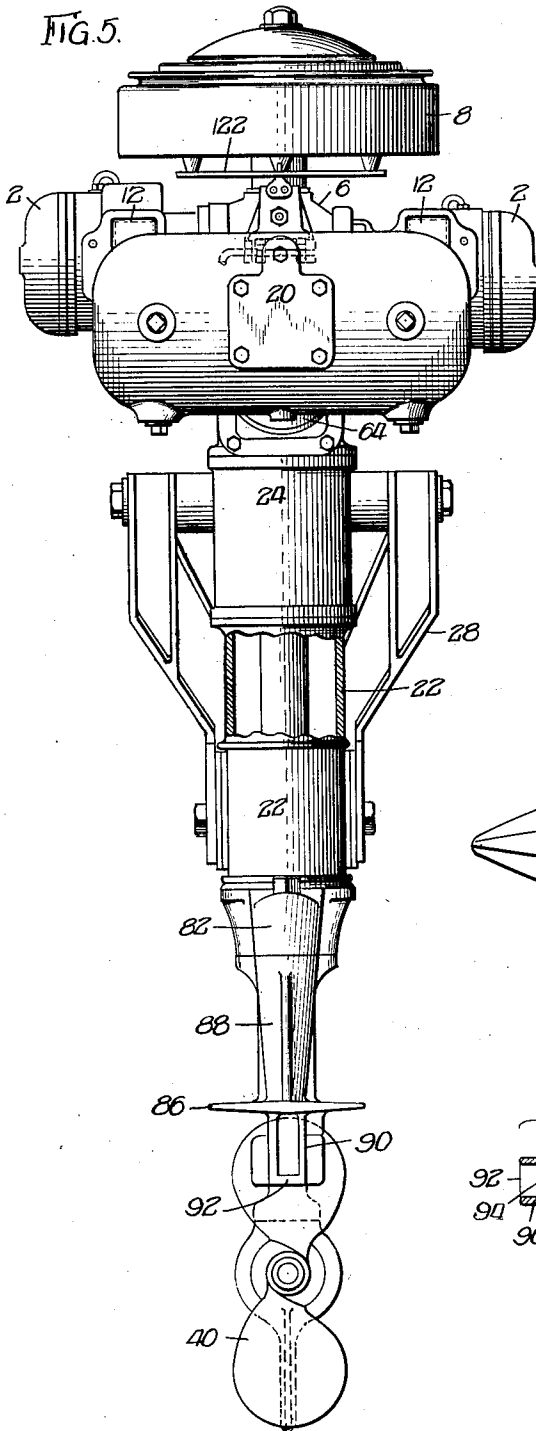


FIG. 6.

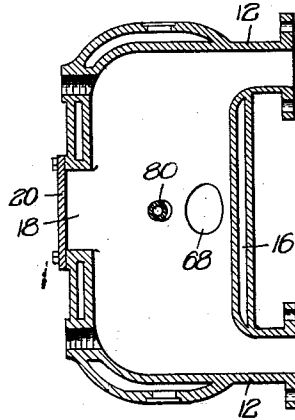


FIG. 7.

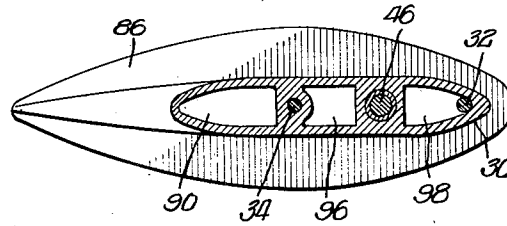
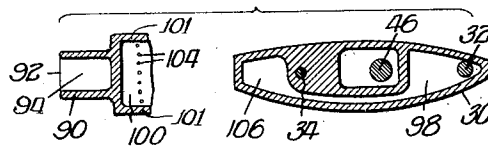


FIG. 8.



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OUTBOARD MOTOR ASSEMBLY

Application filed June 27, 1929. Serial No. 374,110.

Our invention relates to propulsion devices for water vehicles and more particularly to a type of device commonly known as an outboard motor, which is a self-contained unit including the complete gasoline driven power plant and propeller, adapted for bodily attachment to a water vehicle. While for purposes of exemplification, the invention is illustrated as applied to an outboard motor type of device as shown in our co-pending applications Serial No. 335,447 and 337,244, and in Louis J. Johnson application Serial No. 380,730, it is to be understood that it is also applicable to similar constructions of the inboard motor type.

In the present outboard motor art, the propulsion of the water vehicle at high speeds is very desirable. The object of our present invention is to provide an outboard or inboard motor type of device which will produce relatively high rates of propulsion of the water vehicle through the water and which will eliminate the objectionable noises and odors incident to the discharge of the cylinder exhaust gases while not interfering with the facile starting of the motor and its running at comparatively low speeds while at the same time not interfering with the proper turning of the lower unit of the device for steering and/or for reversing.

Other objects of our invention are to provide a simple, unitary construction of outboard or inboard type of motor which utilizes the tubular housing surrounding the vertically depending drive shaft running to the propeller as a means for conducting the cylinder exhaust gases downwardly and discharging them below normal water level whereby to eliminate noise and smell and also for utilizing this tubular casing as a means for conducting cooling water from the body of water in which the propeller carrying casing is immersed, upwardly to the water jacket of the engine and thence downwardly again through

the tubular housing, discharging the same below normal water level and in a manner such that this cooling water assists in cooling the hot exhaust gases which are likewise conducted through this tubular casing.

Still another object of our invention resides in providing a construction wherein there is provided a relatively large expansion chamber into which the exhaust gases from the cylinder are discharged, which expansion chamber also acts as a muffler and in discharging the exhaust gases from this expansion chamber into the tubular casing surrounding the usual vertically depending drive shaft so that the exhaust gases are discharged downwardly therethrough and through suitable passageways formed integrally in the lower casing and preferably in the anti-cavitation plate so as to discharge these exhaust gases underwater. A further object of this aspect of our invention resides in providing the expansion chamber or muffler with a water jacket and in providing means for conducting cooling water upwardly through the hollow casing into the water jacket of the engine cylinder, thence into the water jacket for the expansion chamber and thence downwardly through the hollow casing to a point of discharge located below normal water level whereby during the propulsion of the device, water will not only cool the engine cylinders, the expansion chamber or muffler, but will also serve to cool the exhaust gases discharging downwardly through the hollow casing and will serve to prevent over-heating of the vertically depending drive shaft and the tubular casing.

Another object of our invention resides in the construction and arrangement of an underwater exhaust for the engine cylinders as an integral part of the anti-cavitation plate, preferably formed integral with the propeller carrying casing, and for constructing the same with integral passages connecting with the tubular casing surrounding the

vertically depending drive shaft, and which in turn connects with the expansion chamber or muffler leading to the engine cylinder exhaust whereby the hot gases are discharged at the rear of the propeller and without interfering with the proper propulsion of the device or its turning for steering or reversing.

Still another object of our invention resides in the provision of this type of device wherein the lower propeller carrying unit is of entire stream-like construction and wherein the anti-cavitation plate overlying the propeller is provided on its upper portion with an internal passage connecting with the tubular casing surrounding the engine drive shaft and in turn connected with the cylinder exhaust gases so as to permit the proper turning movement of the stream-line structure for steering and/or reversing, while permitting the underwater discharge of the exhaust gases.

In general, the objects of our invention are to maintain the substantially completed stream-line formation of this lower propeller carrying unit which is submerged in the water while permitting the bodily turning of this structure for steering and/or reversing, while at the same time utilizing this structure and particularly the anti-cavitation portion thereof and the tubular housing connected to the upper portion of this structure as a means for conducting the cylinder exhaust gases to a point below normal water level, thereby permitting high speeds and eliminating concomitant noises and objectionable exhaust gas odors.

These and other objects of our invention will be apparent from a perusal of the following specification when taken in connection with the accompanying drawings, wherein:

Figure 1 is a sectional side view of one form of our new invention;

Figure 2 is a section on line 2—2 thereof;

Figure 3 is a section on line 3—3 of Figure 1;

Figure 4 is an enlarged view of a portion of the mechanism for controlling the opening and closing of the underwater exhaust relief;

Figure 5 is a perspective rear view of the structure shown in Figure 1 at right angles thereto with certain portions broken away to show the underwater exhaust relief;

Figure 6 is a section on line 6—6 of Figure 1;

Figure 7 is a section on line 7—7 of Figure 1;

Figure 8 is a section on line 8—8 of Figure 1; and

Figure 9 is a sectional detail of the release valve.

Referring now to the drawings in detail, as before explained, our invention is exemplified in connection with an outboard motor construction which includes as a type of

power plant or prime mover, the double opposed two-cycle internal combustion engine 2 having the usual vertically depending drive shaft 4 connected thereto and including a crank casing 6 upon the upper end of which is mounted an extension of the engine drive shaft so as to include the usual fly-wheel magneto 8, starter and other construction commonly present in outboard motor construction, including also the usual advance and retarding handle 10 of the magneto.

In the present construction, instead of providing the engine cylinders 2 with the usual type of muffler, we form the crank casing 6 of the cylinders with a lateral extension 12 which as shown in Figure 1, forms a relatively large expansion chamber 14. This expansion chamber also acts as a muffler. This extension 12 is provided with internal passages surrounding the expansion chamber 14 which passages 16 provide a water jacket for this muffler or expansion chamber. We prefer to form this extension 12 with an opening 18, normally closed by a plate 20, but other constructions may be used if desired.

The lower portion of the crank casing 6 is provided with a depending tubular housing 22 suitably attached to the casing 6 so as to form a gas-tight and water-tight joint thereto. This tubular casing 22 concentrically surrounds the vertically depending power drive shaft 4 throughout its length. This tubular casing 22 is mounted for rotary movement in the usual stationary collar or bearing 24, which, in turn, is carried by the usual bracket 26 having means 28 by which the same may be attached to the usual outboard motor as is well known in the art, it being understood that the tubular housing 22 is rotatable within this sleeve 24 about the depending drive shaft 4 as an axis. The lower end of the tubular housing 22 is rigidly and detachably connected to the propeller carrying housing or lower unit. It will be understood that this lower unit is the portion that is normally submerged in the body of water in which the water vehicle or craft rests so that the propeller carried by this lower unit will propel the boat through the water.

In order to carry out the objects of our invention, we have formed the lower unit or propeller carrying casing of entire stream-line contour. While this casing may be integrally made, we prefer to form it of a main portion 30 which extends vertically upwardly so as to be rigidly bolted as at 32 and 34 with the lower portion of the tubular casing 22 and we provide the lower portion 36 of this unit which carries the usual propeller shaft 38 and propeller 40 and a skeg 42 as a separate casting, the same being rigidly secured by means of the bolts 32 and 34, if desired, to the portion 30 and tubular casing 22. The casting 30 is provided with a central bore

44 through which passes an extension shaft 46 of the propeller drive shaft 4. This shaft 46 has on its lower end a bevel gear 48 meshing with another bevel gear 50 on the usual propeller drive shaft 38. The junction of the extension shaft 46 and the drive shaft 4 is effected by means of suitable coupling 51.

Referring to the tubular housing 22, it will be seen that the same includes a tubular wall 52 which concentrically surrounds the drive shaft 4 and two vertically extending passageways 54 and 56 formed by integrally cast walls, if desired. The passage 54 is adapted to conduct cooling water upwardly while the passage 56 is adapted to convey the cooling water coming from the cylinder jacket and muffler downwardly. In addition, the tubular housing 22 provides relatively large vertically extending passageways 58 and 60, which almost entirely surround the passageways 52, 54 and 56. These passageways 58 and 60 are for the conduction of the cylinder exhaust gases downwardly through the tubular casing 22.

At its upper portion, this tubular casing 22 is provided with a preferably integral lateral extension 62 shown in cross-section in Figure 2, which extension detachably connects with a tubular neck 64, which in turn connects with a flange 66 surrounding an opening 68 in the expansion chamber or muffler 14 so that cylinder exhaust gases will be discharged through this expansion chamber through the neck 64 into the hollow tubular casing 22. The upper portion of the tubular passage 54 registers with a passageway 70 in the lower portion of the crank casing and this passage 70 is formed as a substantially hollow collar 72 which has an outlet connecting to a pipe 74 which in turn connects with the lower portion of the water jacket of each cylinder. There are two or more of these pipes 74 each connecting to the lower portion of the jacket of each cylinder.

In addition, the upper portion of each cylinder jacket connects with a pipe 76 which in turn empties into a neck 78 connecting with jacket 16. The upper portion of this jacket, as shown in Figure 1, is provided with a connection with a cross pipe 80 which passes substantially diametrically through the expansion chamber 14 and connects with a pipe 82 which passes around a tubular housing as at 84 and connects with internal passage 56 of the tubular housing so that the heated water after passing through the engine cylinder jacket and the expansion jackets 16, will be conducted outwardly and downwardly through this passage 56.

The lower portion of the tubular housing or casing 22 is provided with a lateral and integrally projecting portion 82 which forms an internal passage 84 communicating with the exhaust passages 58 and 60. In like manner, the lower housing section 30 is provided

with an integrally cast anti-cavitation plate 86. The upper portion of this section 30 is formed integral with the anti-cavitation plate 86 as shown clearly in Figures 1, 3 and 5, the portion 88 of this section directly above the anti-cavitation plate being extended laterally or viewing Figure 1, rearwardly, and merging in stream-line contour into this anti-cavitation plate. This portion 88 is substantially narrow and is more or less tubular to provide an internal passageway 90 which connects with the internal passageway 84 of the portion 82 on the hollow tubular housing so as to receive the flow of the exhaust gases. This extension 88 depends below the plane of the anti-cavitation plate 86 at which point it is formed as a rearwardly extending nozzle 90 of substantially narrow dimensions being preferably of the shape shown in Figure 5, for discharging the exhaust gases underwater. The bottom portion of this nozzle 90 is formed as a substantially horizontal plate or ledge 92 which assists in deflecting the exhaust gases outwardly and rearwardly. The anti-cavitation plate overhangs the nozzle 90 at the point 94.

It will be understood, of course, that the normal water line is well above the anti-cavitation plate, being substantially half-way between the uppermost part of the anti-cavitation plate 86 and the junction between the section 30 and the tubular housing 22 so that the exhaust nozzle 90 is submerged in water at all times during the propulsion of the boat. In addition, this section 30 of the lower housing is provided with an internal passage 96 and an additional internal passage 98. The former has an upper opening registering with the passage 54 in the tubular housing and the latter has an opening registering with the passage 86 in the tubular housing. The internal passage 96 terminates in a water gathering mouth 100 which lies substantially adjacent to and directly in the rear of the path of travel of the propeller blades 102 as they are revolved by the source of power. Suitable bars 104 are placed across the mouth of this water intake 100 to prevent the ingress of debris. In a similar manner the section 30 is provided with a water discharge nozzle 106 which communicates with the passageway flowing around on all sides of the passageway 44 through which the extension drive shaft 46 passes. This discharge passage 106 lies closely adjacent to and directly in front of the path of travel of the propeller blades 102. It will be seen by this construction that the lower casing section 30 closely arches over the path of travel of the propeller blades so that the water gathering mouth and water discharge mouth are placed substantially close to this zone of travel.

Means is provided directly in the tubular casing 22 for diverting the exhaust gases so that in starting or running at low speeds

these exhaust gases will not be discharged below normal water level, but will be discharged directly into the air, thereby preventing the creation of an exhaust back pressure in the cylinders. One embodiment of this means consists in providing the tubular neck 64 directly below the muffler 14 with an exhaust outlet 108 above and clear of the supporting bracket 26 and its sleeve 24 and permitting complete rotation of the motor for steering and for reversing the direction of movement of a boat to which it is attached. This outlet 108 is normally closed by a valve 110 and by means of a coil spring 112. The valve is pivoted at 114 and is operated by means of a lever 116 and a pivoted rod 118. In order to provide for a suitable adjustment, there is a screw 120 passing through the stem of the valve between it and its pivot 114, which screw is engaged by the short lever 116. The rod 118 is adapted to be operated by any type of speed control operable from the outboard motor. In the present instance, it is operated by means of the magneto advance and retarding lever 10 shown and claimed in our prior application, Serial No. 335,447; briefly stated, there is a sector 122 on the magneto plate provided with a raised cam surface 124 which operates upon a shiftable member 126 which controls the rod 118 so that when the magneto plate is shifted in one direction or the other, the rod 118 will be correspondingly operated to open or close the valve 110, the arrangement being that when the magneto is retarded for low speeds the valve will be opened to permit the direct discharge of the exhaust gases into the air, whereas when the magneto control is shifted for high speeds the valve will be closed and the exhaust gases will be discharged through the passages 90 and below the normal water level. It is obvious that instead of having a magneto control that this control may be operated independently or automatically from any other operated portion of the motor.

It will be apparent from the foregoing that in the operation of the motor, when the boat is being propelled by reason of the propeller 140, the pressure thereof will pump or force water into the water gathering mouth 100, thence upwardly through passage 96 then through passage 54, thence through opening 70, thence through water pipe 74 into the water jacket of the engine, thence from the top of the water jacket through pipe 76 into the water jacket of the expansion chamber or manifold from which the heated water flows to the water where it is drawn directly therefrom downwardly through pipe 80 which pipe passes through the manifold and thence outwardly through pipe 82 across to passage 56, thence downwardly through passage-way 98 to the water discharge mouth 106 at which point the rotation of the blades will serve to assist the circulation by sucking the

same from the mouth 106. It will also be appreciated that during the forward travel of the boat, the rush of the water will also serve to force water into the mouth 100 and will also serve to suck water from the mouth 106. At the same time, the exhaust gases from the cylinder will fill the expansion chamber and muffler and will then flow through opening 68 into the tubular housing where the exhaust gases will pass downwardly through the wide passages 58 and 60 to the bottom of the housing where they will pass into the rearwardly extending hollow portion 82 and pass through the conduit 84 thereof downwardly and will discharge rearwardly beneath the anti-cavitation plate 86 and to the rear of the propeller 40. At this point due to the propulsion of the lower casing forwardly and due to the movement of water from the propeller, suction will be created in the mouth 94 so as to assist in the ejection of these exhaust gases. These gases will discharge rearwardly well within the stream-line of the underwater housing and will assist in preventing the possibility of air being drawn downwardly into the race of the propeller. This is especially so since the force of expulsion of the gases creates a more or less solid discharge mass of gases and particularly so due to the presence of the plate 92. It will be noted that the exhaust mouth 90 is provided with laterally projecting wings 101 on each side thereof which serve to deflect the water into the water gathering mouth 100 and separate this zone from the exhaust gas zone. During the downward discharge of the exhaust gases through this underwater exhaust, it will be noted that the exhaust gases are constantly being cooled by the upwardly and downwardly flowing column of cooling water on their way to and from the water jacket of the engine and the water jacket of the expansion chamber.

It is to be particularly borne in mind that our construction is especially and peculiarly adapted for our construction of outboard motor wherein the lower unit is turnable about the drive shaft as an axis for steering purposes and in addition it is also highly desirable and peculiarly adaptable in construction wherein this lower unit is not only partially turnable for steering but is completely rotatable for steering and for reversing. This is due to the fact that this entire lower unit is stream-line so as to cut down to the minimum the frictional resistance as it passes through the water. At the same time, the cooling water is withdrawn from the body of water in which the housing is immersed and taken up to the water jacket and is also brought downwardly again and discharged into the stream-line construction. Furthermore, it will be noticed that by reason of our manner of discharging the exhaust from the cylinders beneath the water and well within

the stream-line contour of this lower structure and beneath the anti-cavitation plate, we have cut down frictional resistance to the minimum. This is brought about by the utilization of the round tubular housing 22 which encloses the drive shaft 4 and which tubular housing is adapted to turn in shifting the lower unit for steering, and for reversing where the device is completely turn-
 10 able. Thus, we utilize this round tubular casing not only as a means for conducting the cylinder exhausts from the engine cylinders to a point below normal water level, but we also utilize it as a means for likewise
 15 conducting the cooling water and the arrangement provides a means for utilizing this cooling water also for holding down the temperature of these hot exhaust gases so that they will not affect the drive shaft 4 and
 20 further, so that their cooling will slightly condense these exhaust gases and assist in expelling them from the expansion chamber.

It will also be apparent that our construction makes possible the provision of a relatively large expansion chamber and muffler whereby these exhaust gases coming from the cylinder may expand thereinto before discharging underwater, and in addition we have provided means for waterjacketing
 30 this expansion chamber and in coupling up the water circulating system so that the water first passes through the cylinder and then through the expansion chamber jacket where it is drawn from the hottest part of the jacket and conducted straight through the expansion
 35 chamber itself and discharged into the passage formed in the hollow housing, which in turn discharges below normal water level.

This application is a continuation in part
 40 of our copending application Serial Number 337,244, filed February 4, 1929.

We claim:

1. An outboard motor having a water jacketed gas engine with a vertically depending drive shaft and casing surrounding the shaft, the casing having separate passages for the cooling water and the engine exhaust connected at the upper end to the engine and terminating at the lower end below the normal
 45 water level, supporting means for hinging the casing about a horizontal axis and permitting rotation of the casing about a vertical axis for steering and reversing, and closable means in the exhaust passage above the supporting
 50 means for discharging the exhaust gases above the water level without interfering with the horizontal or vertical rotation of the casing therein.

2. A marine motor having a water jacketed
 60 gas engine, a propeller operated thereby, a water jacketed expansion chamber connected to the engine exhaust, water passage means connecting the jackets, means operated by the propeller causing water from the body of
 65 water in which the motor is operated to flow

through the engine jacket and through the expansion chamber jacket for cooling them.

3. An outboard motor having a water jacketed gas engine, a water jacketed muffler, a water pipe connecting the jacket of the engine with that of the muffler, a propeller operated by the engine, and means associated with the propeller for inducing a flow of cooling water through the water jackets in series.

4. An outboard motor having a water jacketed gas engine and a water jacketed expansion chamber for the engine exhaust, an engine driveshaft and a propeller with an enclosing case, the casing being provided with separate passage ways, one connected to the expansion chamber and two connected to the water jackets, the lower ends of the passages terminating below normal water level, and means for causing a circulation of cooling water up one of the water passages, through the jackets and down through the other water passage.

5. An outboard motor having a gas engine and a connected muffler with water jackets connected in series, an extended engine shaft and a propeller operated thereby, casing means enclosing the shaft and supporting the propeller having passages terminating below water level and connected at the upper end to the muffler and to the water jackets of the engine and the muffler, the lower ends of the passages terminating close to the propeller to force cooling water up one of the passages and through the water jackets and to withdraw water and exhaust gases from the other passages due to suction produced by water from the propeller.

6. An outboard motor in accordance with claim 5 in which the casing means enclosing the shaft is circular and unobstructed for a portion of its length, and a supporting bracket in which this portion of the casing means is mounted for free pivotal and rotative movement, whereby the motor may be rotated about a vertical axis for steering and for reversing movement when applied to a boat.

7. An outboard motor according to claim 5 in which the shaft enclosing portion of the casing means is free and unobstructed for a portion of its length, an exhaust relief valve in the exhaust passage below the muffler above the unobstructed portion of the casing and means to operate this valve from the engine, and a support engaging the unobstructed portion of the shaft mounting it for free turning about a vertical axis.

8. A device of the class described comprising an internal combustion engine provided with a water jacket, an expansion chamber connected to the cylinder discharge of the engine and likewise provided with a water jacket, water circulating passages formed in the hollow casing surrounding the drive shaft, a propeller carrying casing rigidly mounted on the lower end of

said drive shaft and having an internal passage registering with the water passages in the tubular housing, the passage in said lower casing discharging below normal water level, and means for causing water to flow from the body of water in which the housing is submerged upwardly to the water jacket of the engine, thence to the water jacket of the expansion chamber, thence downwardly through the hollow housing and discharging into the same body of water.

In witness whereof, we have hereunder subscribed our names.

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