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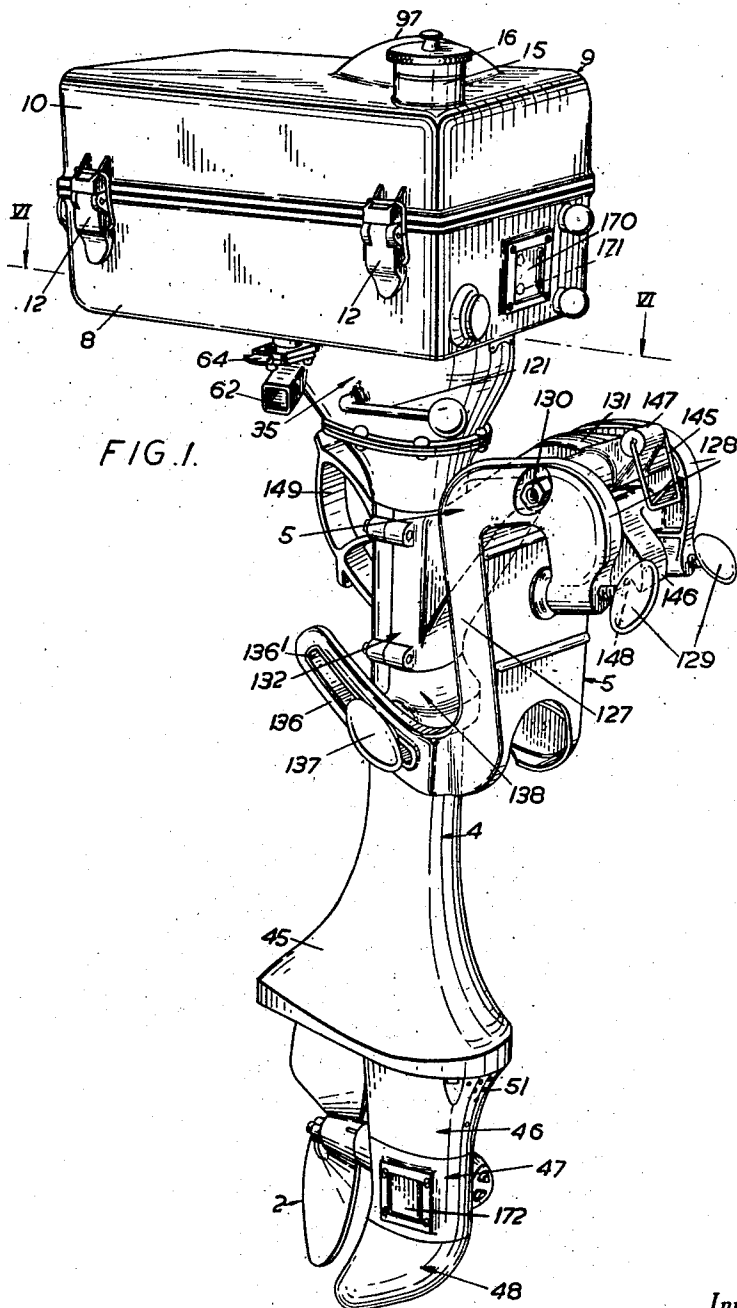
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2,676,559

OUTBOARD MOTOR FOR WATERCRAFT

Filed Dec. 11, 1951

8 Sheets-Sheet 1



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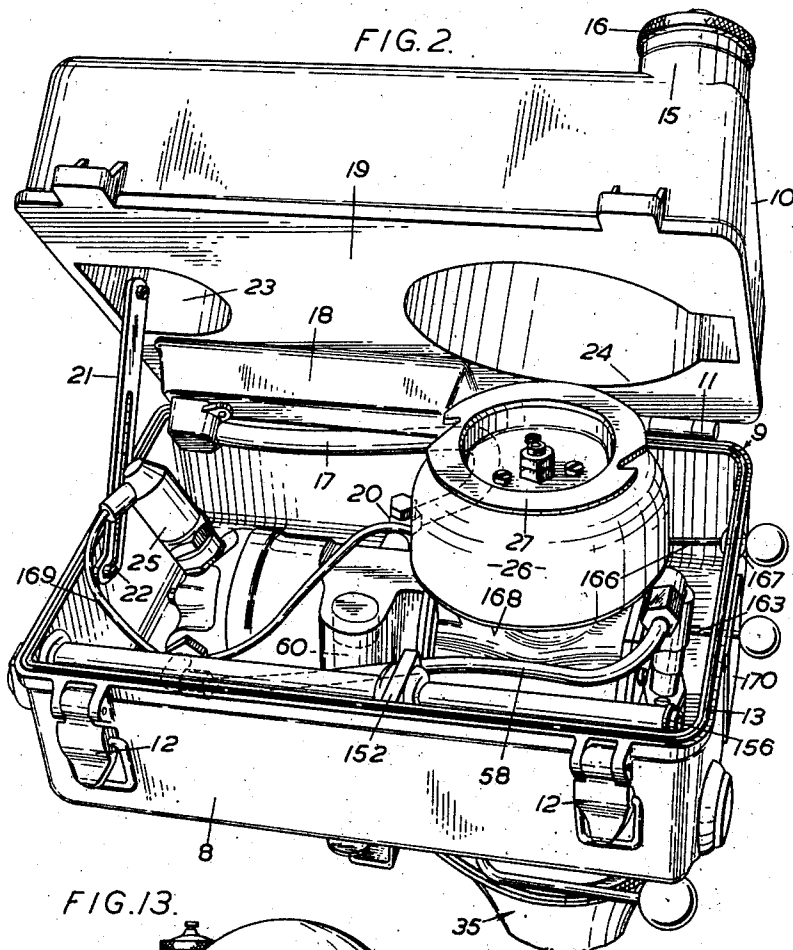
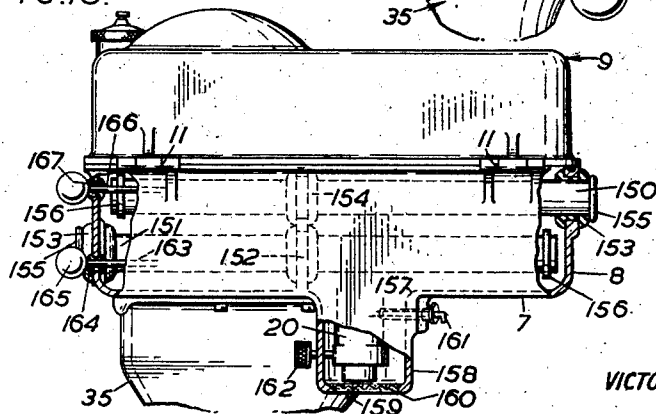


FIG. 13.



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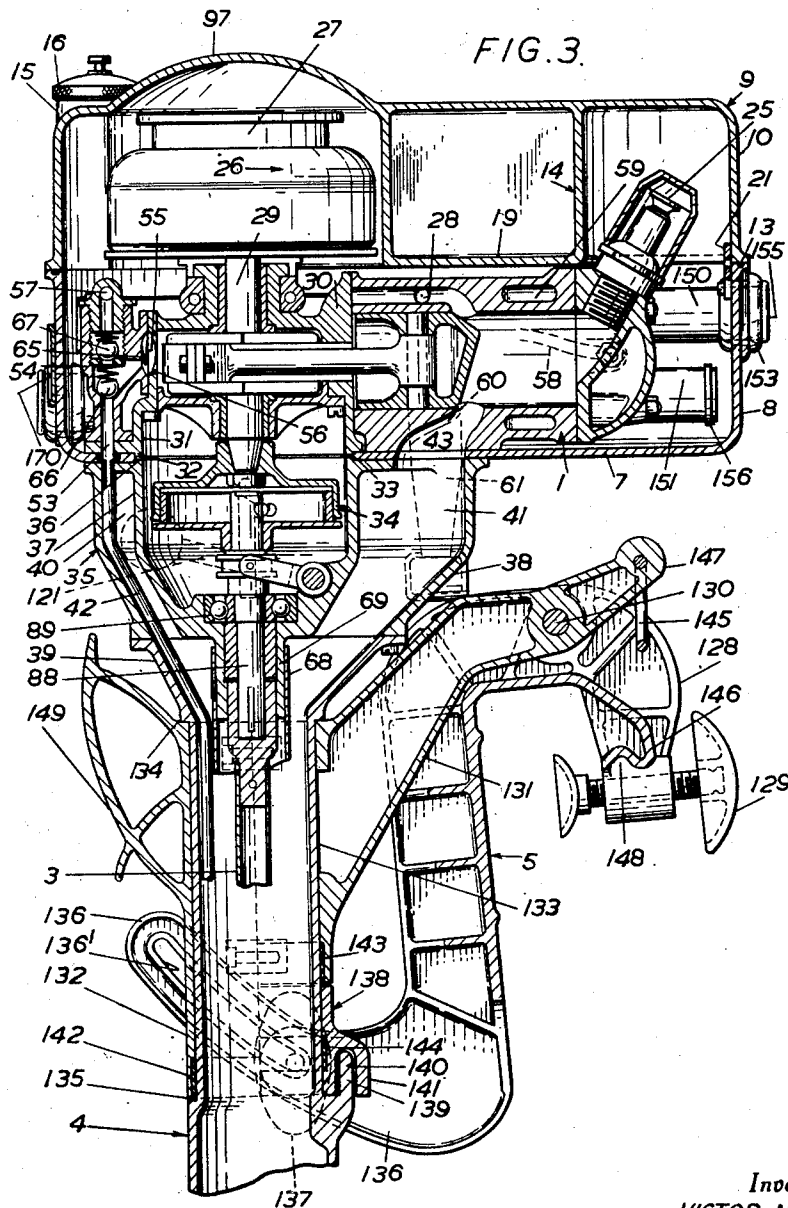
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8 Sheets-Sheet 3



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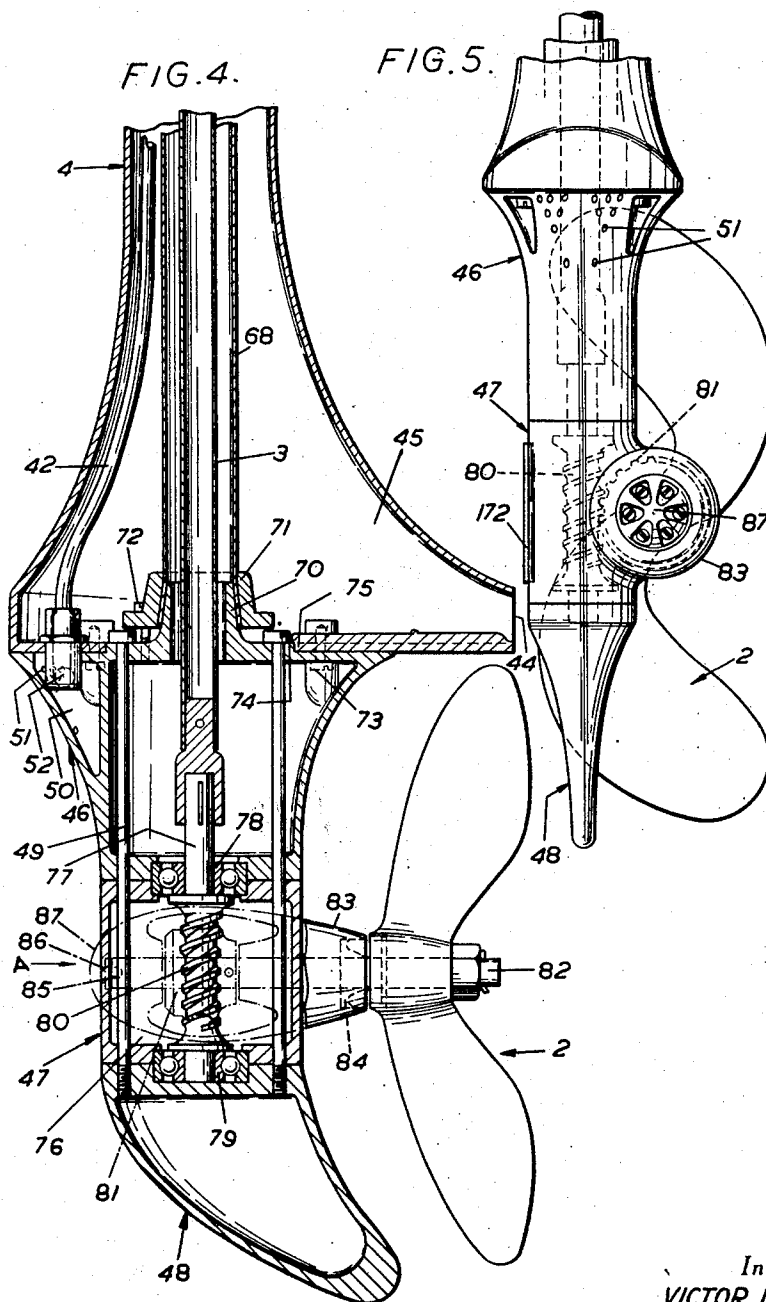
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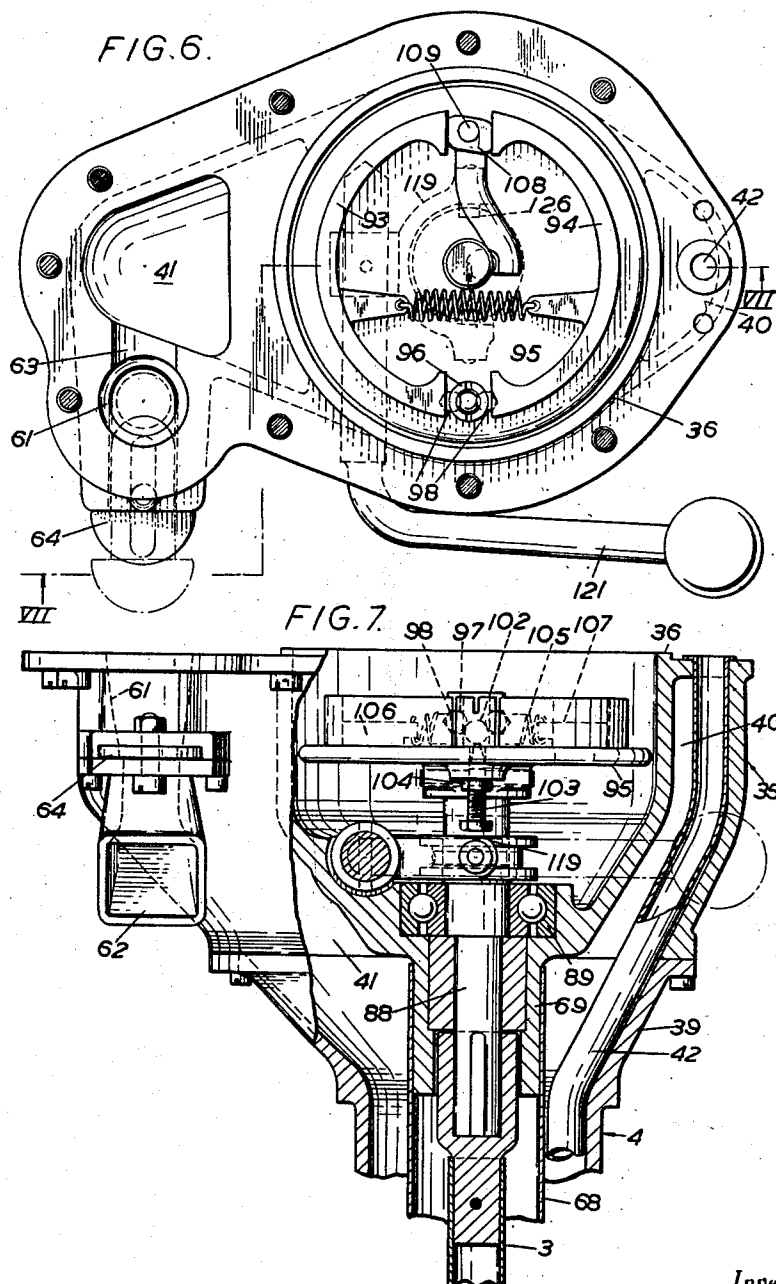
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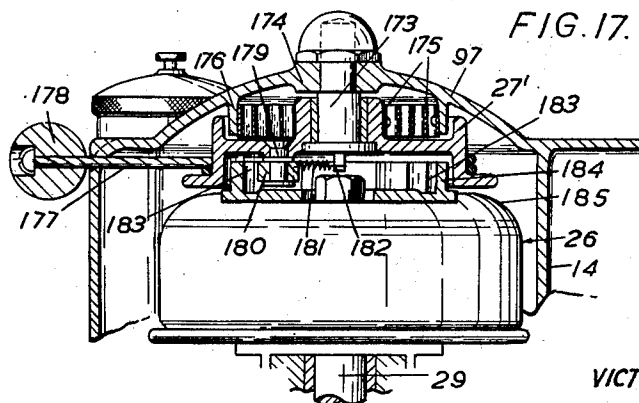
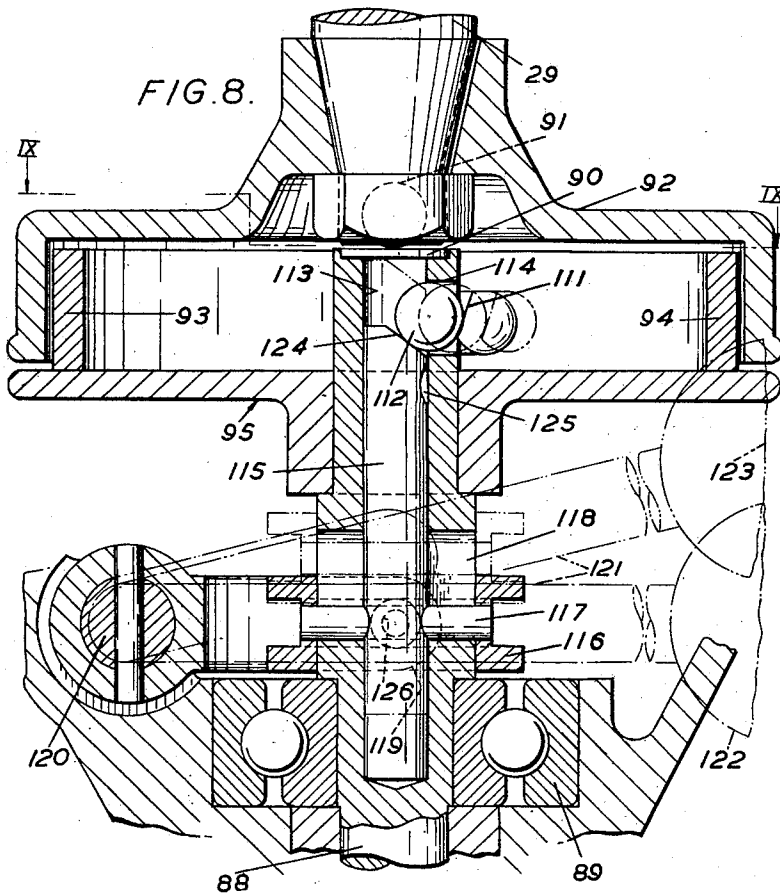
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8 Sheets-Sheet 6



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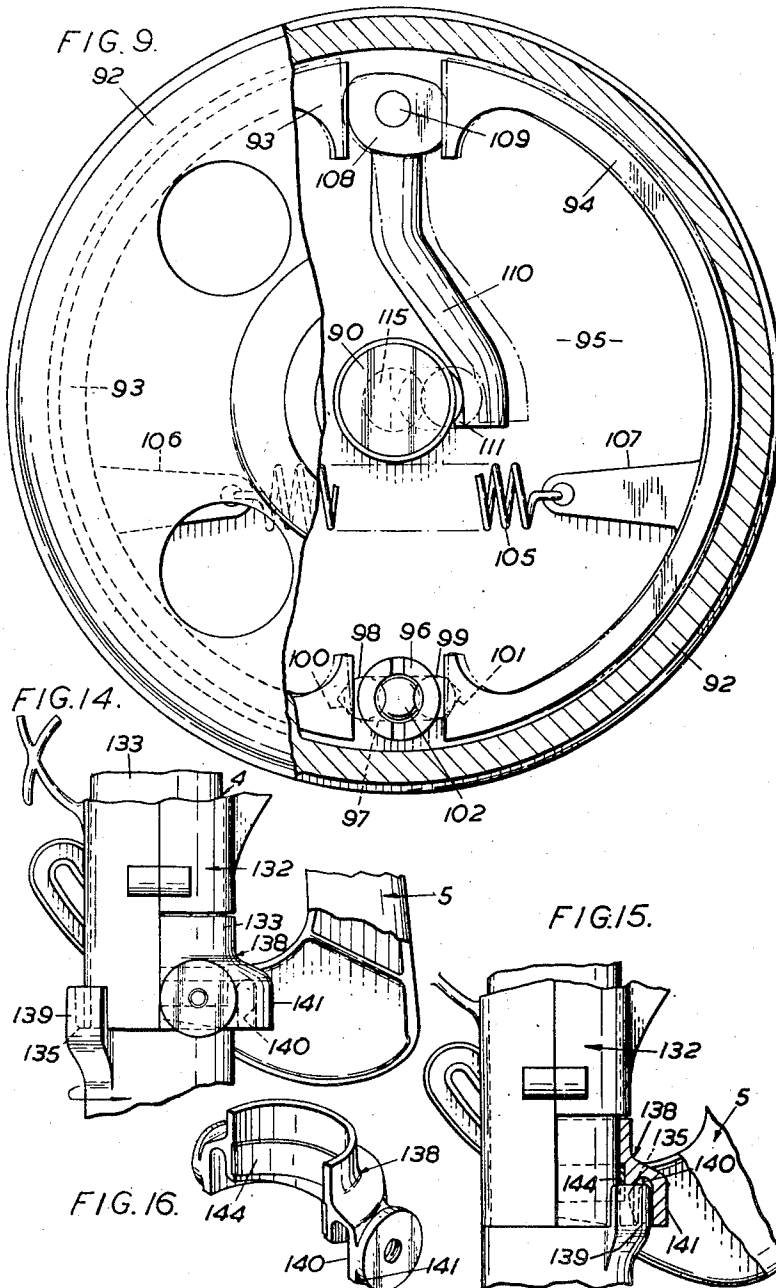
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2,676,559

OUTBOARD MOTOR FOR WATERCRAFT

Filed Dec. 11, 1951

8 Sheets-Sheet 7



April 27, 1954

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2,676,559

OUTBOARD MOTOR FOR WATERCRAFT

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8 Sheets-Sheet 8

FIG. 10.

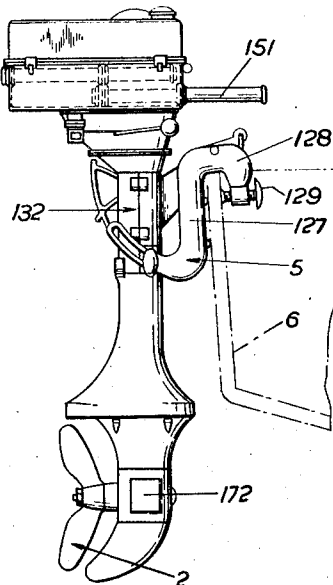


FIG. 11.

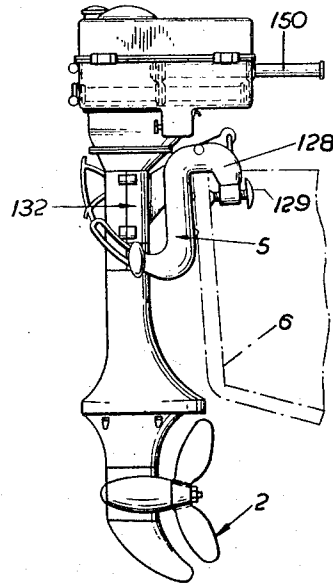
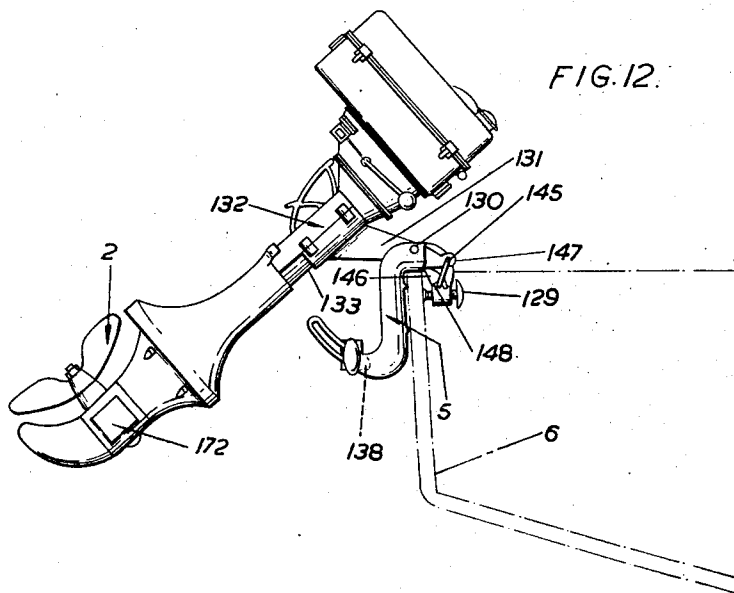


FIG. 12.



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UNITED STATES PATENT OFFICE

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OUTBOARD MOTOR FOR WATERCRAFT

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Application December 11, 1951, Serial No. 260,985

13 Claims. (Cl. 115—17)

1

This invention concerns an improved outboard motor unit for watercraft capable of being propelled by such a unit, e. g. dinghies, skiffs, and like relatively small boats (all hereinafter included in the term "boat") the outboard motor unit being of the kind comprising an internal combustion engine driving a remotely situated screw propeller through a driving shaft extending between the engine and the said propeller and enclosed in a housing having means for attaching the unit pendently to the stern or transom of the boat.

An object of this invention is to provide a generally improved outboard motor unit of the kind specified and in which the engine is thoroughly protected from its external surroundings and from water spray, rain, dirt and the like and from mechanical damage from external sources.

A further object of the invention is to provide a compact and highly serviceable outboard motor unit having a number of advantageous characteristics all of which will become apparent from the following description and claims.

According to the invention there is provided an outboard motor unit of the kind specified including a hollow rigid casing comprising an upper and a lower part, the engine of the unit being carried in and fixed to the said lower casing part which is disposed over, and rigidly connected to, the upper end of the driving-shaft housing of the unit so that this housing depends from said lower casing part, whilst the said upper casing part constitutes a cover which, when closed, co-operates with the said lower casing part to enclose and protect the engine.

The said engine is preferably a two-stroke reciprocating piston engine disposed on its side in the said lower casing part with the crank shaft of the engine aligned with the driving shaft in said driving-shaft housing.

Conveniently the said casing is in the form of a rectangular parallelepipedon, but it may be of other forms, e. g. of a streamlined form, and is divided horizontally or substantially horizontally into two complementary parts which are hinged together along one edge, and have fastening means at the opposite edge thereof, resilient sealing means preferably being provided between the upper and lower parts of the casing so that when the upper part is closed down on to the lower part a water-tight joint is made between the two parts.

According to a still further feature of the invention the upper part of the said casing embodies a fuel tank for the engine and is provided

2

with a filling opening to enable fuel to be placed in the tank, a flexible pipe being provided between the fuel tank and the engine carburetor for supplying fuel to the latter whilst also permitting the upper part of the casing to be moved with respect to the lower part of the casing without interrupting the supply of fuel to the carburetor.

Although the engine crank shaft could be coupled directly to the driving shaft of the unit it is preferred, in accordance with a further feature of this invention, to interpose a clutch assembly between the said crank and driving shafts of the unit, the said clutch assembly being located in a clutch housing disposed between the bottom of the said casing and the upper end of the said driving-shaft housing and rigidly associated with both of these parts. The said clutch assembly preferably comprises a drum and expanding friction shoes as will hereinafter be more fully explained.

According to a further feature of the invention, the said driving-shaft housing also constitutes the exhaust pipe for the engine, the said housing having an exhaust opening at its lower part and being, at its upper part, in communication with the exhaust port of the engine through the medium of a passage provided in the wall of the said clutch housing and which passage registers, at its upper end, with an opening furnished in the bottom of the said casing and in register with the exhaust port of the engine.

The internal combustion engine employed is preferably a water-cooled engine and, according to a further feature of the invention, a pump is provided in the lower part of said casing for circulating the cooling water through the engine cylinder, the suction side of said pump being connected by conduit means to a water straining unit provided at the lower end of the said driving-shaft housing.

According to further features of the invention the motor unit is carried by an attachment member so as to be capable of being turned from a forwardly- to a rearwardly-propelling position and vice versa when desired, and so as also to be capable, when in the forward-propelling position, of being up-tilted to raise the propeller away from the beach or the like when desired, whilst means may also be provided for releasably retaining the unit in this up-tilted position.

According to a still further feature of the invention at least one stowable tiller bar is carried by the said casing for facilitating the steering and manipulation of the outboard motor unit, and preferably the or each tiller bar is mounted

3

in the said casing so as to be stowable wholly or mainly therewithin when not in use whilst being largely withdrawable therefrom into an operating position. Desirably two of said tiller bars are provided and are arranged one for extension beyond one end of the said engine-carrying casing for use when the outboard motor unit is in a forwardly-propelling position and the other for extension beyond the other end of the casing when the said unit is in the rearwardly-propelling or astern position.

Further features of the invention will become apparent from the following description and the appended claims.

In order that the invention may be more readily understood one embodiment of the same, and a modification of such embodiment, will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a perspective view of an outboard motor unit constructed in accordance with this invention and suitable for use on a dinghy or the like;

Figure 2 is a perspective view, drawn to a larger scale than Figure 1, of the upper portion of the outboard motor unit, the casing at the upper end of the unit being shown open;

Figure 3 is a vertical section through the upper part of the outboard motor unit shown in Figure 1, the section being taken on the axis of the driving shaft of the unit and the latter being shown, in this figure, in a rearwardly propelling position;

Figure 4 is a similar section to Figure 3 but of the lower part of the outboard motor unit;

Figure 5 is an elevation, drawn to the same scale as Figure 3, of the part of the unit shown in Figure 4 and as viewed in the direction of the arrow A in the latter figure;

Figure 6 is an enlarged section on line VI—VI, Figure 1;

Figure 7 is a fragmentary section on line VII—VII, Figure 6;

Figure 8 is an enlarged vertical sectional view of some of the mechanism shown in Figures 6 and 7;

Figure 9 is a part sectional plan on line IX—IX, Figure 8;

Figure 10 is a side elevation showing the motor unit illustrated in Figures 1 to 9 ready for attachment to the transom of a dinghy and in a forwardly propelling position with its propeller rearwardly directed, the unit being in an operative position;

Figure 11 is a view similar to Figure 10 with the outboard motor unit turned through 180° (as compared with its position in the latter figure) about the axis of its driving-shaft housing so as to bring it into a rearward propelling or astern position with its propeller forwardly directed;

Figure 12 shows the outboard motor unit of Figure 10 raised into an up-tilted position in which its propeller will be clear of the beach or the like when the dinghy is being beached;

Figure 13 is a side elevation of the upper part of the outboard motor unit shown in Figure 1 of the drawings, the view being taken from the opposite side of the unit to that shown in Figure 1;

Figure 14 is a fragmentary side elevation showing a detail of the bearing sleeve for the driving-shaft housing and the means for locking said housing to the attachment member of the unit when the propeller of the latter is in the rearwardly propelling position;

4

Figure 15 is a view similar to Figure 14, partly in section, showing the driving-shaft housing turned to the rearwardly propelling position and locked against rearward movement relatively to the said attachment member;

Figure 16 is a perspective view of a detail of the mechanism shown in Figures 14 and 15; and

Figure 17 shows in vertical section, similar to Figure 3, a modified arrangement of the starter pulley for the engine of the unit.

Referring to the drawings, particularly Figures 3 and 4, it will be seen that the outboard motor unit there depicted comprises an internal combustion engine 1 adapted to drive a remotely situated screw propeller 2 through a driving shaft 3 extending between the engine and the propeller and enclosed in a hollow or tubular housing 4 having an attachment member 5 for attaching the outboard motor unit pendantsly to the transom 6 (see Figures 10 to 12) of a dinghy or the like.

The engine and casing therefor

The engine 1, which is a single cylinder water-cooled two-stroke internal combustion engine, is fixed on its side to the bottom 7 of the lower part 8 of a rigid hollow casing 9 in the form of a rectangular parallelepipedon, the upper part 10 of this casing forming a cover for the engine and being complementary to the lower part 8 of the casing so that when the said upper casing part is closed, as shown in Figure 11, for example it co-operates with the lower casing part to enclose and protect the engine 1.

As will be seen from the drawings the division between the upper and lower parts of the casing 9 extends horizontally of the casing rather nearer to the top than the bottom thereof, the two parts 8 and 10 of the casing being hinged together at 11, 11 along one side edge (see Figure 2) and being furnished along the other side edge with the fastening means, such as toggle fasteners 12, 12.

In order to effect a water-tight seal between the two parts 8 and 10 of the casing 9 when the upper part 10 is in its closed position, a sealing ring 13 is provided around the edge of one of these parts 8 and 10 and preferably around the upper edge of the lower part 8 as shown clearly in Figures 2 and 3, this sealing ring being of resilient character and conveniently formed of rubber or similar material and of circular or other suitable cross-sectional form, the ring being located in a recess in the upper edge of the lower casing part 8 so as normally to project somewhat above such upper edge when the upper casing part 10 is raised.

The upper part 10 of the casing embodies therein a fuel tank 14 for storing the liquid fuel for the engine 1, this tank being provided with a filling neck 15 closed by a detachable non-spill filler cap 16 and a flexible pipe 17 being provided for conveying liquid fuel from the bottom of a well 18 (provided in the base 19 of the fuel tank 14) to the carburetor 20 connected to the inlet 28 (Figures 2, 3 and 13) of the engine 1, such pipe permitting the upper part 10 of the casing 9 to be raised, and subsequently lowered, with respect to the lower part 8 of the casing 9 without interrupting the flow of fuel from the tank to the engine.

To limit the upward movement of the upper part 10 of the casing 9 with respect to the lower part 8 and to support the part 10 in its raised position, a pivoted strut 21, having an elongated

5

bayonet-type slot, is provided on the casing part 10 for co-operation with a stud 22 on the lower casing part 8 as shown in Figure 2.

The fuel tank 14 embodied in the upper part 10 of the casing 9 is furnished on the inside thereof with recesses 23 and 24 respectively to receive the spark plug 25 and the flywheel and magneto assembly 26 of the engine and a starter cable pulley 27 when the upper casing part 10 is in its closed position, the top of the upper part 10 of the casing 9 being upwardly domed, as shown at 97, over the said fly-wheel and magneto assembly, all as will be clearly seen from Figures 2 and 3, for example.

The crank shaft 29 of the engine 1 is arranged so as to be perpendicular to the bottom 7 of the casing 9 and is journaled in the upper and lower ends of the crank case 30 of the engine, this crank case having a dependent flange 31 around the lower end of which is an externally cylindrical rib 32 coaxial with the crank shaft 29 and fitting coaxially into a circular aperture 33 (Figure 3) in the bottom 7 of the lower casing part 8 so as accurately to position the engine 1 with respect to the casing part 9 and with its crank shaft 29 in end-on alignment with the driving shaft 3. The aperture 33 is located nearer to one end of the casing 9 than to the other end thereof and the engine is secured in position in the casing by means of screws and/or bolts (not shown).

Clutch assembly and housing therefor

A clutch assembly generally indicated by the reference 34 and to be further described hereinafter, is interposed between the lower end of the crank shaft 29 and the upper end of the driving shaft 3, this clutch assembly being enclosed in a double-walled clutch housing (generally indicated by the reference 35) interposed between, and rigidly secured to, the bottom of the lower casing part 8 and the upper end of the driving-shaft housing 4.

The inner and outer walls of the clutch housing 25 are respectively marked 37 and 38, see for example Figure 3. The inner wall 37 is cylindrical at its upper part and frusto-conical at its lower part, and is, as a whole, coaxial with the crank shaft 39. The outer wall 38 of the clutch housing is of a streamlined or approximately elliptical form in horizontal cross-section at its upper part but converges downwardly and inwardly at its lower part to meet and match an upwardly and outwardly flared part 39 at the upper end of the driving-shaft housing 4 which is bolted to the lower end of the clutch housing 35.

The upper part of the outer wall 38 of the clutch housing is rearwardly offset with respect to its inner wall 37 as is clearly seen from Figures 3, 6 and 7, so as to provide respectively at the front and rear of the clutch housing between the outer and inner walls thereof two passages marked 40 and 41 and both extending downwardly completely through the wall of the clutch housing, the passage 40 serving to house a water pipe 42 and to discharge engine cooling water all as subsequently referred to in more detail, whilst the passage 41 serves to conduct exhaust gases from the exhaust port 43 of the engine 1 to the upper end 39 of the driving-shaft housing 4 which, besides housing the driving shaft, also serves as an exhaust pipe and cooling water discharge conduit for the engine.

The said driving-shaft housing gradually in-

6

creases downwardly in cross-sectional area at its lower part which is of a rearwardly streamlined horizontal cross-sectional form, such lower part of the housing being provided, at its lower rear extremity, with an exhaust opening 44 (see Figure 4) for the egress of the exhaust gases and cooling water flowing through the driving-shaft housing from the engine. Moreover, the said lower part of the driving-shaft housing is extended so far rearwardly, as shown in Figure 4, that the rearward extension will constitute a rudder 45 located above the exhaust opening 44, and also a cavitation plate.

In order that the inner wall of the clutch housing shall be accurately aligned with the aperture 33 in the bottom of the lower part 8 of the casing 9 and thus with the crank shaft 29 of the engine 1, the upper end of the housing is furnished with an annular rib 36 therearound and fitting into the lower end of the said aperture 33.

Engine water cooling system

The lower end of the driving-shaft housing 4 carries a streamlined underwater unit comprising a water straining unit 46, a propeller unit 47 and a guard or tail fin 48, the propeller unit being sandwiched between the water straining unit and the guard fin 48 and these three parts being secured together by bolts 49 passing therethrough. The water straining unit 46 includes a water chamber 50 the wall of which is provided with a series of perforations 51 to admit strained water to the chamber 50 which is located in the front of the water straining unit (as is clear from Figures 1 and 4) so that this water can be drawn into the chamber 50 by a water pump 54 (see Figure 3) which draws the water upwardly through a non-return valve 52 (dipping into the water chamber 50) and into and up the pipe 42, previously referred to, the upper end of this pipe being in communication with the water inlet 53 of the water pump 54 which is fixed to the front end of the crank case 30 of the engine 1 within the lower casing part 8.

The pump 54 is of the diaphragm type and its diaphragm 55 is arranged opposite an aperture 56 in the said end wall of the engine crank case 30 so as to be responsive to the cyclical variations in the internal pressure of the said crank case whereby the diaphragm is vibrated and water is pumped up the pipe 42 through the pump inlet 53 as stated and then circulated through an outlet 57 and a pipe 58 (see Figure 2) to the head of the cylinder of the engine 1 and then into a water jacket 59 of this cylinder for cooling purposes, the water leaving the said water jacket 59 (after circulating therethrough) via an outlet passage 60 (see Figure 3) leading to a vertical discharge passage 61 in a bulge on the rear end of the clutch housing 35 and discharging into a horizontal outlet chute 62 and/or into a by-pass 63 (see Figures 6 and 7).

The by-pass 63 is formed in the upper surface of the wall of the clutch housing 35 and communicates with the exhaust passage 41 through this wall, as clearly shown in Figure 6, and a slide valve 64 is provided in the passage 61 so that the water discharge via the chute 62 can be almost entirely cut off, the arrangement preferably being such that this valve 64 will, when the engine 1 is operating, be so set that only a mere trickle of water leaves the chute 62 as an indication that water is circulating through the water jacket 59, whilst the majority of the water

is discharged through the exhaust port 41, down the driving-shaft housing 4 and out of the latter via the exhaust opening 44. The valve 64 also constitutes a pressure releasing cock and will be fully opened when starting the engine to relieve the back pressure on the exhaust gases and thereby to facilitate starting the engine.

The cooling water discharged through the driving-shaft housing 4 serves to counteract the heating effects of the exhaust gases passing through the housing.

The diaphragm 55 of the pump 54 is preferably subjected to slight spring pressure by means of a compression spring 65 arranged on the pump side thereof and the inlet 53 and outlet 57 of the pump are controlled by non-return valves respectively marked 66 and 67 (Figure 3) which ensure a unidirectional flow of the cooling water through the engine.

Driving shaft

To protect the driving shaft 3 from the effects of the exhaust gases and cooling water flowing through the driving-shaft housing 4, and from any other water that may enter such housing, the driving shaft is enclosed by means of an enshrouding tube 68 coaxial with the driving shaft and fitted water-tightly at its upper end upon a coaxial dependent boss 69 on the lower end of the clutch housing 35 (see Figure 3) whilst the lower end of the tube 68 is fitted over an upstanding frusto-conical boss 70 formed integrally upon the upper end of the water straining unit 46, the lower end of the tube 68 being clamped on to this boss by means of a ferrule 71 having a frusto-conical bore to match the external form of the boss 70, the ferrule 71 being drawn down the boss 70 by means of set screws 72 (see Figure 4). Thus the driving shaft 3 is completely segregated from the interior of the driving-shaft housing throughout its whole length and the upper end of the water straining unit is also segregated from such housing so that water and exhaust gases may not pass to the propeller unit.

The assembly of the water straining unit, propeller unit and the guard fin are secured to the lower end of the driving-shaft housing 4 by studs 73, the said unit being centralised with respect to the driving shaft 3 by means of a central short spigot 74 on the upper end of the water straining unit and fitting into a hole 75 in the lower end of the driving-shaft housing, this hole being coaxial with the shaft 3.

Propeller unit

The propeller unit includes a gear box 76 in which is vertically arranged a worm shaft 77 carried in anti-friction bearings 78 and 79 respectively located at the upper and lower ends of the gear box, the shaft 77 being coaxial with the driving shaft 3 and carrying a worm 80 meshing with a worm wheel 81 (see Figures 4 and 5) fixed upon a propeller shaft 82 which is arranged at right angles to the shaft 77 but laterally offset with respect thereto as is clearly seen from Figure 5. The propeller shaft is housed in a streamlined hollow housing or bulge 83 formed on the side of the propeller unit gear box 76 and the propeller shaft is suitably journaled in this bulge in "Oilite" or other suitable bearings, the bulge being furnished with a water-tight gland or seal 84 at its rear end and with a thrust ball 85 at its front end, this ball being located in a recess in the front end of the propeller shaft and bearing against a hardened disc 86 let into the inner

side of a removable cap 87 at the front end of the said bulge.

The upper end of the worm shaft 77 is drivingly and detachably coupled to the lower end of the driving shaft 3 which, in this case, is in the form of a tube, the upper end of the driving shaft being received and journaled in the dependent boss 69 of the clutch housing 35, and being detachably coupled to the lower end of a coaxial transmission shaft 88 journaled in an anti-friction thrust bearing 89 in the lower end of the clutch housing 35 and restrained against axial movement in this housing.

The transmission shaft 88 is coaxial with the crank shaft 29 of the engine 1 and, as will be seen from Figures 3, 6, 7, 8 and 9 in particular, forms part of the clutch assembly of the outboard motor unit and although the transmission shaft is preferably made separately of the driving shaft 3 it could be, if desired, an extension of this shaft.

At its upper end the transmission shaft 88 has an inset hardened steel disc 90 on which bears a thrust ball 91 let into the lower end of the crank shaft 29 of the engine 1, this arrangement relieving the end thrust on the crank case bearings for the engine crank shaft, the end thrust of the crank shaft being transmitted through the said ball 91 and transmission shaft 88 to the bearing 89 for the latter.

Details of the clutch assembly

The clutch is of the expanding friction shoe type and comprises a male and a female part, the female part consisting of a drum 92 fixed coaxially on the conical lower end of the crank shaft 29 and receiving therein a pair of arcuate friction shoes 93 and 94 (see Figures 3, 6, 7, 8 and 9) carried upon the male part of the clutch which consists of a disc 95 keyed upon the transmission shaft 88 coaxially therewith and at a short distance from its upper extremity.

The friction shoes 93 and 94 are each of part-circular form in plan and each has one end pivotally associated with the plate 95 inwardly of the periphery of the latter, the opposite ends of the shoes co-operating with an expanding cam 108 the operation of which is subsequently described.

The pivoting of the friction shoes 93 and 94 to the plate 95 is effected in an adjustable manner by providing the plate 95 with a fixed tubular pillar 96 projecting perpendicularly upwardly therefrom, this pillar having a pair of diametrically arranged radial bores in which are respectively mounted bearing balls 98 and 99 seating in recesses 100 and 101 respectively provided in the pivoted ends of the friction shoes, the portions of the said balls 98 and 99 located within the tubular pillar 96 bearing upon an adjusting ball 102 which can be moved upwardly axially of the tubular pillar 96 by means of an adjusting screw 103 (see Figure 7) screwed into the plate 95 and bearing, at its upper end upon the ball 102, such adjusting screw 103 being provided with a lock nut 104. The ends of the friction shoes 93 and 94 which engage the expanding cam 108 are maintained in contact with this cam by means of a low rate tension spring 105 connected at opposite ends to lugs 106 and 107 respectively provided on the said shoes.

The cam 108 is mounted on a pivot 109 projecting perpendicularly upwardly from the clutch plate 95 and is furnished with a substantially radial arm 110 extending to the centre of the clutch plate 95 and suitably joggled so as to be

located at its free end adjacent the external periphery of that part of the transmission shaft 88 which projects above the clutch plate 95, this free end of the lever 110 having an oblique thrust surface 111 (see Figure 8) with which engages a ball 112 located partially in an axial bore 113 in the transmission shaft 88 and partially in a radial bore 114 leading outwardly from said axial bore, the ball 112 being adapted to be thrust radially outwardly with respect to the transmission shaft 88 (thereby to operate the cam lever 110 and expand the friction shoes 93 and 94 into contact with the dependent flange of the drum 92) by means of an axially slidable clutch adjusting or push rod 115 mounted in the axial bore 113 of the transmission shaft 88 and adapted to be slidden endwise in the latter through the medium of a peripherally grooved collar or bobbin 116 mounted on the exterior of the transmission shaft 88 so as to be slidable axially therealong, such collar being coupled to said clutch adjusting rod 115 by a diametrical cross pin 117 carried by said rod and engaging in diametrically opposite holes in the said collar, the transmission shaft 88 being longitudinally slotted at 118 to provide for the necessary movement of the cross pin 117.

The collar 116 is slidden along the transmission shaft 88 through the medium of radial pins and rollers 126 on the free ends of a semi-circular forked lever 119 (Figures 6, 7, and 8) carried upon a horizontal shaft 120 journaled in the lower part of the clutch housing 35 and extending to the exterior of the latter where it is provided at one end with an operating handle 121, the arrangement being such that, when the handle 121 is raised from the lower position shown in dot and dash lines at 122 (Figure 8) to the upper position shown in dot and dash lines at 123 in the same figure, the push rod 115 will be raised so as to cause an oblique surface 124 provided at its upper end to push the ball 112 radially outwardly thereby to expand the friction shoes 93 and 94 of the clutch and bring the two parts 95 and 92 of the clutch into driving engagement.

Any suitable means may be provided for releasably retaining the operating lever 121 for the clutch adjusting rod in its terminal positions and, in the embodiment of the invention illustrated, the lever remains in its disengaged or lower position by virtue of its weight and of the engagement of the diametrical cross pin 117 against the bottom of the slot 118 in the transmission shaft 88 whilst the lever 121 is temporarily locked in its upper position by the snap engagement of the ball 112 in a notch 125 in the adjusting rod 115.

Attachment member for the unit

The outboard motor unit is adapted to be mounted on the transom 6 of the dinghy by means of an attachment member 5 comprising a substantially upright body 127 having, at its upper end a forwardly extending inverted U-shaped clamp (see Figures 1, 3, 10 to 12, 14 and 15) adapted to engage over the upper edge of the transom centrally of the width of the latter, the clamp comprising a pair of forwardly and downwardly extending arms 128 each of which carries, at its lower end, a clamping screw 129 adapted to engage on the inside of the transom to clamp the latter between their rear ends and the front surface of the body 127 of the attachment member.

The upper part of the attachment member 5 is (if desired, with the aid of a rubber bush) pivoted on a horizontal bolt 130 passing through the

upper end of an upwardly and forwardly directed bracket 131 united at its lower part to the front portion of an internally cylindrical bearing sleeve 132 in which is journaled a cylindrical port 133 (see Figures 3, 14 and 15 for example) of the driving-shaft housing 4, the upper and lower ends of the said sleeve being located between circumferential shoulders 134 and 135 at the ends of the said cylindrical part of the driving-shaft housing so as to be restrained by these shoulders against endwise movement with respect to such housing.

The sleeve 132 is made in two similar semi-cylindrical halves bolted together about the driving-shaft housing and the latter is freely rotatable about its own axis in the bearing sleeve so that the propeller 2 of the outboard motor unit can be moved from a forwardly-propelling rearwardly-directed position, such as shown in Figures 1 and 10 for example, to a forwardly-directed rearwardly-propelling reverse or astern position, such as is shown in Figures 4 and 11 for example, or into any position intermediate these two alternative positions.

It should also be understood that the complete motor unit, other than the attachment member, is capable of being swung in a vertical plane about the horizontal pivot bolt 130 so that the outboard motor unit can be swung from a more or less upright operative position in which the propeller is below water level (shown for example in Figures 10 and 11) to a position such as that shown in Figure 12 where the unit is raised into an up-tilted position (at about 45° to the horizontal) with the propeller lifted above beach level and probably out of water so as to avoid damage to the outboard motor unit during, for example, the beaching of the dinghy to which it is fitted.

At its lower end the body 127 of the attachment member 5 is provided with a pair of laterally spaced parallel rearwardly extending arcuate horns 136 each having a longitudinal slot 136' whose centre of curvature lies on the axis of the pivot bolt 130. The horns 136 embrace between them the said driving-shaft housing 4 and are respectively secured, by locking screws 137 passing adjustably through the said slots 136', to the opposite ends of a substantially semi-cylindrical or segmental bridge piece 138 (see Figures 1, 3, 14 to 16) lying around the lower front part of the cylindrical portion 133 of the driving-shaft housing 4, the front part of the bearing sleeve 132 being shorter than the rear part of this sleeve in order to accommodate the bridge piece 138 therebelow with this bridge piece forming, as it were, a separate but complementary portion of the sleeve 132. Thus the bridge piece 138 serves to bear the forward thrust of the driving-shaft housing when the propeller of the unit is in its rearwardly-directed forwardly-propelling position, such as shown in Figures 1 or 10 for example, but does not interfere with the free raising of the outboard motor unit into an up-tilted position such as that shown in Figure 12 so long as the propeller 2 is in the rearwardly-directed forwardly-propelling position.

However, in order to lock the outboard motor unit in a more or less upright operative position, such for example, as that shown in Figure 11, when the propeller is in the forwardly-directed rearwardly-propelling position, the bridge piece 138 and the driving-shaft housing are provided with means for interlockingly engaging with one another when the outboard motor unit is

turned to its said rearwardly propelling position, such interlocking means comprising, in the embodiment illustrated, a part cylindrical or segmental upstanding locking flange 139 formed integrally on the rear part of the driving-shaft housing adjacent the lower shoulder 135 thereof, this locking flange being adapted, when the outboard motor unit is turned from a forwardly propelling to a reverse position, to enter and interlockingly engage in a semi-annular open-ended groove 140 in a peripheral bulge 141 provided around the lower part of the bridge piece 138, see Figure 15 for example.

The locking flange 139 is coaxial with the driving shaft 3 and the cylindrical part 133 of the driving-shaft housing 4 and also partially surrounds the bearing sleeve 132 at the lower end thereof and it will be seen that, when the flange 139 is engaged in the groove 140, the driving-shaft housing is interlocked rigidly to the attachment member 5 so as to prevent the outboard motor swinging rearwardly when the unit is being used in the astern or reverse position.

Preferably the bearing sleeve 132 is provided with semi-cylindrical bearing liners 142 and 143 for the driving-shaft housing, these bearing liners being arranged respectively in the rear and front halves of the sleeve; a similar bearing liner 144 is also preferably provided in the bridge piece 138.

It will be appreciated that by the provision of locking screws 137 operating in the arcuate slots 136' in the horns 136, the actual angular setting or operative position of the outboard motor unit with respect to the transom of the dinghy can be adjusted between a strictly vertical position and a somewhat oblique position.

When the outboard motor is not in use and it is, for example, to be stored, the attachment member 5 may be swivelled about the driving-shaft housing so as to be situated below the rear end portion of the engine casing 9, as shown in Figure 3 for example, the arrangement being such that when so disposed the attachment member is wholly located within the overall dimensions of the said casing so that the unit is in a compact condition for storage or transport.

Means for supporting unit in an up-tilted position

In order to support the outboard motor in its raised or uptilted position, such as shown for example in Figure 12, while pulling the dinghy up or down a beach or in similar circumstances where it is necessary to protect the propeller from damage, the forwardly and upwardly directed bracket 131 and the attachment member 5 are respectively furnished with a pivoted loop 145 and a lug 146, the loop being adapted to be engaged over the said lug when the driving-shaft housing 4 occupies its raised or uptilted position so as thereby releasably to retain the outboard motor unit in this position. In the embodiment of the invention shown, the loop 145, is, as will be clearly seen from Figures 1, 3 and 10 to 11, for example, pivoted at its upper end to a forward extension 147 of the bracket 131 whilst the lug 146 which has an undercut or hooked nose portion 148 forms an integral part of the attachment member 5, being disposed centrally between the forward dependent portions of the arms 123 of such member. In the arrangement shown the loop 145 serves to retain the outboard motor unit with the axis of the driving shaft 3 at about 45° to the vertical.

Carrying handle

To facilitate the carrying of the outboard motor

unit with the driving-shaft housing 4 in a more or less horizontal position, the sleeve 132 is provided, on its rear part, with an integral handle 149.

Tiller bar arrangement

For steering and manipulating the outboard motor unit, one or more tiller bars are provided and such tiller bar or each of them is of a stowable or retractible character. In the embodiment of the invention shown in the drawings two such tiller bars are provided, and are marked respectively 150 and 151, these two tiller bars being intended for alternative use, the tiller bar 151 being used (as shown in Figure 10) when the outboard motor unit is in the forward-propelling or ahead position and the tiller bar 150 being used (as shown in Figure 11) when the outboard motor unit is in the rearwardly-propelling or astern position.

The tiller bars 150 and 151 are arranged in parallelism one above the other in the lower part 8 of the casing 9, the tiller bars being parallel to the bottom 7 of this casing and both the bars being capable of being telescoped substantially wholly into and housed or stowed within the casing 9 and one of the bars, namely, the bar 151, being withdrawable into a forwardly extended position beyond the front of the casing 9, as shown in Figure 10, whilst the other bar 150 is extensible beyond the rear end of the casing (turned to the front when this tiller bar is extended) as shown in Figure 11.

Each of the tiller bars 150 and 151 is in the form of a metal tube supported in a pair of axially spaced guides, one of these guides being constituted by an end wall of the lower part 8 of the casing 9 and the other guide being formed by a lug 152 formed integrally with the lower part 8 of the casing 9 and on the interior of this casing part as is clearly seen, for example, from Figures 2 and 13.

The tiller bars 150 and 151 respectively pass through holes in the rear and front ends of the casing 9 and are sealed in these holes by resilient bushes or glands 153 (made of rubber or a composition of rubber or a synthetic resin such as polyvinyl chloride or alkathene or other suitable material) which also serve frictionally to retain the tiller bars in any axially adjusted positions in which they may be placed.

The tiller bars also pass through holes in the lug 152 and these holes are fitted with resilient bushes 154 similar to the bushes 153, and although these bushes 154 are not required to effect any sealing they do assist in retaining the tiller bars in their axially adjusted positions. Each tiller bar is provided at its opposite ends respectively with a head 155 and a collar 156 to limit the endwise movement of the bar.

Carburettor housing

The carburettor 20 of the engine is to one side of the cylinder of the latter and depends through an opening 157 (see Figure 13) in the bottom of the lower part 8 of the casing 9 and is surrounded by a dependent cowl 158 formed integrally with the bottom 7 of the casing 9 and furnished, at its lower end, with an air inlet opening 159 covered by a gauze 160 to prevent water spray entering the casing and the carburettor whilst permitting air to enter the latter. A choke having a control knob 162 is provided for the carburettor, and also a needle valve 161 for adjusting the jet of the carburettor, these controls passing through the cowl 158.

Throttle and magneto controls

The throttle control for the carburettor comprises a push rod 163, the inner end of which is connected to a lever on the carburettor butterfly valve spindle (not shown in the drawings as it is of normal form), the push rod 163 being located mainly inside the lower part 8 of the casing 9 and projecting outwardly through a hole formed in the front end of the latter and furnished with a resilient sealing bush 164 similar to the bushes or glands 153 previously described, the rod 163 having an operating knob 165 at its outer end.

A similar push rod 156 (Figures 2 and 13) is also mounted in the front end of the lower part 8 of the casing 9 in a resilient sealing bush 167 and serves to adjust the advance and retard setting of the magneto, the rod being connected to an angularly adjustable plate 168 at the base of the magneto-flywheel assembly 26 and which carries the terminal (not shown) to which is connected a lead 169 to the sparking plug 25.

The throttle and magneto controls are preferably arranged, as shown, at the front end of the casing 9 adjacent the tiller bar 151 which is the one most frequently used as it is employed during forward movement of the dinghy. It will, however, be appreciated that these controls may be duplicated at both ends of the casing if desired.

Inspection covers

Appropriate inspection and access covers are provided at various parts of the outboard unit, such as an access cover 170 at the front end of the lower part 8 of the casing 9 covering a series of holes 171 in the front end of the casing affording access to screws securing the pump 54 to the crank case of the engine 1, and an inspection cover 172 giving access to the gear box 76 to enable it to be refilled with oil or grease.

Modification of starter pulley arrangement

In the embodiment of the invention described in Figures 1 to 16 of the drawings it is necessary to open the casing 9 by raising the upper part 10 thereof in order to apply the starter cable to the starter cable pulley 27, but if desired the unit may be modified so that the starter cable can be operated from the exterior of the casing 9 without raising the upper part 10 thereof. Thus, as will be seen from the modification illustrated in Figure 17 of the drawings, the starter pulley 27 of the arrangement shown in Figures 1 to 16 may be replaced by a starter pulley 27' independent of the engine crank shaft 29 and freely rotatable upon a vertical pivot pin 173 fixed centrally in a central boss 174 on the dome 97 of the upper part 10 of the casing 9, the said pulley being urged in one rotational direction by means of a spiral or clock type rewinding spring 175 fixed at one end to the pulley and at its other end to a surrounding dependent flange 176 formed integrally with, and on the under side of, the dome 97 coaxially with the pivot pin 173.

One end portion of a starter cable 177 is fixed to the external periphery of, and is wrapped around, the pulley 27' whilst the other end portion of the cable passes out through an opening in the front end of the casing 9 and is furnished with an operating knob 173, a sealing gland (not shown) being arranged around the cable where it leaves the casing 9, if desired.

To couple the pulley 27' to the crank shaft 29 and to transmit rotation from the pulley to the crank shaft when the pulley is rapidly rotated

by the cable 177, the pulley is provided with an eccentric vertical pivot pin 179 upon which is pivoted one end of a pawl or dog 180, the other end of which is urged inwards (towards the centre of the pulley) by means of a low rate tension spring 181 anchored at one end to the pawl or dog and at the other end to a coaxial dependent extension 182 of the pivot pin 173.

The pawl or dog 180 is adapted for co-operation with internal ratchet teeth 183 of an annular ratchet 184 rigidly mounted on the fly-wheel cover 185 of the magneto and fly-wheel assembly 26 coaxially with the crank shaft 29 of the engine, and the arrangement is such that the pawl or dog 180 does not normally engage the ratchet teeth 183 but only does so when the starter pulley 27' is rapidly rotated by pulling out the cable 127, centrifugal force then causing the free end of the dog or pawl to fly outwardly and engage in the said ratchet teeth, whereafter the fly-wheel and crank shaft are rotated unitarily with the starter pulley until the engine starts, the ratchet teeth then over-run the dog or pawl. On being released the cable 177 is automatically rewound on to the cable pulley 27' by the action of the spiral spring 175 which, although initially tensioned, is further tensioned by the withdrawal of the starter cable to start the engine. Thus it will be clear that the engine can be started without opening the casing 9 and that the only time it will be necessary to open this casing will be when it is required to inspect the engine or, for example, to flood the carburettor before starting the engine. After the engine has once been started, should it then stall, it will usually be possible to restart it without opening the casing 9 and merely by operating the starter cable 177. It will be noted that when the upper part 10 of the casing is raised, the starter pulley is lifted with it.

Conveniently the casing 9, clutch housing 35, driving-shaft housing 4, water strainer unit 46, propeller unit 47, fin 43, bearing sleeve 132, attachment member 5, and bridge piece 138 are all formed as castings of a light-weight alloy such as, for example, an aluminium alloy. A unit so constructed and employing a $1\frac{1}{4}$ H. P. engine and of overall dimensions of $12\frac{1}{2}'' \times 9\frac{3}{8}'' \times 3''$ —2'' will weigh approximately only 33 lbs.

Some advantages of the outboard motor units above described

By entirely enclosing the engine in a rigid casing as above described the engine is protected from water spray, rain, and the atmosphere and consequently gives improved service as compared with less protected engines. In addition, when the casing 9 is closed, noise from the engine is largely muffled or trapped and the outboard motor unit is therefore much more pleasant to use than the normal type of outboard motor unit wherein the engine is not completely enclosed and sealed-in as in this case. The usual light sheet metal detachable sectional farings or cowlings which have been placed over outboard motor engines in the past do not seriously hinder the transmission of sound from the engine and in many cases add to the noise rather than detract from it. In addition the total enclosing of the engine in a rigid and robust casing protects the engine and parts connected therewith from mechanical damage which is an important advantage since outboard motors are liable to receive somewhat rough handling. Also by providing the unit with a worm gear propeller drive it is possible to run

the propeller at a speed much less than that of the engine crank shaft, whilst providing a higher power output than usual and permitting, if desired, the use of a larger propeller (e. g. a 9¾" diameter x 15" pitch weedless propeller) than

The construction of the outboard motor unit in accordance with this invention also enables a water-cooled engine to be used instead of an air cooled engine and this is a further advantage because, as is well recognised, a water cooled engine is quieter in operation than an air-cooled engine. Moreover, the provision in the unit of a clutch assembly enables the engine to idle whilst the propeller is stationary and permits the propeller to be brought into or taken out of operation instantly when required, this facilitating the manoeuvring of the dinghy to which the outboard motor unit is applied. Furthermore by embodying the fuel tank in the casing as above described, the unit is rendered self-contained and compact and the fuel tank can be made of a rigid and robust construction unlikely to sustain material damage in ordinary use.

Finally, by arranging for the tiller bars to be stowable within the casing 9 as above described and for the attachment member 5 to be capable of being stowed below the casing 9 within the overall dimensions of the outboard motor unit, transport and storage of this unit is greatly facilitated.

I claim:

1. An outboard motor unit for boats, such unit comprising a hollow rigid casing formed in two complementary parts hinged together so that one of such parts may be opened relatively to the other part to give access to the latter part; fastening means for securing the said openable casing part in its closed position; a single cylinder two stroke water cooled internal combustion engine fixed on its side in the bottom of the said other casing part with its crank shaft arranged transversely of said bottom and aligned with a hole in the latter; a tank for the fuel for the said engine and formed integrally with the said openable casing part; a flexible pipe for supplying fuel from said tank to the said engine and permitting said openable casing part to be moved relatively to the other casing part without interrupting the flow of fuel to said engine; a clutch assembly connected to the lower end of the crank shaft of the said engine; a clutch housing for said clutch assembly and rigidly secured to the underside of the said other casing part and depending therefrom; a driving shaft depending downwards from the said clutch assembly and connected at its upper end to the latter; a tubular combined driving-shaft housing and cooling-water and exhaust gas discharge pipe, such housing being fixed at its upper end to, and depending from, the lower end of the said clutch housing to which it is rigidly secured; a propeller unit fixed to the lower end of the said driving-shaft housing; a propeller shaft journaled in said propeller unit at right angles to said driving shaft; transmission gearing between said driving shaft and propeller shaft; a propeller fixed on said propeller shaft; a water pump in said other casing part, said pump being driven by said engine and having its outlet connected to water cooling system of the latter; conduit means leading from the lower part of said driving-shaft housing to the inlet of said pump; controls for said engine and said clutch assembly

arranged externally of the said casing and clutch housing respectively; an attachment member adapted to be secured to the stern of a boat; a bearing sleeve in which the upper mid-portion of the said driving-shaft housing is coaxially journaled so as to be rotatable about the axis of the said driving shaft relatively to said sleeve, such bearing sleeve having its upper part connected to said attachment member for tilting movement about an axis forwardly offset from, and at right angles to, the said driving shaft; means for adjusting the angular relation between the said driving-shaft housing and said attachment member; means for locking the said bearing sleeve against tilting relatively to the said attachment means when the said propeller is in the astern position; and stowable tiller means for rotating the said casing and parts fixed thereto about the axis of the said driving shaft and relatively to the said attachment member.

2. An outboard motor unit for boats, such unit comprising a water-cooled internal combustion engine disposed with its crank shaft substantially vertical; a screw propeller remotely situated with respect to said engine; a driving shaft extending between said engine and said propeller; a hollow rigid casing including complementary upper and lower parts, said engine being rigidly secured in said lower casing part and said upper casing part being hinged to said lower casing part so that, when closed, it co-operates with said lower casing part to form a cover for, and enclose and protect, said engine; sealing means disposed between said upper and lower casing parts water-tightly to seal the same together; means for maintaining said upper casing part closed; a fuel tank rigidly carried by, and internally of, said upper casing part and adapted, when said upper casing part is closed, to lie above said engine; a flexible conduit extending between said fuel tank and said engine for conveying fuel to said engine and permitting the said upper casing part to be opened without interrupting the fuel supply to said engine; a tubular housing enclosing said driving shaft and rigidly connected to said lower casing part; a cooling water inlet port at the lower part of said housing; a cooling water circulating pump adapted to draw water in through said cooling water inlet port and to pass the same to the said engine to cool the latter; a bearing sleeve surrounding a portion of said tubular housing and in which the latter is, between its ends, rotatably journaled; and means for attaching said bearing sleeve, and thereby the whole unit, to the stern or transom of a boat.

3. An outboard motor unit according to claim 2, wherein there is provided, for facilitating the steering and manipulation of the said unit, at least one tiller bar telescopically slidable in said casing in a direction transverse to the axis of rotation of the unit and sealing means around said tiller bar to seal said casing.

4. An outboard motor unit according to claim 2, including a starter pulley freely mounted for rotation on the inside of said upper casing part; an internally toothed annular ratchet coaxially fixed to the engine crank shaft, said starter pulley and said ratchet being coaxial when the casing is closed; a spring retained pawl carried by said starter pulley and adapted, when the latter is rapidly rotated, to be urged by centrifugal force against the action of the spring into engagement with said ratchet thereby to

couple together said starter pulley and said crank shaft; a flexible starter cable attached to said pulley so that by pulling on the cable said starter pulley may be rapidly rotated; and a re-winding spring to re-wind said cable on to said starter pulley when the former is released.

5. An outboard motor unit according to claim 2, including a forwardly directed bracket on the said bearing sleeve and by which the latter is tiltably connected to the said attachment member, and a pivotal loop and a lug respectively provided on the said bracket and the said attachment member, such lug and loop being adapted for interengagement to support the said driving-shaft housing in an up-tilted position with respect to the said attachment member when desired.

6. An outboard motor unit according to claim 2, wherein the said pump is a diaphragm pump whose diaphragm is exposed to, and operated by, the cyclical variations of the pressure in the crank case of the said engine.

7. An outboard motor unit according to claim 6, including a manually operable back-pressure release valve for use when starting the engine of the unit and affording, at the upper end of the unit, an alternative discharge outlet for the engine exhaust gases and cooling water.

8. An outboard motor unit according to claim 7, including a propeller unit carried at the lower end of the said driving-shaft housing, such propeller unit comprising a housing, a propeller shaft journaled in this housing and extending transversely of the axis of the said driving shaft, such propeller shaft rigidly carrying a toothed gear meshing with another toothed gear driven by the said driving shaft; and a central thrust ball located between the front end of the said propeller shaft and the front end of the housing containing such shaft.

9. An outboard motor unit according to claim 2, including a clutch housing disposed between, and rigidly associated with, the bottom of said casing and the upper end of said driving shaft housing; a clutch assembly located in said clutch housing between said crank shaft and said driving shaft, said clutch assembly comprising a transmission shaft and two co-operating clutch parts, one fixed coaxially upon the lower end of the crank shaft of said engine and the other upon the transmission shaft which is coaxial with, and disposed between, said crank shaft and the said driving shaft and is fixed to the latter, and means for actuating the clutch from manually controlled operating means arranged externally of the clutch housing.

10. An outboard motor unit according to claim 9, wherein the said clutch assembly includes a male clutch part fixed to said transmission shaft and a female clutch part, in the form of a drum, fixed coaxially to said crank shaft; expandible

friction shoes carried by said male clutch part; friction shoe expanding means operable from the exterior of said clutch housing for expanding the said friction shoes into contact with said drum, and spring means for disengaging said shoes from said drum when the shoes are relieved of the action of said expanding means.

11. An outboard motor unit according to claim 10, wherein the said friction shoe expanding means includes a push rod slidable endwise in an axial bore in the said transmission shaft; means, operable from the exterior of said clutch housing, for moving said push rod in said endwise direction relatively to the said transmission shaft, a thrust element located in a lateral opening provided in said transmission shaft and leading to the bore of the latter, said thrust member being engaged with an oblique thrust surface on said push rod so as to be pushed radially outwardly with respect to said transmission shaft when the said push rod is moved in one endwise direction in said transmission shaft; an expanding cam for expanding said brake shoes; and a lever fixed at one end to the said cam and operable at the other end by said thrust member for expanding said friction shoes.

12. An outboard motor unit according to claim 11, wherein a thrust ball is arranged between the upper end of the said transmission shaft and the lower end of the engine crank shaft.

13. An outboard motor unit according to claim 12, wherein the said driving-shaft housing constitutes an exhaust pipe for the engine, the housing being in communication at its upper end with the exhaust port of the engine and having an exhaust opening at its lower end, an enshrouding tube being arranged around the said driving shaft within the housing for the latter and being sealed at its upper and lower ends respectively to the lower end of said clutch housing and in the lower end of said housing thereby to protect the said driving shaft from water and exhaust gases in the said housing.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,941,360	Mathias	Dec. 26, 1933
2,091,247	Williams	Aug. 24, 1937
2,204,750	Conover	June 18, 1940
2,224,900	Conover	Dec. 17, 1940
2,256,831	Karey	Sept. 23, 1941
2,346,148	Bosma	Apr. 11, 1944
2,460,419	Kincannon	Feb. 1, 1949
2,549,483	Kiekhaefer	Apr. 17, 1951
2,549,484	Kiekhaefer	Apr. 17, 1951
2,585,774	Robertson	Feb. 12, 1952

FOREIGN PATENTS

Number	Country	Date
985,118	France	Mar. 7, 1951