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MARINE PROPELLER FOR DISCHARGING ENGINE EXHAUST THROUGH THE PROPELLER HUB

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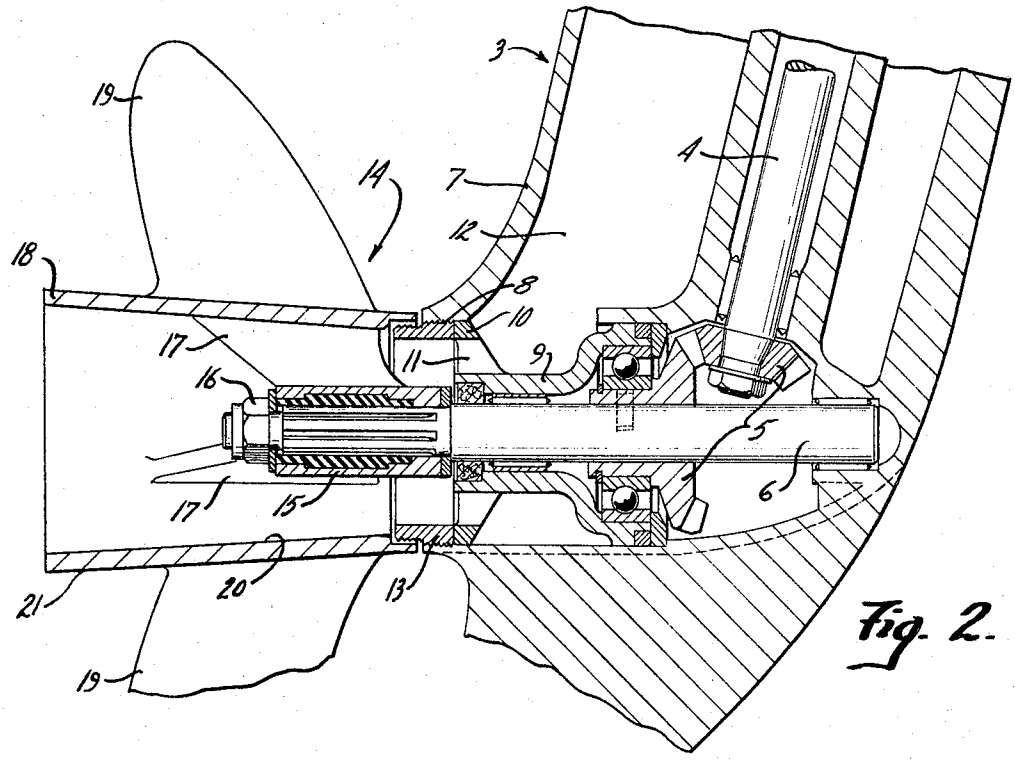


Fig. 2.

Fig. 1.

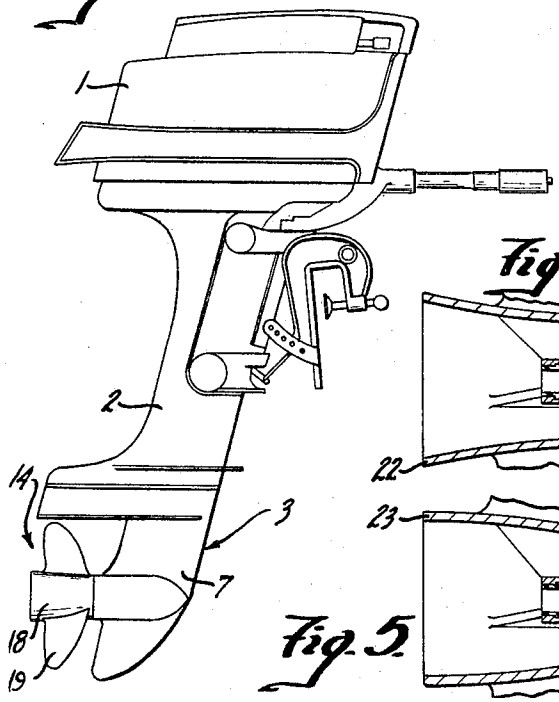
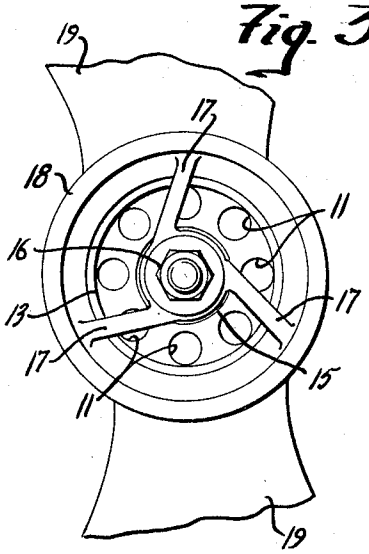


Fig. 4.

Fig. 5.

Fig. 3.



INVENTOR.

ELMER CARL KIEKHAEFER

BY

Andrus & Starke

Attorneys

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MARINE PROPELLER FOR DISCHARGING ENGINE EXHAUST THROUGH THE PROPELLER HUB

Elmer Carl Kiekhaefer, Winter Haven, Fla., assignor to Kiekhaefer Corporation, Fond du Lac, Wis., a corporation of Delaware

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This invention relates to a marine propeller for discharging engine exhaust through the propeller hub for marine propulsion devices. More particularly, the invention relates to a through-the-propeller exhaust system for outboard motors, stern drive units and the like.

Generally, such propellers have comprised a hollow hub casing member which supports the propeller blades for propelling a boat or other marine vehicle through the water. Exhaust from the engine is directed rearwardly through the annular casing for discharge into the water. An example of such a propeller is disclosed in Alexander Patent No. 2,948,252, issued August 9, 1960, entitled, "Propeller Hub Exhaust System," and assigned to a common assignee.

When marine propulsion units such as that shown in Patent No. 2,948,252 are left in the water in a generally vertical position between uses, water fills not only the propeller hub casing, but also flows forwardly into the lower portion of the exhaust passage of the lower housing and rises to the level of the water outside the unit. It has been discovered that when the motor is started up, some of the water in the housing exhaust chamber and its opening into the hub may not be discharged rearwardly. Although the amount of remaining water may be small, it is nevertheless undesirable since it may interfere with the exhaust gases which should be completely free to move from the housing into the hub.

The present invention solves the aforementioned problem. Generally, in accordance with the invention, the rotary hub casing which supports the propeller blades is formed to provide an internal passage of continuously increasing section rearwardly from the housing exhaust passage. More specifically, the inner annular walls of the casing are flared radially outwardly from front to rear.

The accompanying drawing illustrates the best mode presently contemplated by the inventor for carrying out the invention.

In the drawing:

FIGURE 1 is a side elevation of an outboard motor which incorporates the present invention therein;

FIG. 2 is an enlarged central vertical axial section of the lower portion of the motor which is normally underwater, and showing details of the hub exhaust system;

FIG. 3 is an end elevation of the propeller hub unit;

FIG. 4 is a longitudinal section of a casing showing a second embodiment thereof; and

FIG. 5 is a longitudinal section of a casing showing a third embodiment thereof.

As shown in the drawing, the concept of the invention may be applied to an outboard motor having an engine enclosed by a cowl 1, which is supported at the upper end of a drive shaft housing 2, and a lower normally submerged underwater unit 3. The engine drive shaft 4 extends downwardly through housing 2 into unit 3 and is coupled as by gears 5, to a generally horizontal propeller shaft 6.

Shaft 6 is suitably mounted for rotation in the lower housing portion 7 of unit 3 and extends rearwardly through a threaded opening 8 in housing portion 7. A spool-shaped annular member 9 serves as a central support for shaft 6. Member 9 has an annular flange 10

which is mounted in opening 8, with the flange being provided with a plurality of circumferentially spaced openings 11 which permit rearward discharge of exhaust gases from an exhaust passageway 12 leading downwardly through housing portion 7 from the engine. Such gases are thus directed through opening 8 of housing portion 7.

An annular retaining ring 13 is threaded into opening 8 and abuts flange 10. Ring 13 is adapted to receive the forward end portion of a propeller assembly 14. As shown, assembly 14 comprises a central sleeve 15 mounted on the rear end of propeller shaft 6 by an intermediate rubber drive member and secured as by a nut 16. A plurality of circumferentially spaced longitudinally straight struts 17 extend radially and generally tangentially outwardly from sleeve 15 and support an annular outer hub member or casing 18 which is concentric with sleeve 15. A plurality of propeller blades 19 extend outwardly from casing 18. The casing itself extends rearwardly substantially beyond the blades.

During operation of the engine of the outboard motor, shaft 4 drives shaft 6 which in turn rotates propeller assembly 14 to propel the motor and its associated vehicle through the water. During such movement, exhaust gases from the engine will pass downwardly through passage 12, through openings 11 disposed in flange 10, and hence through the hollow casing 18 of the hub to be discharged into the slip stream of the propeller.

Since the underwater unit 3 is normally submerged, the water which fills the inside of housing 7 should be displaced during operation to provide for freedom of movement of exhaust gases from passage 12 through openings 11 and hub casing 18. In accordance with the present invention, means are provided to cause all of the water disposed adjacent and rearwardly of the housing opening to be fully discharged through the propeller hub.

For this purpose, and as best shown in FIG. 2, hub-casing 18 is formed to have an internal annular wall or surface 20 which is straight and which flares or diverges radially outwardly from near the front end thereof and throughout the major portion of its length. Surface 20 is shown as being frusto-conical, and expands continuously from front to rear so that each circumferential portion thereof is of a larger diameter than any portion disposed forwardly thereof. When the propeller is rotated, either in a forward or reverse direction, centrifugal force will cause all water within hub casing 18, from opening 8 to the rearmost portion thereof, to flow radially outwardly and rearwardly. Since the outwardly diverging surface 20 provides a rearward component of force when the radially outwardly moving water impinges on it, the water will flow rearwardly and out of the casing. No pocket of water can form within the hub of the propeller since there are no converging surfaces on the interior of casing 18. In addition, water in the passageway 12 and in the vicinity of openings 11 will be drawn away therefrom. The rearward flow of exhaust gases will be completely free of obstruction by water and will be initially aided by the vacuum effect of the discharging water.

The propeller hub casing shown in FIG. 2 is of uniform thickness and thus has an outer surface 21 which is also frusto-conical and which diverges continuously from front to rear. This slight taper of the outer casing surface prevents cavitation in the vicinity of propeller blades 19 by densifying water in this region. Propeller efficiency is therefore increased.

Second and third embodiments of a hub casing are shown in FIGS. 4 and 5 and are also constructed in accordance with the principles of the present invention. In the embodiment of FIG. 4, the inner surface of the casing 22 is provided with a curved flare and the rate of flare varies by increasing from front to rear, as contrasted with a continuous rate of flare of casing 18. In the embodi-

ment of FIG. 5, the inner surface of the casing **23** is also provided with a curved flare, but the rate of flare varies by decreasing from front to rear. In both embodiments, however, the circumference of each section of the inner surface increases rearwardly. In addition, casings **22** and **23** are shown as having walls of uniform thickness so that the outer surfaces thereof follow the contour of the inner surfaces, as in the embodiment of FIG. 2.

The structure of the invention increases the efficiency of marine propulsion devices in a simple, yet important manner.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims and particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. A reversible propeller unit for an internal combustion engine driven marine propulsion device in which the exhaust gases are discharged rearwardly through the hub of the propeller, comprising:

(a) a sleeve for mounting upon a drive shaft extending rearwardly through the exhaust discharge opening of a hollow underwater unit of the device,

(b) a hollow hub casing concentric with said sleeve and spaced therefrom,

(c) a plurality of spaced longitudinally straight generally radial struts disposed generally tangential to said sleeve and extending from said sleeve to said casing,

(d) and propeller blades extending outwardly from said casing,

(e) said casing having a continuously rearwardly flared inner surface with its smaller end adapted to be disposed adjacent the housing exhaust opening and with its larger end extending rearwardly of said blades.

2. A reversible propeller unit for an internal combustion engine driven marine propulsion device in which the exhaust gases are discharged rearwardly through the hub of the propeller unit, comprising:

(a) a sleeve for mounting upon a drive shaft extending rearwardly through the exhaust discharge opening of a hollow underwater unit of the device,

(b) a hollow hub casing concentric with said sleeve and spaced therefrom,

(c) a plurality of spaced longitudinally straight generally radial struts disposed generally tangential to said sleeve and extending from said sleeve to said casing,

(d) and propeller blades extending outwardly from said casing,

(e) said casing having a frusto-conical outer surface with its smaller end forward of said blades and its larger end rearwardly of said blades.

3. For use with a marine propulsion device having a hollow underwater housing with a rearwardly directed engine exhaust opening therein, drive means disposed within said housing and extending through said opening: a rotatable reversible propeller unit secured to said drive means, said propeller comprising:

(a) a hollow annular hub casing adapted to be disposed at its forward end adjacent said housing opening to provide for free discharge of exhaust gases therethrough,

(b) propeller blades extending outwardly from said casing,

(c) and means for connecting said casing to said drive means to provide rotation thereof, said connecting means including a sleeve and a plurality of longitudinally straight struts disposed tangential to said sleeve and extending from said sleeve to said casing,

(d) said hub casing having a curved rearwardly flared surface forming the inner wall of said casing and diverging radially outwardly at a varying rate and continuously throughout its length from closely adjacent said housing opening and rearwardly to the end of the casing to cause discharge by centrifugal force of all water disposed in said casing during rotation thereof in either direction.

4. For use with a marine propulsion device having an underwater housing with an engine exhaust opening therein, and having drive means disposed within said housing adjacent said opening: a rotatable reversible propeller assembly for attachment to said drive means, said assembly comprising:

(a) a hollow annular hub casing adapted to be disposed at its forward end adjacent said housing opening to provide for free discharge of exhaust gases therethrough,

(b) propeller blades extending outwardly from said casing,

(c) and means for connecting said casing to said drive means to provide rotation thereof, said connecting means including a sleeve and a plurality of longitudinally straight struts disposed tangential to said sleeve and extending from said sleeve to said casing,

(d) said casing having a generally frusto-conical surface forming the inner wall of said casing and diverging radially outwardly continuously throughout its length from closely adjacent to said housing opening and rearwardly to the end of the casing to cause discharge by centrifugal force of all water disposed in said casing during rotation thereof in either direction,

(e) said casing being of uniform thickness to thereby form a continuously radially outwardly flared frusto-conical outer surface which tends to prevent cavitation in the area of said blades.

5. For use with a marine propulsion device having an underwater housing for an engine exhaust opening therein, and having drive means disposed within said housing adjacent said opening; a rotatable reversible propeller unit for attachment to said drive means, said propeller comprising:

(a) a hollow annular hub casing adapted to be disposed at its forward end adjacent said housing opening to provide for free discharge of exhaust gases therethrough,

(b) propeller blades extending radially from said casing,

(c) and means for connecting said casing to said drive means to provide rotation thereof, said connecting means including a sleeve and a plurality of longitudinally straight struts disposed tangential to said sleeve and extending from said sleeve to said casing,

(d) said casing having a frusto-conical inner surface for the major length of said casing and extending to the rear end thereof.

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MILTON BUCHLER, *Primary Examiner.*

ANDREW H. FARRELL, FERGUS S. MIDDLETON, *Examiners.*