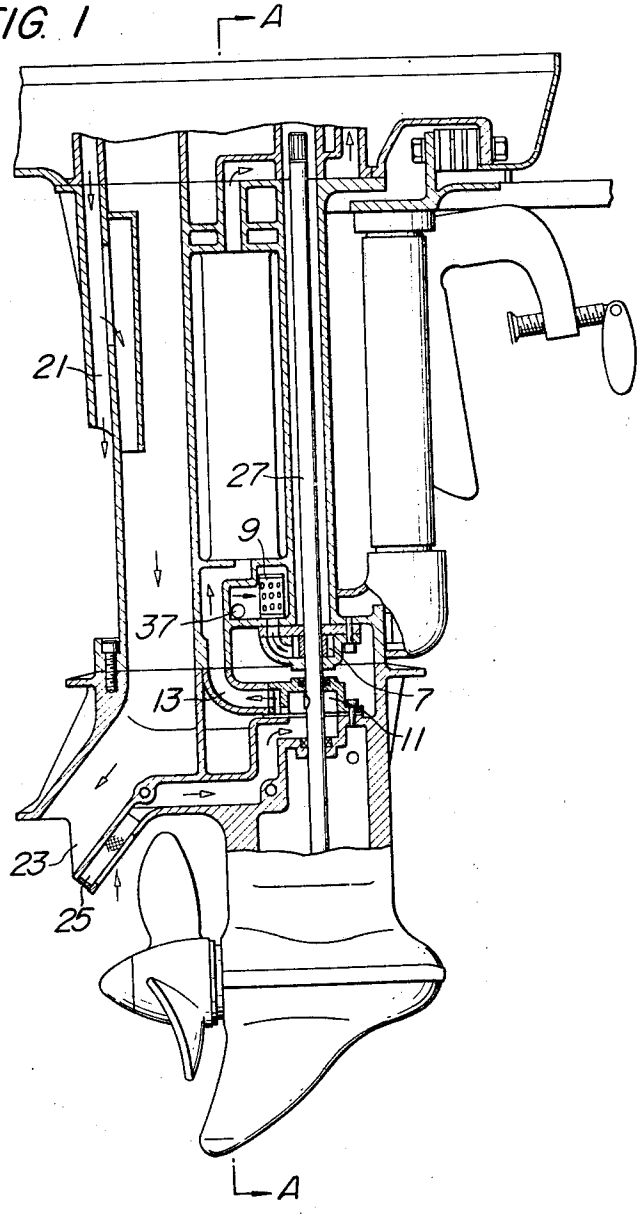
Feb. 3, 1970 HIROSHI TADO 3,493,081

OUTBOARD PROPULSION APPARATUS

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FIG. 1



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FIG. 2

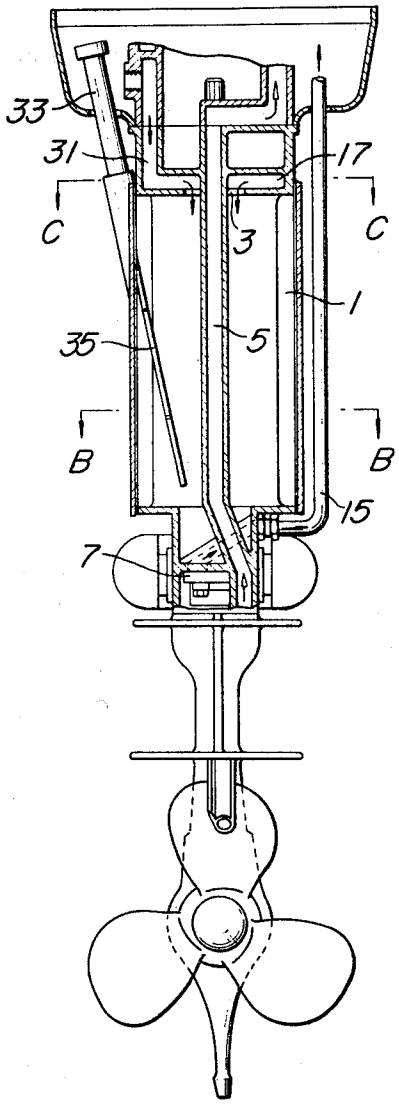


FIG. 3

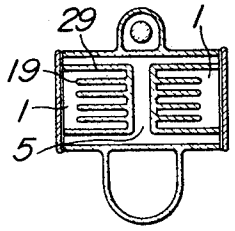
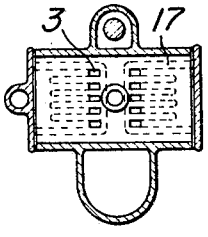


FIG. 4



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3,493,081

OUTBOARD PROPULSION APPARATUS

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Continuation of application Ser. No. 430,685, Feb. 5, 1965. This application Jan. 26, 1968, Ser. No. 701,013
Claims priority, application Japan, Apr. 18, 1964, 39/30,056
Int. Cl. F01m 5/00; F02d 13/00; F28d 1/06
U.S. Cl. 184—104 1 Claim

ABSTRACT OF THE DISCLOSURE

An outboard propulsion apparatus having an internal combustion engine driving an output member, and a closed housing disposed between the engine and the output member. An oil sump is formed in at least the bottom portion of the housing, and is divided into two sections by means of a water jacket extending vertically through a central portion of said housing. A plurality of cooling fins are disposed adjacent the water jacket and extend into the sections of the sump so that oil is cooled as it passes from the engine, over the fins, and into the sump.

This application is a continuation of Ser. No. 430,685, filed Feb. 5, 1965 and now abandoned.

The present invention relates to outbord propulsion apparatus of the type having an engine which requires the provision of a lubricating oil sump and a lubricating oil cooler.

It is widely acknowledged that simplification of cooling and lubricating oil systems for the engine in outboard propulsion apparatus of the type described offers many advantages including the reduction of the volume and weight of the apparatus with attendant reduction in the cost and simplified structure and procedure for operation.

The primary object of the persent invention is to provide an outboard propolsion apparatus of the type described which is provided with a lubricating oil sump and a lubricating oil cooler of simplified structure.

In order to attain the above-described object, the present invention proposes an outboard propulsion apparatus of the type described which comprises means for providing a lubricating oil sump in a space in an intermediate body portion of said apparatus, means for defining a water jacket section vertically centrally of said lubricating oil sump so as to divide said oil sump substantially into two sections, cooling fins provided in said lubricating oil sump at positions adjacent said water jacket section, and means for circulating cooling water through said water jacket section, whereby cooling water passing through said water jacket section, can cool the lubricating oil in said lubricating oil sump. This arrangement is particularly advantageous for simplification of the structure and reduction of the volume of the outboard propulsion apparatus because the lubricating oil sump can also function as a lubricating oil cooler. Further, incorporation of the lubricating oil sump in the intermediate body portion of the outboard propulsion apparatus offers additional advantages in respect of simplification of equipment of the engine part of ships and added stability when installed on ships due to the lowered center of gravity.

Other objects and particularities of the present invention will become obvious from the following description with reference to the following drawings, in which:

FIG. 1 is a side elevational view partly in vertical section of the outboard propulsion apparatus according to the present invention in which the engine is not shown because it is not directly related with the invention;

FIG. 2 is a section taken substantially on the line A—A in FIG. 1;

FIG. 3 is a section taken on the line B—B in FIG. 2; and

FIG. 4 is a section taken on the line C—C in FIG. 2.

Referring to the drawings, the outboard propulsion apparatus of the present invention includes a lubricating oil sump 1 which is disposed in a space in an intermediate body portion of the apparatus. Partitions 29 divide the oil sump 1 substantially into two sections to define therebetween a central water jacket section 5. The two sections of the oil sump 1 are arranged to communicate with each other at their upper and lower ends. A cooling water pump 11 and a lubricating oil pump 7 are coaxially mounted on a driving shaft 27.

Cooling water is drawn by the cooling water pump 11 through a strainer screen 25 in a cooling water suction port disposed rearwardly of the propeller and fed through a cooling water conduit 13 connected to the discharge port of the pump 11 into the water jacket section 5. While passing through the water jacket section 5, the cooling water cools lubricating oil in the oil sump 1 through the partitions 29 and cooling fins 19 provided on the oil sump sides of the partitions 29 and is fed upwardly into the engine (not shown) to cool the same. After having cooled the engine, the greater portion of the cooling water is discharged outwardly of the apparatus from a discharge port 21 disposed at a rear part of the apparatus while the remaining small portion of water is discharged together with engine exhaust from the apparatus through an exhaust port 23 at a lower part of the apparatus.

On the other hand, lubricating oil is filtered clean by an oil filter 9 disposed below the bottom of the oil sump 1 and drawn into the lubricating oil pump 7 disposed at a lower part of the intermediate body portion of the apparatus. In FIG. 2, the lubricating oil discharged from the lubricating oil pump 7 is fed through an oil conduit 15 into the engine. After having lubricated and cooled the engine, the lubricating oil drains downwardly from the engine to pass through an oil discharge port 31 at an upper part of the intermediate body portion of the apparatus into a chamber 17. Then, the lubricating oil passes through communication openings 3 bored in the bottom of the chamber 17 to return into the oil sump 1 while draining downwardly along the cooling fins 19. It will be evident that the aforedescribed flow arrangement of oil relative to cooling water results in a highly effective heat transfer between the respective liquids. Specifically, the oil flowing downwardly from conduit 31 and through openings 3 is caused to flow along the height of sump 1 along the fins 19 which obviously divide the mass of oil into a plurality of vertically extending layers. Further, the fact that the oil flows downwardly while the cooling water flows upwardly provides a condition of counter-current flow. The resulting counter-current flow, as heretofore described, provides optimum conditions of heat transfer between the oil and water. Thus, the rate and overall capacity for heat transfer are increased and the cooling effect is enhanced. According to the usual practice, the apparatus is provided with an oil filling port 33, an oil inspection rod 35 and an oil discharge plug 37.

What is claimed is:

1. An outboard propulsion apparatus having an internal combustion engine driving an output member, wherein the improvement comprises a closed housing disposed between said engine and said output member, an oil sump formed in at least a portion of said housing, a water jacket section extending vertically through a central portion of said housing and dividing said sump into two sections to each side of said jacket, a plurality of cooling fins adjacent said water jacket section and extending into the sections

of said sump, means to direct said oil to move from said engine, downwardly over said fins and into said sump, and means for circulating cooling water upwardly through said water jacket section and into said engine to cool the oil during said movement and to then cool the engine, wherein said closed housing and said output member are disposed below said combustion engine, and wherein said oil is moved downwardly from said engine, downwardly over said fins, and into said sump, and wherein said water jacket section includes partitions from which said cooling fins extend inwardly into said oil sump section.

References Cited

UNITED STATES PATENTS

1,844,386 2/1932 Harris et al.
3,180,270 4/1965 Arnts et al.

LAVERNE D. GEIGER, Primary Examiner
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