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Strang

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[54] **LOW PROFILE OUTBOARD WITH IN-LINE ENGINE**

[75] Inventor: **Charles D. Strang,** Lake Forest, Ill.

[73] Assignee: **Outboard Marine Corporation,** Waukegan, Ill.

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Related U.S. Application Data

[63] Continuation of Ser. No. 330,596, Feb. 8, 1973, abandoned.

[52] **U.S. Cl.** ..... **115/18 R**

[51] **Int. Cl.²** **B63H 5/13**

[58] **Field of Search** ..... 115/12 R, 17, 18 R; 123/1, 123/195 P

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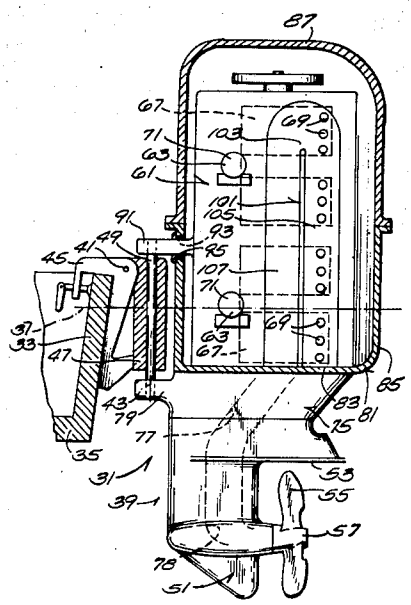
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Primary Examiner—Trygve M. Blix
Assistant Examiner—Jesus D. Sotelo
Attorney, Agent, or Firm—Michael, Best & Friedrich

[57] **ABSTRACT**

An outboard motor comprising a propulsion unit adapted to be attached to the transom of a boat for vertical swinging movement relative to the transom about a horizontal tilt axis and for steering movement relative to the transom about a steering axis extending transversely of the tilt axis. The propulsion unit comprises a lower unit including an exhaust gas discharge outlet normally located underwater, a powerhead assembly rigidly fixed to the top of the lower unit and including an engine with a plurality of vertically in-line cylinders each including an exhaust port, together with an exhaust gas discharge system including an inverted "U" shaped passageway comprising an upper junction portion located above the at-rest water level when the outboard motor is boat mounted, a first leg extending downwardly from the junction portion and communicating with at least one of the exhaust ports, and a second leg extending downwardly from the junction portion and separately from the first leg and communicating with the lower unit underwater exhaust gas discharge outlet. Also included in the disclosed outboard motor is an upwardly open water guard which extends upwardly from above the lower unit, in watertight encircling relation to the engine, to above the at-rest water level.

9 Claims, 2 Drawing Figures



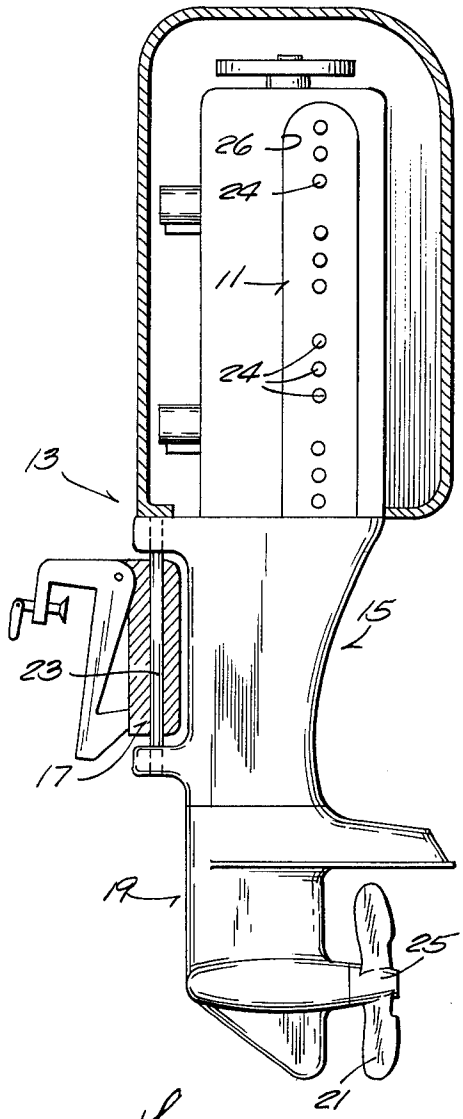

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Fig. 1

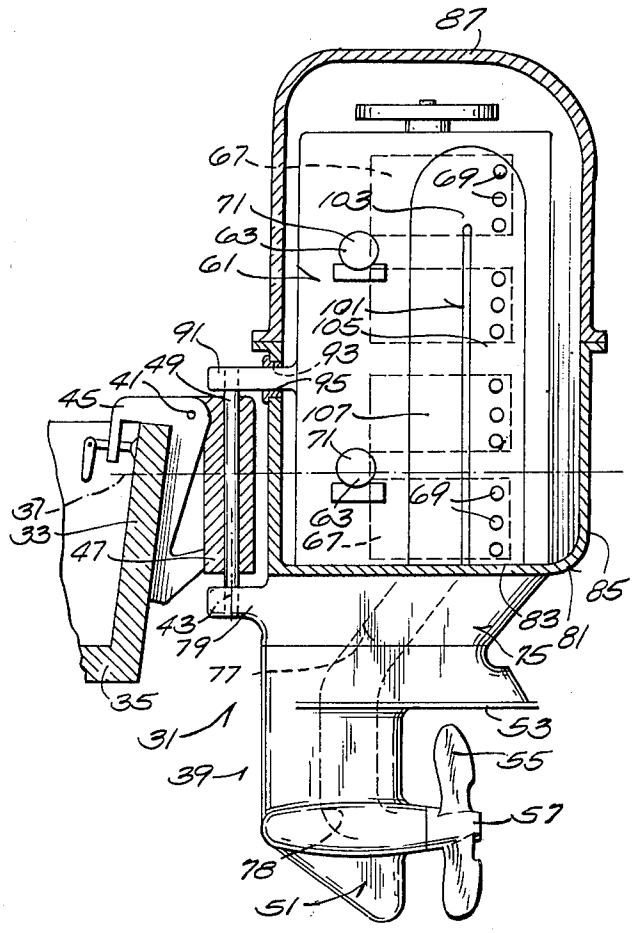

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Fig. 2

LOW PROFILE OUTBOARD WITH IN-LINE ENGINE

This application is a continuation of my application Ser. No. 330,596 filed Feb. 8, 1973 now abandoned.

BACKGROUND OF THE INVENTION

The invention relates generally to outboard motors and particularly to outboard motors including multi-cylinder engines. The invention has particular significance to in-line engines including four or more cylinders, but is not limited to such in-line engines.

In conventional commercial construction, as illustrated in FIG. **1**, the engine or powerhead **11** of an outboard motor **13** is rigidly attached to the upper end of a drive shaft housing **15** which normally extends from above to below a swivel bracket **17** and which, at its lower end, is rigidly connected to a lower unit **19** carrying a propeller **21.** The drive shaft housing **15** is normally connected to the swivel bracket **17** for steering movement relative thereto through a king pin **23** which is pivotally carried by the swivel bracket **17** and connected to the drive shaft housing **15** through suitable vibration isolating mounts. Exhaust gas from the exhaust ports **24** of the engine combustion chambers or cylinders is directed through a downwardly open vertically extending exhaust passage **26** and through the drive shaft housing **15** to an underwater discharge outlet **25.**

This prior construction results in location of the powerhead about 15 to 20 inches above the at-rest water level and advantageously serves to keep water out of the engine cylinder exhaust ports and carburetor inlets. However, this construction also suffers from the disadvantages of a high center of gravity and an ungainly appearance.

Attention is also directed to the prior Holterman U.S. Pat. No. 3,613,631, issued Oct. 19, 1971.

SUMMARY OF THE INVENTION

The invention provides a low profile, low center of gravity outboard motor including a multi-cylinder engine. More particularly in accordance with the invention, there is provided a propulsion unit in which the lowermost combustion chamber or cylinder in the powerhead is located adjacent to or below the at-rest water level when the outboard motor is boat mounted (and preferably below the at-rest water level) together with an exhaust gas discharge system which includes an inverted "U" shaped passageway with a junction portion located above the normal at-rest water level when the outboard motor is boat mounted (and preferably substantially above). The inverted "U" shaped passageway further includes a first leg extending downwardly from the junction portion and communicating with the exhaust ports and a second leg communicating with the junction portion separately from the first leg and extending downwardly and in communication with and underwater exhaust gas discharge outlet.

Also in accordance with the invention there is provided a bucket or water guard which extends upwardly from adjacent the bottom of the powerhead in watertight, encircling relation to the powerhead to above (and preferably substantially above) the at-rest water level when the outboard motor is boat mounted.

Thus in accordance with the invention, even though the powerhead is located relatively low, entry of water into the engine exhaust ports or into the carburetor air inlets is prevented by one or both of the water guards and the inverted "U" shaped exhaust gas discharge passageway.

One of the principal objects of the invention is the provision of a low profile and low center of gravity outboard motor having a multi-cylinder in-line engine.

Another of the principal objects of the invention is the provision of an outboard motor engine which is supported at a substantially lower level than heretofore and which includes means for preventing entry of water into the engine notwithstanding its relatively low position.

Another of the principal objects of the invention is the provision of an outboard motor which includes an engine supported at a substantially lower level than heretofore and which further includes a water guard in encircling, watertight relation to the engine.

Another of the principal objects of the invention is the provision of an outboard motor which includes an engine supported at a substantially lower level than heretofore and which further includes means for preventing entry of water into the engine exhaust ports through the exhaust gas system.

Other objects and advantages of the invention will become known by reference to the following description, claims and drawings.

THE DRAWINGS

FIG. **1** is a side elevational view, partially in section, of a prior art outboard motor.

FIG. **2** is a side elevational view, partially in section, of an outboard motor embodying various of the features of the invention.

Before explaining the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts set forth in the following general description or illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

GENERAL DESCRIPTION

Shown in FIG. **2** is an outboard motor **31** which is attached to the transom **33** of a boat **35.** The line **37** indicates the at-rest water level or line relative to the boat **35** and motor **31.** Of course, the waterline is subject to vertical fluctuation in response to wave motion, etc.

The outboard motor **31** includes a propulsion unit **39** and means connected to the propulsion unit and adapted to be attached to the boat transom **33** for affording vertical swinging movement of the propulsion unit **39** relative to the transom **33** about a horizontal tilt axis **41** and for affording steering movement of the propulsion unit **39** relative to the transom **33** about a steering axis **43** extending transversely of the tilt axis **41.** In the illustrated construction, such means comprises a transom bracket **45** adapted to be attached to the boat hull **35,** together with a swivel bracket **47** pivotally connected to the transom bracket **45** about the horizontal tilt axis **41.** In turn, the propulsion unit **39** is pivotally connected to the swivel bracket **47** for common vertical swinging movement with the swivel bracket relative to the transom bracket **45** and for horizontal swinging movement relative to the swivel bracket **47** about the

steering axis **43** provided by a king pin **49** extending transversely of the tilt axis **41**.

The propulsion unit **39** comprises a conventional lower unit **51** including a cavitation plate **53**, a rotatably mounted propeller **55**, and an underwater exhaust gas discharge outlet **57** which, in the illustrated construction, is provided in the propeller **55**. Alternatively, the outlet **57** could be provided elsewhere in the lower unit.

In accordance with the invention, there is rigidly connected to the lower unit **51** a powerhead assembly or engine **61** including an engine block and associated equipment, as for instance one or more carburetors. In the illustrated construction, the engine **61** includes four in-line combustion chambers or cylinders **67**, each including one or more exhaust ports **69**, all of which ports are generally vertically aligned. In addition, the illustrated engine **61** has associated therewith two vertically spaced carburetors **63**, each including an air inlet **71**.

While the powerhead assembly or engine **61** can be rigidly mounted directly to the lower unit **51**, in the illustrated construction, there is rigidly fixed between the powerhead assembly or engine **61** and the lower unit **51** a relatively thin adaptor plate **75** which includes an exhaust passage **77** communicating with an exhaust passage **78** which is located in the lower unit **51** and which terminates at the exhaust gas discharge outlet **57** at the rear of the propeller **55**. Extending forwardly from the adaptor plate **75** is a bracket **79** which is connected to the lower end of the king pin **49**.

As can be readily appreciated from FIG. **2**, the lower most of the combustion chambers or cylinders **67** is substantially entirely below the at-rest water level and the lower one of the carburetors **63**, as well as the second from the bottom one of the cylinders **67** are located only slightly above normal at-rest water level, and in the absence of any protective means, would be subject to immersion in water.

Accordingly, as the lower cylinders **67** and the lower carburetor **63** are located adjacent to or below the at-rest water level, in accordance with the invention, means are provided for preventing immersion of the lower part of the engine **61** in water and for preventing entry of water into the engine **61** through the exhaust gas ports **69**.

While various arrangements can be employed to prevent at least partial immersion of the engine **61** in the water, in the illustrated construction, there is provided an upwardly open water guard or bucket **81** including a bottom wall **83** rigidly sandwiched between the adaptor plate **75** and the powerhead **61**. The water guard **81** also includes a nonapertured continuously extending tubular portion or housing portion **85** which extends upwardly from the bottom wall **83** in watertight encircling relation to the engine or powerhead assembly **61** to a level above the at-rest level, and preferably substantially above the at-rest water level, so as to thereby provide a dam which prevents water from reaching the engine **61** even though a portion of the engine is located below the at-rest water level and even though there is vertical variation in the at-rest water level due to wave motion.

At its upper end, the water guard **81** is adapted to removably receive an engine cover **87**.

As shown in FIG. **2**, the upper end of the king pin **49** is connected directly to the powerhead assembly or engine **61** by a bracket **91** extending through a slot or aperture **93** in the water guard **81**. In this regard, there is also provided a boot or seal **95** which extends between the bracket **91** and the water guard **81** to prevent entry of water.

If desired, the water guard **81** could be non-slotted and the bracket **91** could extend directly from the water guard **81** to the king pin **49** as the water guard **81** extends rigidly from the connection of the engine **61** to the lower unit **51**.

Referring to the lower bracket **79**, the adaptor plate **75** could be omitted (with the engine **61** being directly converted to the lower unit **51**) and the lower bracket **79** could extend directly from the powerhead assembly or engine **61** through a slot (not shown) in the water guard **81** with a suitable watertight seal or boot (not shown) interposed between the bracket **79** and the water guard **81**. Under such circumstances the bottom of the water guard **81** would be sandwiched directly between the lower unit **51** and the powerhead assembly or engine **61**.

Furthermore, the water guard **81** need not include the bottom wall **83** so long as the lower end of the water guard **81** is suitably attached in watertight relation to the lower unit **51**, or to an adaptor, such as the adaptor plate **75**, or to a bottom portion of the powerhead assembly or engine **61**, in such manner as to prevent entry of water through the mounting.

Suitable vibration isolators (not shown) can be utilized between the king pin **49** and the powerhead assembly or engine **61** so as to reduce noise and vibration transmission from the engine **61** to the king pin **49** and thence to the boat hull **35**.

Entry of water into the lower engine cylinders **67** through the exhaust ports **69** is prevented, in accordance with the invention, by valveless means in the form of an inverted "U" shaped exhaust passageway **101** which includes an upper junction portion **103** located above, and preferably substantially above, the at-rest waterline. Extending downwardly from the junction portion **103**, is a first passageway leg **105** which communicates with the exhaust ports **69** of the lower cylinders **67**. The leg **105** can also extend above the junction portion **103** to communicate with the exhaust ports **69** of the upper cylinder **67**. Also extending downwardly from the junction portion **103**, and separately from the first leg **105**, is a second passageway leg **107** which communicates through the exhaust passage **77** on the adaptor plate **75** with the exhaust passage **78** in the lower unit **51** and with the exhaust discharge outlet **55**. Thus, water entering into the exhaust system can enter into the exhaust ports **69** only by overflowing through the relatively elevated junction portion **103** of the exhaust passageway **101**. As this junction portion **103** is located above the at-rest water level, entry of water into the engine **61** through the cylinder exhaust ports **69** from the exhaust gas discharge system is normally prevented.

Various of the features of the invention are set forth in the following claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An outboard motor comprising a propulsion unit, means connected to said propulsion unit and adapted to be attached to the transom of a boat for affording vertical swinging movement of said propulsion unit relative to the transom about a horizontal tilt axis and for

affording steering movement of said propulsion unit relative to the transom about a steering axis extending transversely of said tilt axis, said propulsion unit comprising a lower unit including an exhaust gas discharge outlet normally located underwater, a powerhead assembly rigidly fixed to the top of said lower unit and including an engine with a plurality of vertically in-line cylinders each including an exhaust port, and an exhaust gas discharge system including an inverted "U" shaped passageway comprising an upper junction portion located above the at-rest water level when the outboard motor is boat mounted, a first leg extending downwardly from said junction portion and communicating with at least one of said exhaust ports, and a second leg extending downwardly from said junction portion and separately from said first leg and communicating with said lower unit underwater exhaust gas discharge outlet.

2. An outboard motor comprising a transom bracket adapted to be attached to the transom of a boat, a swivel bracket adapted to be connected to said transom bracket for vertical swinging movement about a horizontal tilt axis, a propulsion unit connected to said swivel bracket for common vertical swinging movement relative to said transom bracket and for steering movement relative to said swivel bracket about a steering axis extending transversely of said tilt axis, said propulsion unit comprising a lower unit including an exhaust gas discharge outlet normally located underwater, a powerhead rigidly fixed to the top of said lower unit and including an engine with a plurality of vertically in-line cylinders each including an exhaust port and with the lowermost of said exhaust ports being located adjacent to or below the at-rest water level when the outboard motor is boat mounted, a water guard extending upwardly from the bottom of said powerhead in watertight encircling relation to said powerhead to above the at-rest water level when the outboard motor is boat mounted, and an exhaust gas discharge system including an inverted "U" shaped passageway comprising an upper junction portion located above the at-rest water level when the outboard motor is boat mounted, a first leg extending downwardly from said junction portion and communicating with at least one of said exhaust ports, and a second leg extending downwardly from said junction separately from said first leg and communicating with said lower unit underwater exhaust gas discharge outlet.

3. An outboard motor comprising a propulsion unit, means connected to said propulsion unit and adapted to be attached to the transom of a boat for affording vertical swinging movement of said propulsion unit relative to the transom about a horizontal tilt axis and for affording steering movement of said propulsion unit relative to the transom about a steering axis extending transversely of said tilt axis, said propulsion unit comprising a lower unit including an exhaust gas discharge outlet normally located underwater, a powerhead assembly rigidly fixed to the top of said lower unit and including an engine with a plurality of combustion chambers each including an exhaust port, and an exhaust gas discharge system communicating between said exhaust ports and said exhaust gas discharge outlet and including an inverted U-shaped portion preventing entry of water through said exhaust gas discharge system into said combustion chambers under normal conditions.

4. An outboard motor comprising a propulsion unit, means connected to said propulsion unit and adapted to be attached to the transom of a boat for affording vertical swinging movement of said propulsion unit relative to the transom about a horizontal tilt axis and for affording steering movement of said propulsion unit relative to the transom about a steering axis extending transversely of said tilt axis, said propulsion unit comprising a lower unit including an exhaust gas discharge outlet normally located underwater, a powerhead assembly rigidly fixed to the top of said lower unit and including an engine with a plurality of combustion chambers each including an exhaust port, and an exhaust gas discharge system communicating between said exhaust ports and said exhaust gas discharge outlet and including valveless means located upstream of said exhaust gas discharge outlet for preventing entry of water through said exhaust gas discharge system into said combustion chambers.

5. An outboard motor comprising a propulsion unit, means connected to said propulsion unit and adapted to be attached to the transom of a boat for affording vertical swinging movement of said propulsion unit relative to the transom about a horizontal tilt axis and for affording steering movement of said propulsion unit relative to the transom about a steering axis extending transversely of said tilt axis, said propulsion unit comprising a lower unit including an exhaust gas discharge outlet normally located underwater, a powerhead rigidly fixed to the top of said lower unit and including an engine with a plurality of combustion chambers each including an exhaust port with the lowermost of said exhaust ports being located adjacent to or below the at-rest water level when the outboard motor is boat mounted, an exhaust gas passageway communicating between said exhaust ports and said exhaust gas discharge outlet and including an inverted U-shaped portion preventing entry of water through said passageway and said ports into said combustion chambers, and a water guard extending upwardly from the bottom of said powerhead in watertight encircling relation to said powerhead to above the at-rest water level when the outboard motor is boat mounted.

6. An outboard motor comprising a propulsion unit, means connected to said propulsion unit and adapted to be attached to the transom of a boat for affording vertical swinging movement of said propulsion unit relative to the transom about a horizontal tilt axis and for affording steering movement of said propulsion unit relative to the transom about a steering axis extending transversely of said tilt axis, said propulsion unit comprising a lower unit including an exhaust gas discharge outlet normally located underwater, a powerhead rigidly fixed to the top of said lower unit and including an engine with a plurality of combustion chambers each including an exhaust port with the lowermost of said exhaust ports being located adjacent to or below the at-reast water level when the outboard motor is boat mounted, an exhaust gas passageway communicating between said exhaust ports and said exhaust gas discharge outlet and including valveless means upstream of said exhaust gas discharge outlet for preventing entry of water through said passageway and said ports into said combustion chambers, and a water guard extending upwardly from the bottom of said powerhead in watertight encircling relation to said powerhead to

above the at-rest water level when the outboard motor is boat mounted.

7. An outboard motor comprising a propulsion unit including a lower unit including an exhaust gas discharge outlet normally located underwater and a propeller normally located at least partially in the water, said propulsion unit also including a power head rigidly fixed to the top of said lower unit and including an engine having an exhaust port, said propulsion unit also including an exhaust gas discharge system communicating between said exhaust port and said exhaust gas discharge outlet and including valveless means upstream of said exhaust gas discharge outlet for preventing entry of water through said exhaust gas discharge system into said engine, a bracket adapted to be attached to the transom of a boat, a king pin having upper and lower ends, means connecting said king pin to said bracket to afford vertical swinging movement of said king pin relative to the transom about a horizontal tilt axis, means connecting said king pin upper end to said powerhead, and means connecting said king pin lower end to said lower unit, said means connecting said king pin to said engine, to said lower unit, and to said bracket affording steering movement of said propulsion unit relative to the transom about a steering axis extending transversely of said tilt axis.

8. An outboard motor in accordance with claim **7** wherein said powerhead further includes an upwardly open water guard extending from the bottom of said powerhead in watertight encircling relation to said engine to above the at-rest water level when the outboard motor is boat mounted, and wherein said means connecting said king pin upper end to said powerhead includes a member extending through an opening in said guard.

9. An outboard motor in accordance with claim **8** and further including a water tight seal extending between said member and said opening in said guard.

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