Sept. 3, 1940. A. RONNING 2,213,610

BOAT PROPULSION APPARATUS

Filed April 25, 1938 2 Sheets-Sheet 1

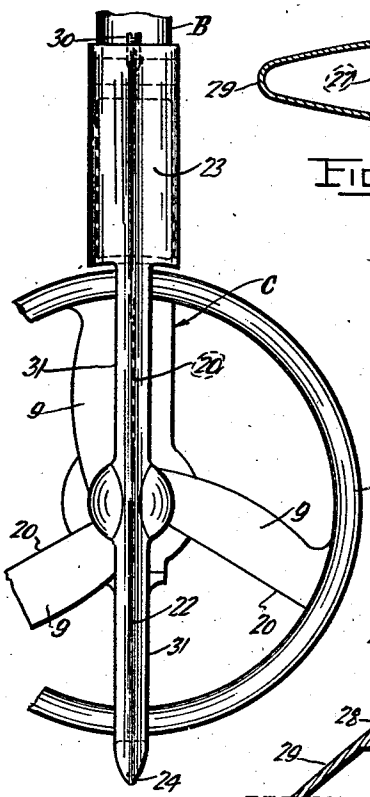

Fig. 2.

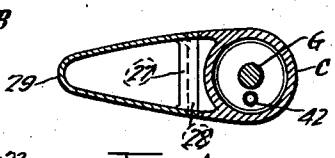

Fig. 4.

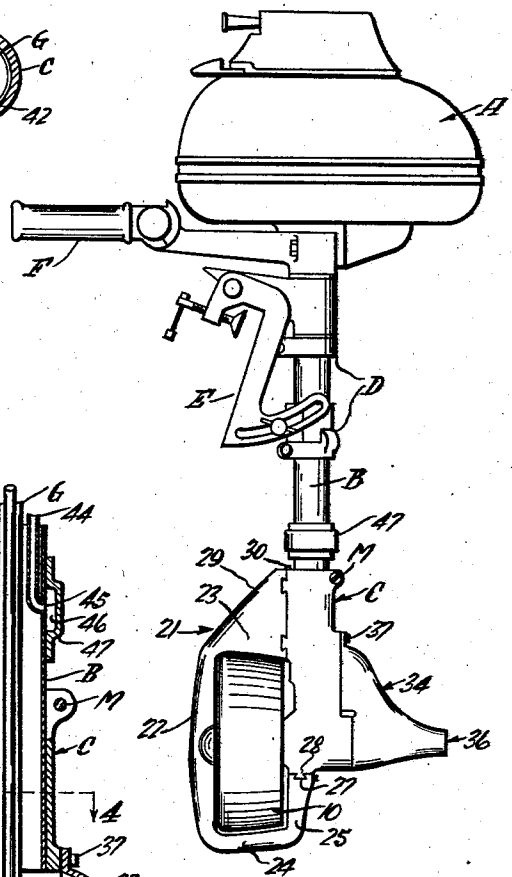

Fig. 1.

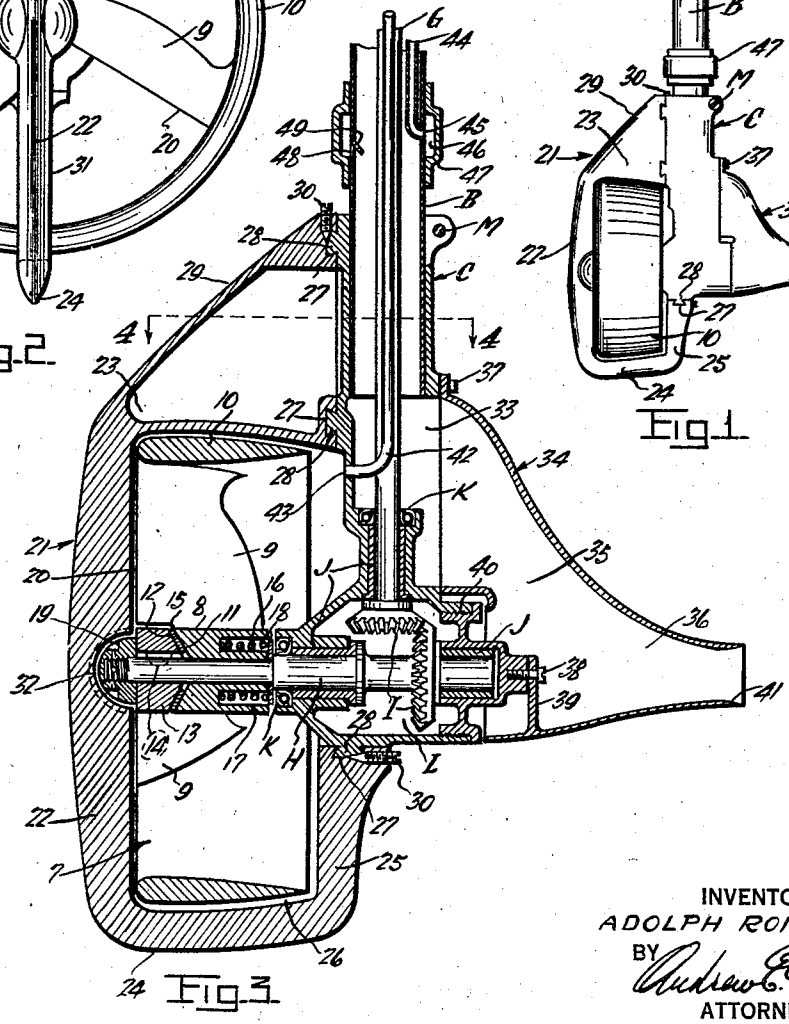

Fig. 3.

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BOAT PROPULSION APPARATUS

Filed April 25, 1938 2 Sheets-Sheet 2

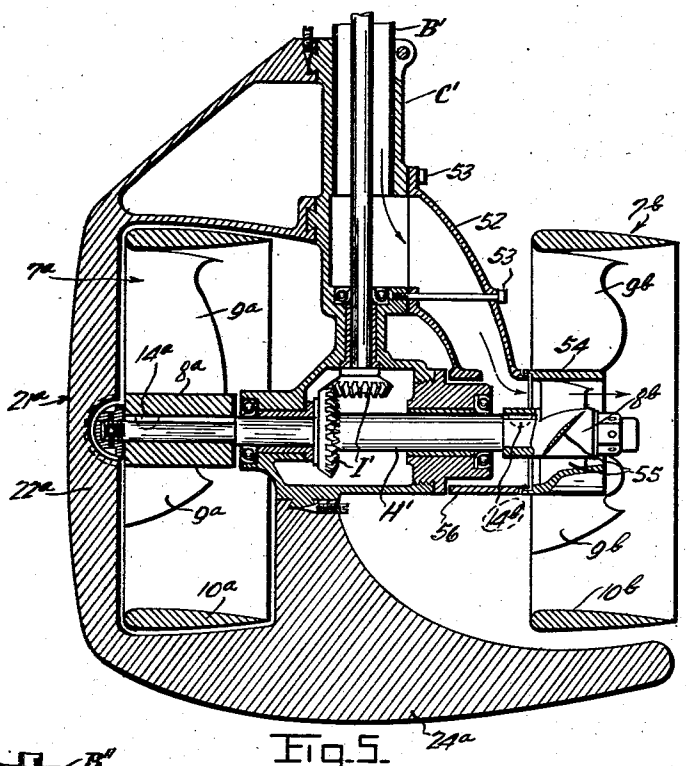

Fig. 5.

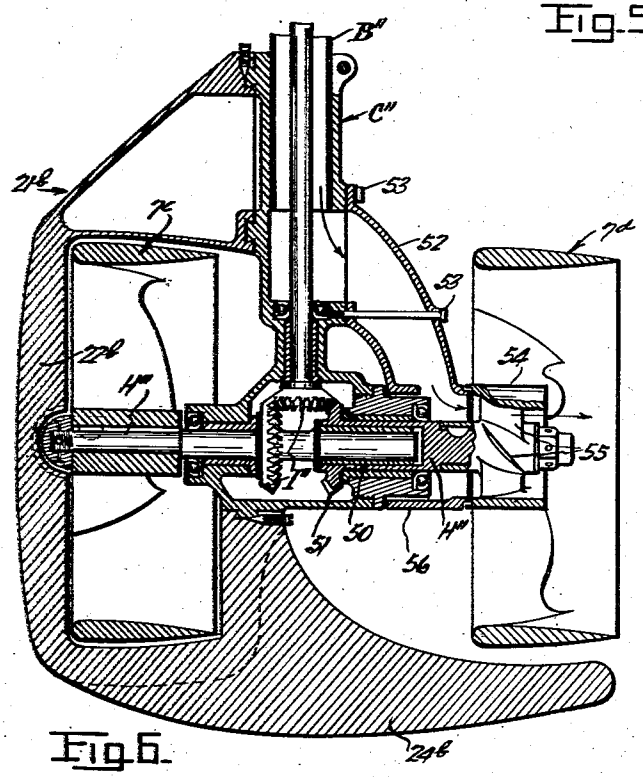

Fig. 6.

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UNITED STATES PATENT OFFICE

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BOAT PROPULSION APPARATUS

Adolph Ronning, Minneapolis, Minn.

Application April 25, 1938, Serial No. 204,061

1 Claim. (Cl. 115—17)

My invention relates to apparatus for the propulsion of boats and water craft of various kinds, and more particularly the invention provides improvements in the type of propulsion apparatus known generally as outboard motors.

Apparatus of this kind consists usually of a motor of the internal combustion type and a propeller which is supported by a standard from the motor and rotates on a substantially horizontal and fore and aft extended axis below the water. Also included as basic elements of the assembly are the water circulating system and exhaust discharge system for the motor, which systems are conveniently arranged to terminate in the transmission housing carrying the propeller in order that the cooling water may be circulated in a continuous stream picked up from, and returned to, the water surrounding the boat, and so that the exhaust gases may be discharged below water level for the purposes of reducing exhaust noises of the motor.

The primary object of my invention is to provide, in an apparatus of this kind, an improved propeller assembly wherein the propeller operates within the confines of a guard device which includes a forwardly disposed cutting bar extended across the frontal face of the propeller, and cooperating with cutting edges formed on the blades thereof in such manner that a shearing effect will be produced in order to enable the propeller to cut through weeds and other matter in the water which would otherwise become entangled in the propeller, and possibly stop or damage the same.

Another object is to provide, for a propeller assembly as described, a guard device which includes a rearwardly trailing foot member extending beneath the propeller in order to protect the same against contact with rocks or other obstructions in the water, and which further includes vertically disposed and relatively flat portions disposed edgewise to the directions of travel of the boat and apparatus in order to afford a rudder effect to facilitate steering.

Another object is to provide a propeller guard assembly of this kind which is arranged for convenient removal and replacement on the supporting parts of the assembly, by virtue of the use of dove-tailed connections for the guard and lock screws which normally prevent disengagement of these connections but which may be readily removed when it is desired to disengage the guard.

Another object is to provide an improved propeller for an apparatus of this nature, in which the propeller blades are enclosed around their outer ends by an annular rim of relatively wide material in order to thus substantially confine the water acted upon by the blades and cause all of said water to be urged rearwardly in order to obtain the maximum forward thrust from the blades.

Another, and important, object is to provide a multiple or tandem propeller assembly wherein two or more similar propellers are disposed one behind the other, and arranged to rotate in either the same, or opposite, directions. In either case the forward thrust and propelling power of the assembly is multiplied and, in the case of opposite rotation of the propellers, the usual lateral "creep" of the boat propelled by the apparatus is prevented. This lateral creep is occasioned ordinarily by the difference in water pressures and densities above and below the propeller, and the aforesaid rotation of the propeller will neutralize the effect to such extent as to prevent said creeping motion.

Another object is to provide a propeller assembly embodying a guard and weed cutting means as described, and wherein the propeller is driven through a friction type overload clutch of such nature as to allow the propeller to be automatically uncoupled from its driving shaft should the weeds or other larger material jam in the guard and prevent the propeller from rotating. Damage to the propeller from this cause is thus prevented, and the clutch is so arranged that the overload or pressure required to uncouple the propeller may be readily adjusted as may be required.

A further object of the invention is to provide a propeller, guard, and transmission assembly which may be supported readily from the standard depended from the motor, and which embodies means for the discharge of the exhaust gases of the motor rearwardly substantially along the axis of rotation of the propeller, or propellers, in order to take advantage of the suction existing behind the propeller for forcibly and effectively drawing the exhaust gases from the motor. This assembly further makes possible the use of a cooling water circulating system wherein no mechanical pump need be employed but, instead, the flow of the exhaust gases may be utilized to set up a suction sufficient to circulate the water.

Still a further object is to provide a novel assembly of this kind in which a rear bearing member for the propeller shaft is threaded in place to facilitate the assembling of the parts and which bearing member is then employed as the sup-

porting means for a duct element or outlet nozzle member which acts to conduct and discharge the exhaust gases rearwardly as described.

The foregoing and other objects, together with means whereby the same may be carried into effect will be best understood from the following detailed specification, reference being had to the accompanying drawings, wherein:

Fig. 1 is a side elevation of an outboard motor assembly embodying certain elements of my invention.

Fig. 2 is an enlarged frontal elevation of the lower portion of the apparatus of Fig. 1, showing the propeller and the weed cutting guard device.

Fig. 3 is an enlarged vertical and fore and aft cross section through the lower portion of the apparatus shown in Fig. 1.

Fig. 4 is a horizontal cross section along the the line 4—4 in Fig. 3.

Fig. 5 is a view similar to Fig. 3, but showing an assembly embodying tandem propellers rotating in the opposite direction.

Fig. 6 is a similar view but showing means for driving the tandem propellers in opposite directions.

It may be here noted that the present invention includes subject matter described and claimed in my copending application filed April 15th, 1938, and given Serial No. 202,258, to which application attention is invited for comparative purposes.

Referring now with more particularity to Figs. 1 through 4 of the drawings, A designates a conventional outboard motor which includes the tubular standard B for supporting the transmission unit or housing C and which standard is rotatably supported at D in a bracket E. This bracket E is used for clamping and supporting the entire assembly from the side, rear, or other part of the boat, and the rotatable support at D permits the entire assembly to be rotated about a vertical axis by means of the handle F for purposes of steering the boat. The bracket E also permits upward and rearward tilting of the assembly, and it will be assumed, for convenience in this description, that the motor operates ordinarily in the position shown with the standard B vertically disposed.

The drive shaft G of the motor A depends through the standard B and enters the transmission unit C where it is arranged to rotate the propeller shaft H by means of the bevel gears I. The drive and propeller shafts G and H are journaled in bearings J, and oil seals K are provided so that the chamber L may be oil filled for lubricating the parts. The transmission unit C is releasably secured on the lower end of the standard B by a clamp M, and is substantially tubular in form, terminating at its lower end in said chamber L and in the fore and aft extended bearings J. The propeller shaft H extends forwardly from this unit C, as shown.

The propeller 7 includes the hub 8, radially extended blades 9, and the annular rim 10 which is supported at the outer extremities of the blades concentrically with the hub. The said hub 8 is journaled freely on the forward end portion of the propeller shaft H, and has its frontal end 11 angularly and annularly beveled as shown, to engage the complementally beveled rear end 12 of a clutch collar 13 which is keyed at 14 on the shaft. A friction ring or washer 15 is interposed between the hub and collar, and an expansion coil spring 16 located in an annular recess 17 in the hub 8 is braced against a fixed washer 18 on the propeller shaft to normally and yieldably urge the propeller hub forwardly into frictional engagement with the clutch collar 13. This collar is retained in place by a nut 19 threaded on the frontal end of the propeller shaft H, and the tension of the spring 16, hence the driving effect of the clutch, may be varied by adjusting this nut. The frictional engagement between the hub 8 and the clutch collar 13 is sufficient, under normal load conditions, to cause the propeller 7 to rotate with the propeller shaft H. However, should the propeller be jammed or entangled by weeds or the like the clutch will release, allowing the shaft H to turn free without damaging either the propeller or driving parts.

The propeller rim 10 is widened parallel with the axis of rotation of the propeller, and is of forwardly rounded and rearwardly tapered across section shape in order to move through the center with very little resistance. The rim, thus formed, serves to prevent outward displacement of the water radially of the propeller due to action of the blades 9, and thus ensures that the water will be moved rearwardly with the greatest possible driving thrust thus secured from the propeller.

The frontal and leading edges 20 of the propeller blades 9 are extended straightly and radially, and are sharpened in order to have a cutting effect on weeds and the like with which the propeller might come in contact. To facilitate this cutting action, as well as to guard the propeller, I provide a guard frame or device designated generally at 21 made up of the integrally formed frontal guard and cutting bar 22, the upper and lower rearwardly turned portions 23 and 24, and the upwardly turned mounting portion 25 on the lower portion 24. The guard thus formed defines a substantially rectangular opening 26 in which the propeller 7 may readily rotate with its rim 10 just clearing the portions 23 and 24, and the cutting edges 20 of the blades 9 operating just behind the rear edge of the bar 22 which extends vertically and diametrically across the face of the propeller, as shown.

The guard 21 is removably mounted and supported on the transmission housing C by means of laterally extended dovetailed grooves 27 which receive complementary, laterally extended, dovetailed ribs or tenons 28 cast on the frontal and lower sides of the housing C. These connections, as shown in the drawings, are three in number, with one located at the upper extremity of the mounting portion 25 and two spaced along the rear end of the upper guard portion 23 which is widened rearwardly in a vertical direction to present the forwardly and downwardly sloping frontal edge 29. This construction also provides a substantial lateral surface or area which is of value in the rudder effect of the assembly necessary for steering the boat.

The upper and lower dovetailed connections 27—28 are provided with set screws 30 which are threaded in the guard 21 in such position that they may be turned into locking engagement with the ribs or tenons 28.

The guard may thus be slipped into place laterally, or from the side of the unit is a whole, and when located it may be locked by turning up the screws 30. By loosening these screws the guard may then be readily removed at any time. Preferably the grooves 27 and ribs 28 are tapered lengthwise in order to thus bind and more rigidly secure the guard in place.

The entire frontal and lower edge portion of the guard 21 is rounded, as indicated, in order to move through the water with little resistance, and the lateral rear edges 31 of the frontal or cutter bar 22 are sharpened in order to cooperate with the cutting edges 20 of the propeller blades. As a result there will be a shearing action between the blades 9 and this bar 22, such as will readily cut through weeds and the like which may be encountered in the water.

The bar 22 also serves as a guard to prevent injury to the propeller should it come in contact with an obstruction in the water, and the upper and lower portions 23 and 24 similarly serve to protect the propeller. The lower portion 24, or foot, will be of particular service to guide the propeller over obstructions. This protective function of the guard 21 is furthered and enhanced by the rim 10 which also serves to protect the blades 9.

The frontal bar 22 has a medially located and rearwardly opening recess 32 which provides clearance for the nut 19 at the end of the propeller shaft.

The exthaust gases from the motor A are carried down the tubular standard B until they reach the transmission housing C, where they may emerge from an opening 33 in the rear thereof. A nozzle member 34 is provided and has its large inlet or mouth portion mounted over this opening 33 so that the gases will flow rearwardly into the nozzle. The nozzle then has the downwardly turned offset portion 35 which carries the gases rearwardly, and finally discharges them through the rearwardly turned exhaust or discharge end 36 located exactly in line with the axis of rotation of the propeller 7. The nozzle is mounted as described, by means of a screw 37 which is screwed into the housing C above the opening 33 and by another screw 38 passed through a lug 39 in the lower part of the nozzle, and screwed into the rear bearing J. This rear bearing is screwed into the rear end of the housing C as shown at 40 in order that it may be removed when required to give access to the chamber L, and for assembling the gears I and shaft H. The screw 38 may be reached for removal and replacement through the discharge end 36 of the nozzle.

The forward movement of the assembly through the water, together with the rearward movement of the water by the propeller 7, will cause a suction to be exerted at the nozzle discharge end 36 such as will cause the exhaust gases to be rapidly and forcibly drawn from the engine and discharged into the water. This effect is enhanced by the Venturi-like action which takes place due to the outward flare at 41 of the inner surface of the nozzle at its discharge end. The advantageous effects and results of this exhausting of the gases have been pointed out in my copending application hereinbefore identified, and include the complete scavenging of the motor and the elimination of exhaust noises. It is also possible, due to this action and as detailed in my copending application, to eliminate the usual mechanical water pump by utilizing the flow of exhaust gases to circulate the cooling water.

For this purpose a water inlet pipe 42 is provided with an inlet at 43 for the water surrounding the housing C, and this pipe leads the water up to the cooling system of the motor A. The used water is then carried downwardly through an outlet pipe 44 which communicates at 45 with a chamber 46 which is formed around the standard B by an annular casing 47 affixed thereto. The water may enter the standard B from this chamber 46 through vents or ports 48 which have the downwardly and inwardly extended overhead guides or deflectors 49. The pipes 42 and 44 pass upwardly through the standard B as shown.

The foregoing arrangement is thus such that the downwardly rushing exhaust gases will strike the deflectors 49 to set up a Venturi-action resulting in a suction through the ports 48 sufficient to draw the water therefrom and cause a circulation of the water through the entire cooling system. The waste water is discharged, along with the exhaust gases, through the nozzles 34.

Referring now to Fig. 5, it is noted that I provide in the assembly therein a tandem propeller arrangement utilizing a frontal propeller 7^a and rear propeller 7^b both similar in construction and mounted on a common propeller shaft H'. The propellers comprise the hubs 8^a—8^b, the blades 9^a—9^b, and the annular surrounding rims 10^a—10^b and the frontal propeller 7^a operates within a guard 21^a substantially as hereinbefore described. However, the foot portion 24^a of this guard 21^a is extended rearwardly beneath the rear propeller 7^b in order to protect the same from obstruction in the water. The transmission housing C' is substantially the same as that previously described, and carries the drive shaft G' operating the propeller shaft H' through the gears I' and the propeller shaft extends both forwardly and rearwardly from the housing in order that the propellers may be mounted on opposite ends thereof, as shown. The propellers are keyed as at 14^a—14^b on the propeller shaft H', and no overload clutch is employed in the assembly shown, though it may be used if desired. The guard 21^a is mounted on the housing C' by the dovetailed grooves and tenons in exactly the manner hereinbefore described.

In the assembly shown, both propellers 7^a—7^b are rotated in the same direction, and the forward thrust thus afforded is approximately doubled. In Fig. 6 the assembly is substantially identical except that the propeller shaft H'' is divided into two sections which are journaled together by the pilot bearing 50. The beveled gears I'' drive the frontal shaft section and frontal propeller 7^c in one direction, while the rear shaft section and rear propeller 7^d are rotated in the opposite direction by a separate beveled gear 51 engaging the drive gear as shown. This action also substantially doubles the driving thrust over the single propeller assembly, and in addition, neutralizes "water spin" and prevents the lateral creeping of the boat which is caused by the differences in water resistance above and below the propellers.

The exhaust gases from the motors (not shown) in either of the assemblies of Figs. 5 and 6 are carried rearwardly and downwardly by duct members 52 secured by screws 53 over the openings in the rear of the housings C'—C'', and these ducts terminate in collars 56 which surround the propeller shafts H'—H''. The rear propeller hubs carry enlarged tubular drums 54 which rotate behind the collars 56, and in which fan blades 55 are radially disposed. These blades act, as the propellers rotate, to set up a suction to draw the gases rearwardly and discharge them

into the water behind the propellers, and the water circulating system may be the same as that hereinbefore described, or a mechanical water pump may be used if desired. This fan assembly for drawing the gases and other waste products outwardly is also disclosed in my copending application above referred to.

The frontal propellers 7^a—7^c in both Figs. 5 and 6 cooperate with the frontal bars 22^a—22^b of the guards 21^a—21^b to cut weeds or similar material in the water, and thus clear the way for the rear propellers, as will be understood. Of course, more than two propellers may be used in tandem if so desired.

It is understood that I may vary from the specific assemblies and structures herein described, provided that such variations fall within the scope of the appended claim. Having thus fully disclosed my invention, what I claim as new and desire to secure by Letters Patent is:

A boat propulsion apparatus comprising, a power driven propeller means, a supporting device for the propeller means, a guard frame, and dovetailed detachable mounting means supporting the guard frame from the supporting device in position for protecting the upper, frontal and lower sides of the propeller.

ADOLPH RONNING.