July 24, 1956 C. F. ALEXANDER 2,755,764

OUTBOARD MOTOR WATER INLET STRUCTURE

Filed Dec. 23, 1954 2 Sheets-Sheet 1

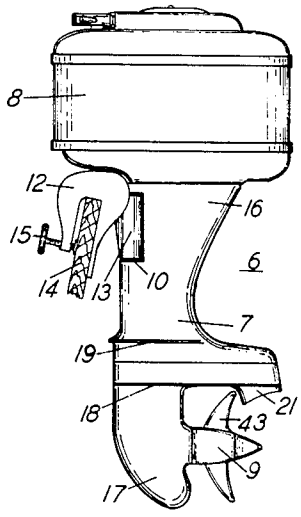


FIG. 1.

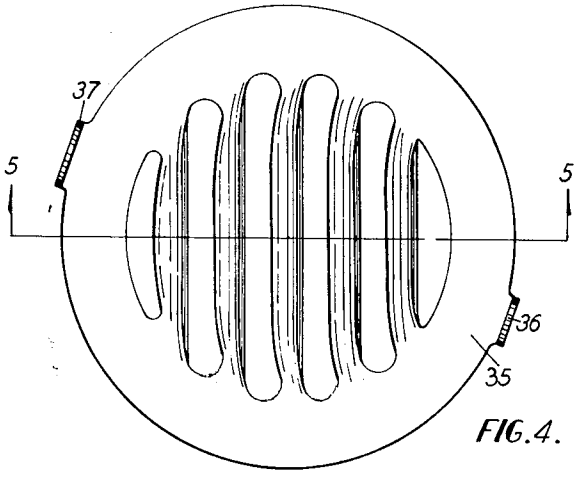


FIG. 4.

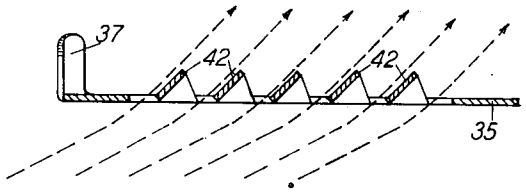


FIG. 5.

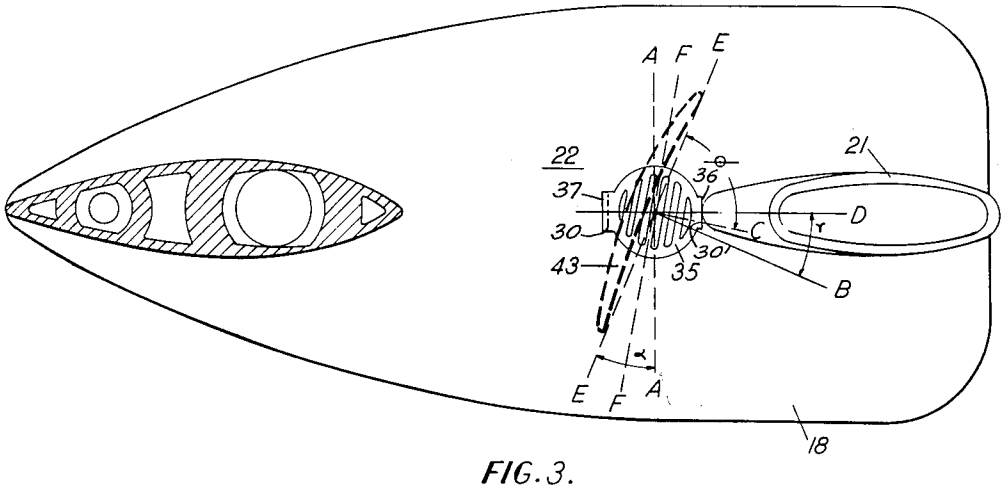


FIG. 3.

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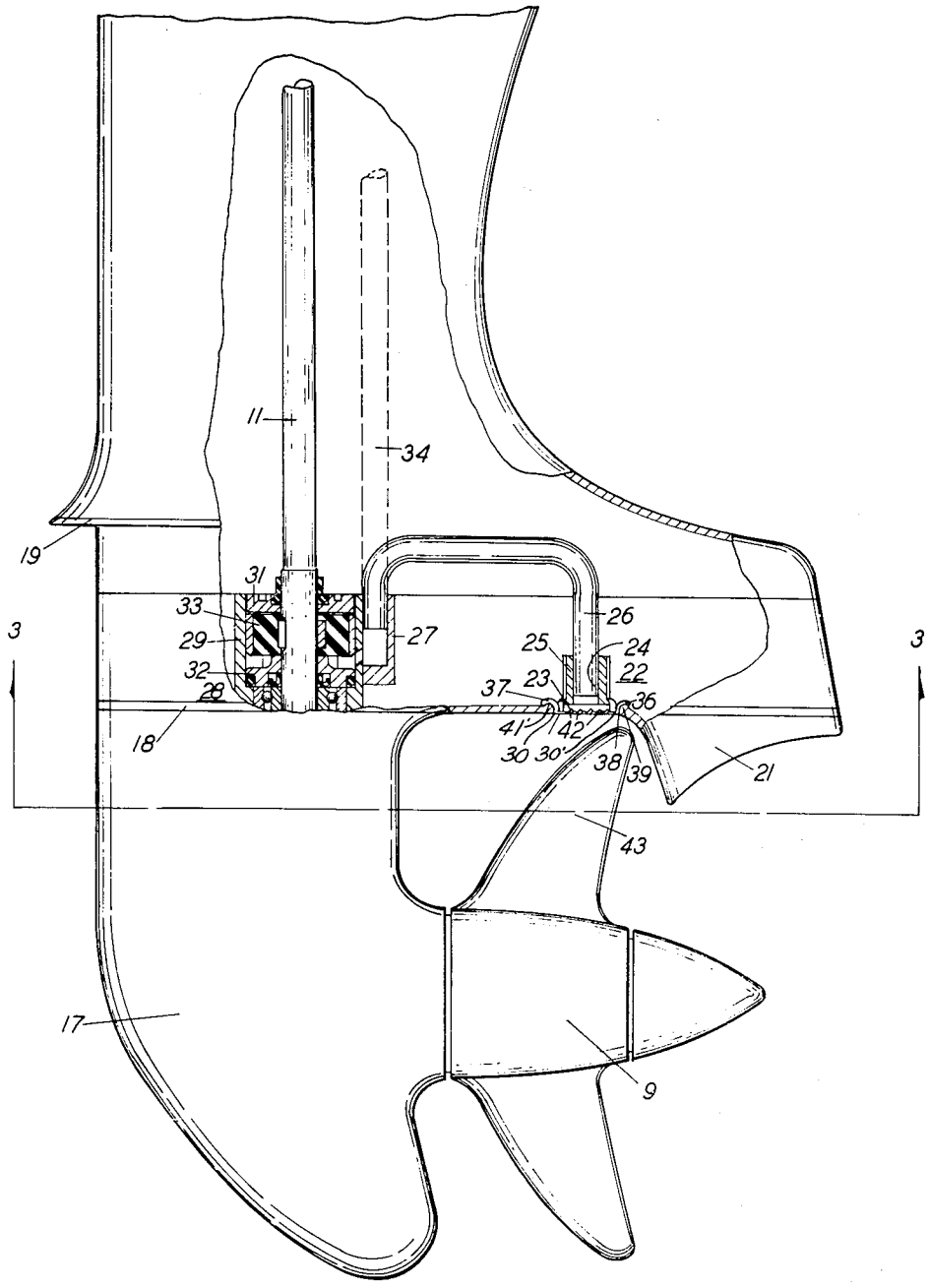


FIG. 2.

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OUTBOARD MOTOR WATER INLET STRUCTURE

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4 Claims. (Cl. 115—17)

This invention relates generally to outboard motors and more specifically to an improved cooling water inlet means for an outboard motor.

Several requirements for an ideal cooling water inlet means for an outboard motor are: (1) that it be positioned so as to be free of any weeds or other foreign matter ending to obstruct the flow of water therein; (2) that it provide a sufficient supply of cooling water to the engine during sustained reverse operation of the outboard motor such as is encountered in commercial fishing operation; and (3) that it provide a sufficient supply of cooling water to the engine during surface pitch operation of the outboard motor, that is where the motor is employed with the propeller partially out of water with the blades thereof successively entering the water at a given angle according to their pitch. Applicant's improved cooling water inlet means more nearly achieves these foregoing objectives than any prior known structure.

It is therefore an object of the present invention to provide a cooling water inlet means for an outboard motor positioned above the propeller.

Another object of the invention is the provision of a cooling water inlet means for an outboard motor that coacts with the propeller to provide the engine with sufficient cooling water under surface pitch operation conditions.

Another object of the present invention is the positioning of a cooling water inlet of an outboard motor above the propeller so that the propeller will act to assist the entry of water into the opening.

Another object of the invention is to provide an improved cooling water inlet means that is more weedless in operation than any prior known water inlet structure.

Another object of the invention is the provision of an improved cooling water inlet means for an outboard motor that provides sufficient cooling water to the engine during sustained reverse operation.

Another object of the invention is to provide an improved cooling water inlet means for an outboard motor having a grid or screen adapted to direct or scoop the water into the inlet structure.

Another object of the invention is to provide an improved cooling water inlet means adapted to direct a larger quantity of water therein at a higher pressure than any prior known water inlet structure of comparable size.

Another object of the invention is the provision of an improved cooling water inlet means for an outboard motor having a grid or screen forming turning vanes having axes disposed generally perpendicular to the propeller slip stream to direct or scoop the water into the water inlet means.

Objects and advantages other than those set forth above will be obtained from the following description when read in connection with the accompanying drawing, in which:

Fig. 1 is a side elevation view of an outboard motor embodying the invention;

Fig. 2 is an enlarged fragmentary elevation view shown partially in section of a portion of the outboard motor shown in Fig. 1 embodying the invention;

Fig. 3 is a section view taken along line 3—3 of Fig. 2 showing a cooling water inlet and grid therefor;

Fig. 4 is an enlarged view of the cooling water inlet grid shown in Fig. 3; and

Fig. 5 is a section view taken along line 5—5 of Fig. 4 having arrows showing how the water is directed through the turning vanes of the grid.

As shown in the drawings, a preferred embodiment of this invention is illustrated as applied to an outboard motor 6 having a drive shaft housing 7 and a power head 8 mounted on the drive shaft housing 7 for imparting rotation to a propeller 9 through a drive shaft 11 and propeller shaft, not shown, as is well known in the art.

Attachment means comprising a clamp bracket 12 and a swivel bracket 13 is provided for attaching the outboard motor 6 pendently to the transom 14 of a boat, not shown. The clamp bracket 12 carries a clamping screw 15 at the lower end adapted to engage the inside of the transom 14 to clamp the transom 14 between the end of the screw 15 and a portion of the clamp bracket 12.

The swivel bracket 13 of the attachment means is pivotably connected to the clamp bracket 12 by means of a horizontal bolt, not shown, and is further pivotably mounted to the housing 7 by means of a longitudinal rod 10. The drive shaft housing 7 comprises an upper casing 16 formed by a single piece casting having an upper flared region, an intermediate convergent region, and a lower shoe portion which extends outwardly and rearwardly and is inclined slightly downwardly with respect to the intermediate region of the upper casing 16. A lower casing shown as a gear housing 17 comprising a generally L-shaped single piece casting is secured to the lower shoe portion of the upper casing 16 by any suitable means such as studs and bolts, not shown. The gear housing 17 contains an anti-cavitation plate 18 cast integrally therewith and a splash guard 19 cast integrally with the upper casing 16 of the drive shaft housing 7 which serves to deflect the upwardly traveling spray created by the gear housing 17 cutting through the water. The upper portion of the gear housing 17 is provided with an exhaust snout 21 extending beneath the lower face of the anti-cavitation plate 18 so as to overhang the propeller 9 and is a downward continuation of the shoe portion of the upper casing 16. The exhaust snout 21 and its opening is directed angularly downwardly and rearwardly with respect to the propeller 9 whereby the slip stream of the propeller 9 causes an outward suction at the opening thereof causing an aspirating effect on the exhaust gases being expelled therethrough.

The cooling water inlet means 22 comprises a circular opening, although any other shape may be used, disposed in the anti-cavitation plate 18 of the gear housing 17 above the propeller 9. In this location, weedless operation of the outboard motor 6 is assured since any weeds or foreign matter tending to obstruct the opening are cleared away therefrom by the cutting action of the propeller tip 9 which in operation just clears the opening. The water inlet 22 leads into a cavity 23 which is provided with a water outlet 24 formed by a boss 25. A tube 26 connects the outlet 24 of the cavity 23 to the water inlet 27 of a pump 28 which comprises an outer casing 29 having opposite end walls 31, 32 to form a pump chamber as is well known in the art. An impeller 33 is mounted within the pump chamber on the drive shaft 11 which extends through the end walls 31, 32 with the impeller 33 eccentric to the pump casing 29 to provide for flexing of the impeller vanes and the operation of the pump 28 upon rotation of the drive shaft 11. The pump 28 has an outlet passage extending from the pump 28 and communicating with an upwardly extending conduit 34

shown in dotted lines for carrying the cooling water to the motor 6.

In accordance with the invention, the water inlet 22 is covered by a grid 35 or screen comprising a disc having diametrically opposed fingers 36, 37. The gear housing 17 is provided with an annular recess 38 into which the grid 35 is disposed with the outer surface of the grid 35 flush with the lower surface of the anti-cavitation plate 18. In assembly, the grid 35 is secured to the gear housing 17 by slipping the grid 35 over the opening in the water inlet 22 with the fingers 36, 37 mating with corresponding slots 30, 30' in the housing 17. The fingers 36, 37 are bent over ridges 39, 41 formed by the gear housing 17 to firmly secure the grid 35 to the housing 17. One of the fingers of the grid 35 and corresponding slot 30 of the housing 17 is made of greater width to insure securement of the grid 35 to the housing 17 in only one way. The grid 35 is further provided with a plurality of louvers shown as longitudinal turning vanes 42 in which no part of each of the turning vanes 42 extends below the plane defined by the anti-cavitation plate 18. The turning vanes 42 are inclined approximately 45 degrees with respect to the plane of the anti-cavitation plate 18 to provide efficient scooping of the water into the water inlet cavity 23. The action of the turning vanes 42 develops a positive water pressure in the cavity 23 during operation of the outboard 6.

The rotating, forwardly moving blade 43 of the propeller 9 in water in its uppermost vertical position, as shown in Fig. 3 moving with respect to the anti-cavitation plate 18 along the line A—A, imparts a theoretical force to the water as indicated by the line B that is normal to the approximate plane E—E defined by the tip of the propeller blade 43, neglecting the curvature of the blade 43. This force would tend to impart movement to the water leaving the blade 43 in the same direction, that is, normal to the plane E—E. In actual practice, however, the actual water flow from the propeller blade 43 or propeller slip stream tends to follow a spiral path rearwardly of the propeller and would have a component observable in a plane parallel to the anti-cavitation plate which would assume the direction indicated by the arrow C due to water resistance, forward movement of the motor, etc. making an angle theta (θ) with the plane E—E of the propeller blade 43 that is slightly less than 90 degrees. The angle θ of the slip stream further varies with the speed, being more nearly 90 degrees at low speed and approaching the angle formed between the plane E—E of the propeller blade 43 and the arrow D where the arrow D represents the theoretical direction of the water approaching the blade 43. The slip stream, therefore, varies through an angle approximately equal to the theoretical included angle gamma (γ) defined by the arrows B and D as the speed of the outboard varies from zero to maximum. To provide effective cooling, the grid 35 is secured to the gear housing 17 so that the longitudinal axes of the turning vanes 42 are disposed to be perpendicular to a slip stream which substantially bisects the included angle γ. This slip stream is formed at some predetermined intermediate engine speed by the propeller blade 43 in its uppermost vertical position. Stated in another way, for optimum performance of the water inlet the axes of the turning vanes 42 are positioned so that a line F—F parallel to the axes thereof would bisect the included angle alpha (α) formed by a line parallel to the anti-cavitation plate 18 and lying within the plane E—E of the propeller tip and the arrow A which angle α is equal to the angle γ. Since the grid 35 is positioned to be most effective when the slip stream is in the center range of the included angle γ, at low and high speeds, the axes of the turning vanes 42 will not be perpendicular to the propeller slip stream resulting in a corresponding slight reduction in effectiveness of the turning vanes. 42. This reduction in efficiency is not great enough to prevent adequate cooling of the engine for all operating conditions including surface pitch operation.

In operation, the action of a propeller blade 43 when in the uppermost vertical position imparts movement to the water thereon forming a slip stream flowing generally upwardly toward the anti-cavitation plate 18 and the grid 35 at a slight angle thereto and slightly rearwardly at an angle less than 90 degrees with respect to the plane E—E of the propeller blade 43. The water in the slip stream from the propeller 9, as indicated by the arrows in Fig. 5, moves toward the anti-cavitation plate 18 and the grid 35 at a slight angle thereto and is scooped into the cavity 23 by the action of the turning vanes 42 which are inclined thereto.

Although but one embodiment has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. An outboard motor comprising: a casing, a propeller shaft journaled in said casing, a propeller secured to said shaft and having a tip portion, said casing having a portion above said propeller having an opening forming a cooling water inlet, and a grid covering said opening and having a turning vane disposed so that its longitudinal axis is substantially perpendicular to a propeller slip stream developed at a predetermined intermediate engine speed bisecting an included angle gamma defined by the intersection in a first plane of a line parallel to the axis of said propeller shaft and a line perpendicular to a second plane defined by said propeller tip portion in its uppermost vertical position.

2. An outboard motor comprising: a casing, a propeller shaft journaled in said casing, a propeller secured to said shaft, said casing having a portion forming a cooling water inlet opening above said propeller and in register therewith, said portion of said casting defining a pair of slots adjacent said opening, a grid having a pair of fingers peripherally depending therefrom and adapted to engage said slots to secure said grid to said opening to cover same, and a turning vane formed by said grid and disposed so that its longitudinal axis is substantially perpendicular to a propeller slip stream developed at a predetermined intermediate engine speed bisecting an included angle gamma defined by the intersection in a first plane of a line parallel to the axis of said propeller shaft and a line perpendicular to a second plane defined by said propeller tip portion in its uppermost vertical position.

3. The invention of claim 2 wherein one of said fingers and corresponding slot are of greater width to assure securement of said grid in only one position.

4. An outboard motor comprising: a casing, a propeller shaft journaled in said casing, a propeller secured to said shaft and having a tip portion, said casing having a portion above said propeller forming a cooling water inlet opening, and a grid covering said opening and having water deflecting means disposed so that its longitudinal axis is substantially perpendicular to a propeller slip stream developed at a predetermined intermediate engine speed bisecting an included angle gamma defined by the intersection in a first plane of a line parallel to the axis of said propeller shaft and a line perpendicular to a second plane defined by said propeller tip portion in its uppermost vertical position.

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