

[54] EXHAUST GAS PURIFYING DEVICE FOR AN OUTBOARD PROPULSION UNIT

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Apr. 30, 1971 Japan ..... 46/34569 (utility model)

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[58] Field of Search..... 60/309, 310, 311, 60/320; 55/DIG. 30

[57] ABSTRACT

An exhaust gas purifying device of an outboard motor comprising an exhaust gas discharge pipe; a expansion chamber where exhaust gas introduced from the pipe is rapidly expanded for cooling; a cooling chamber for elevating the efficiency of cooling the exhaust gas; and a reservoir for holding the ingredients of the exhaust gas which are liquefied when the gas is cooled, thus enabling the exhaust gas to be drawn off to the outside in a state free from harmful ingredients.

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11 Claims, 2 Drawing Figures

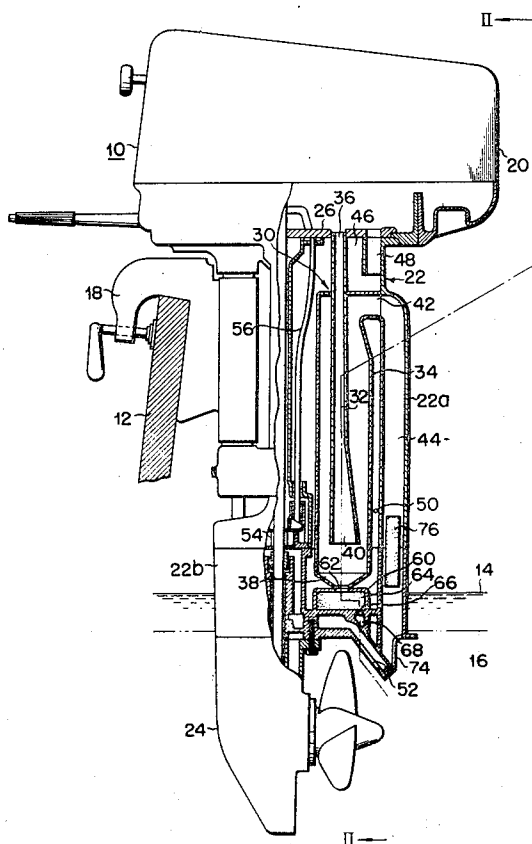


FIG. 1

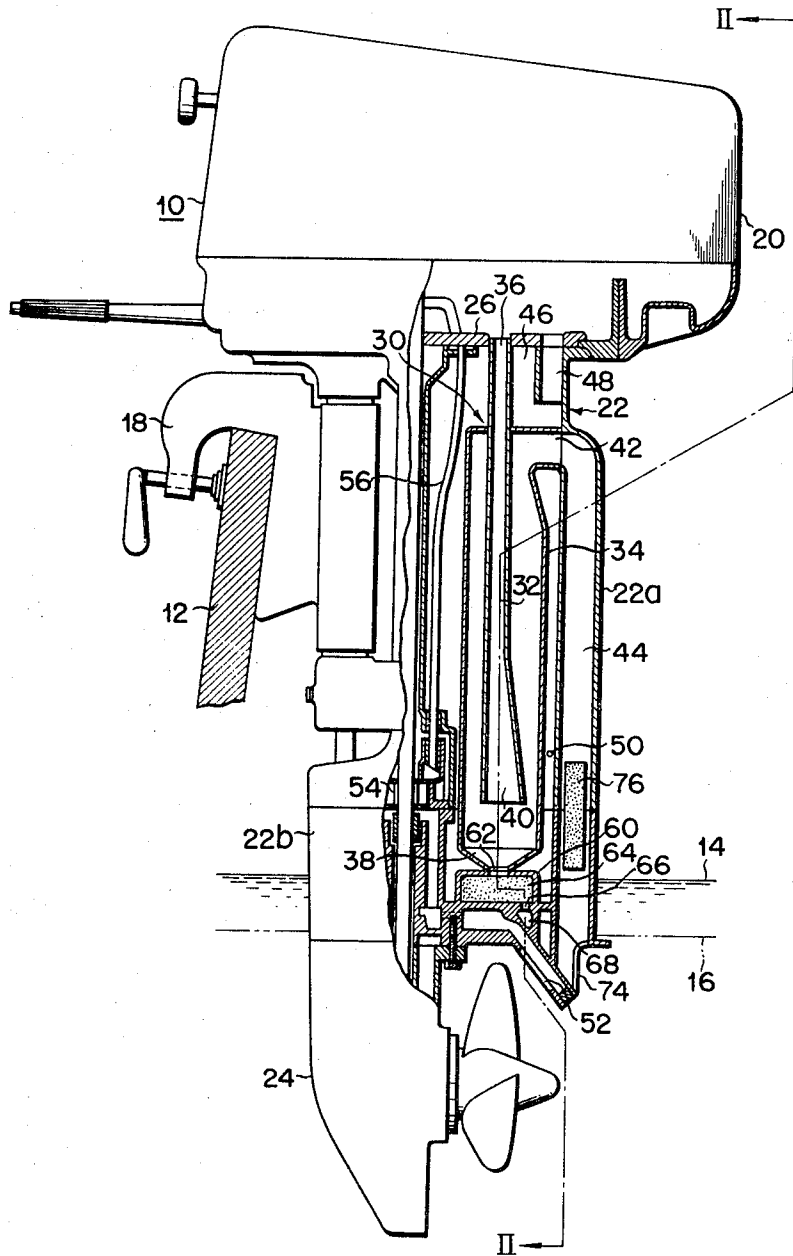
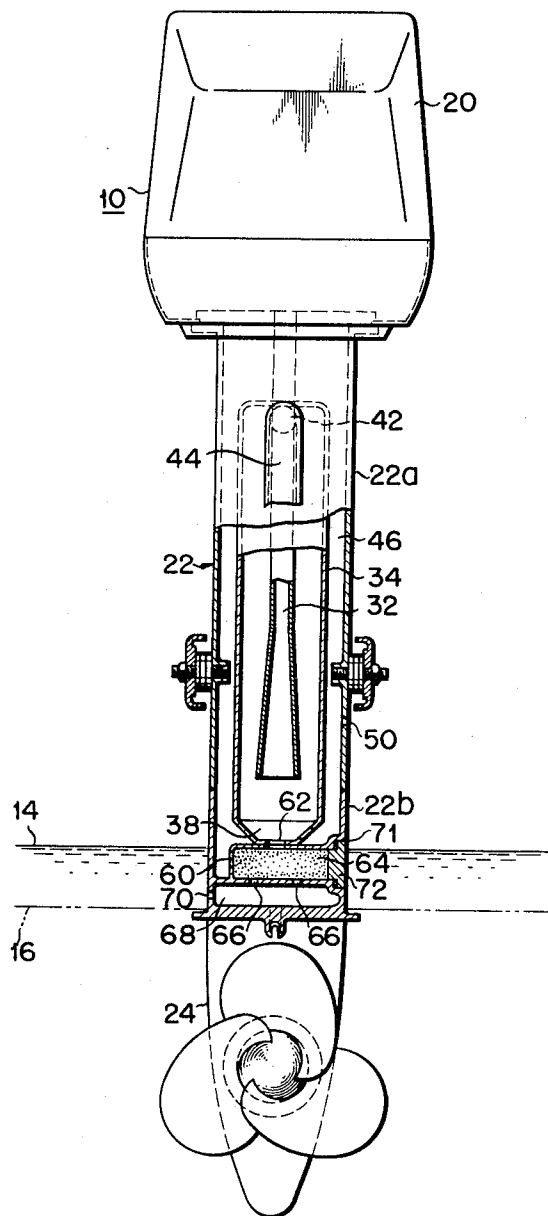


FIG. 2



## EXHAUST GAS PURIFYING DEVICE FOR AN OUTBOARD PROPULSION UNIT

### BACKGROUND OF THE INVENTION

The invention relates to an outboard propulsion unit such as an outboard motor or a stern drive unit, and more particularly to an exhaust gas purifying device for an outboard propulsion unit.

The prior art exhaust gas discharge device of an outboard propulsion unit comprises an upper casing having an exhaust gas passageway, an exhaust gas discharge port connecting the internal combustion engine of the propulsion unit and the upper end of the exhaust gas passageway, and an exhaust gas outlet disposed at the lower end of the passageway. Thus the discharge device causes the exhaust gas brought into the passageway through the discharge port to be drawn off directly into the air or the water of the seas or lakes.

With the conventional exhaust gas discharge device of the above-mentioned arrangement, therefore, harmful ingredients of the exhaust gas, such as vapors of lubricant and fuel or carbon matter are allowed to expelled intact into the air or water together with the exhaust gas to float on or under the water surface. As is well known, protection of the seas and lakes from pollution caused by such harmful substances is raising a problem of increasing importance for society. However, there has not heretofore been taken any proper measure to eliminate said problem.

### SUMMARY OF THE INVENTION

It is accordingly the object of this invention to provide a new and improved type of exhaust gas discharge device or particularly an exhaust gas purifying device for an outboard propulsion unit which cleans exhaust gas of unwholesome ingredients such as vapors of lubricant and fuel or carbon matter.

With an exhaust gas purifying device according to this invention, the upper casing has an exhaust gas passageway means for introducing exhaust gas from the internal combustion engine and cooling it while it is conducted therethrough. The volatilized ingredients of exhaust gas such as vapors of lubricant and fuel and water steam are condensed or liquefied when the exhaust gas is cooled in the passageway means and collected at the bottom thereof, under which there is disposed a reservoir for holding liquefied ingredients.

The exhaust gas purifying device of this invention may discharge the exhaust gas cleaned of harmful ingredients. Further, this device is of simple construction and inexpensive.

Efficient cooling of exhaust gas is attained by constructing said passageway means of a first portion having a small cross section and a second portion having a large cross section for rapid expansion of the exhaust gas and/or surrounding the passageway means with a cooling chamber. The first portion may consist of an exhaust gas discharge pipe extending downward from a drive section into the upper casing and the second portion may be constituted by an exhaust gas expansion chamber into which there is inserted the discharge pipe.

Further, the reservoir may contain an adsorbent for capturing the ingredients of exhaust gas which are collected therein.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view, partly in section, of an exhaust gas purifying device according to this invention fitted to an outboard motor; and

FIG. 2 is a front view, partly in section, of the device as taken on line II—II of FIG. 1.

### DETAILED DESCRIPTION OF THE INVENTION

There will now be described by reference to the appended drawings the preferred embodiment of this invention particularly in connection with an outboard motor.

Numerals 10 represents an outboard motor, 12 the transom of a boat, 14 the water level when the boat is in a rest position and 16 the water level when the boat is in motion. The outboard motor 10, which may be fitted to the transom 12 of the boat by a transom bracket 18, comprises a drive section 20 with a water-cooled internal combustion engine (not shown), an upper casing 22 disposed below the drive section and a lower casing 24 extending downward from the upper casing. The upper casing consists of a first upper casing section 22a connected to the drive section 20 and a second upper casing section 22b bolted to the lower end of the first section 22a.

In the space of the upper casing 22 there is disposed apart from the inner walls thereof a passageway means 30 for conducting exhaust gas from the drive section 20 and cooling it while it passes therethrough. The passageway means 30 comprises a narrow exhaust gas discharge pipe 32 for introducing exhaust gas from the drive section into the upper casing 22 and a broad exhaust gas expansion chamber or cylinder 34 for receiving the exhaust gas from the discharge pipe 32 and drawing it off.

The discharge pipe 32 vertically extends downward from an exhaust gas discharge port 36 formed in a base plate 26 of the drive section 20 and is inserted airtight into the expansion chamber 34 at its top. The expansion chamber is also vertically disposed in the upper casing 22.

At the lower end of the discharge pipe 32 is formed an opening 40 facing the bottom 38 of the expansion chamber 34. The opening is made sufficiently small to allow the exhaust gas to be rapidly expanded when it passes therethrough into the expansion chamber 34. At the upper end of the expansion chamber is formed an opening 42 to which there is connected a conduit or outermost pipe 44. Such wide separation of both openings 40 and 42 is advantageous to elevate the efficiency of cooling exhaust gas by the later described cooling chamber.

Between the inner wall of the upper casing 22 and the outer wall of the passageway means 30 is defined a space forming the cooling chamber 46 for cooling the passageway means. This cooling chamber is completely shut off from the interior of the passageway means 30 so as to prevent exhaust gas from leaking into the cooling chamber.

At the upper part of the cooling chamber, a water inlet pipe 48 extends downward from the base plate 26 to conduct cooling water into the chamber 46. At the lower part of the cooling chamber is provided a water outlet port 50 for drawing off the cooling water therein. Such vertical arrangement of the water inlet pipe 48 and the water outlet port 50 permits the easy flow of

cooling water and increases the cooling effect, and prevents the boat from being unduly trimmed due to the remaining water in the cooling chamber 46.

For the exhaust gas purifying device of this invention, cooling water for the cooling chamber 46 may consist of that for the engine. The engine cooling water is taken from the seas or lakes into the engine through an inlet 52, water pump 54 and feed pipe 56 and then into the cooling chamber 46 through the aforesaid water inlet pipe 48.

Below the bottom 38 of the exhaust gas expansion chamber 34 is disposed a reservoir 60 integrally formed with the upper casing 22 so as to hold the condensed or liquefied ingredients of exhaust gas. This reservoir 60 communicates with the expansion chamber 34 through a connection port 62 and is fixed airtight to expansion chamber so as to prevent the condensed ingredients from leaking into the cooling chamber 46.

The reservoir contains an adsorbent 64, which may consist of any kind, provided it can adsorb condensed ingredients, or preferably that kind which is particularly adsorptive to oils.

According to this embodiment, the adsorbent is made of foamed or fibrous polypropylene resin. Where there is used such an adsorbent as polypropylene resin which is particularly adsorptive to oils, the bottom of the reservoir 60 is perforated with holes 66. These holes communicate with a passage 68, which extends across the second upper casing section 22b and communicates with outside through an opening 70. When there are collected condensed ingredients of exhaust gas in the reservoir 60, oils and carbon matter are captured by the adsorbent 64, whereas condensed water is discharged outside through the holes 66, passage 68 and opening 70.

One side wall of the reservoir 60, mainly, one side wall of the upper casing 22 has an opening 71 which is fitted with a detachable cap 72. When the adsorbent 64 is expected to have fully adsorbed the ingredients, the cap 72 is taken off to replace the spent adsorbent with a fresh one through the opening 71. To observe the operating condition of the adsorbent from outside, there may be formed a peeping window in the cap or the side wall of the upper casing. Further to prevent the physical damage of adsorbent by rapidly flowing exhaust gas, there may be provided a roof-shaped hood above the connection port 62.

The aforementioned outermost pipe 44 communicating with the opening 42 is integrally formed on the rear wall of the upper casing 22 and extends down said rear wall. At the lower end of the pipe 44 is provided an exhaust gas outlet 74 open to the water. This outlet 74 is so disposed as to be considerably under water while the boat is in a rest position and slightly below the water level 16 even while the boat is driven.

In the pipe 44 near the outlet 74 is provided a silencer 76 for absorbing noises caused by the discharge of the exhaust gas. This silencer is preferred to take a position slightly higher than the water level 14 so as to be prevented from being directly brought into contact with water. According to this embodiment, the silencer 76 consists of a noise absorber such as glass wool or steel wool, but may be formed of a mechanical noise absorbing mechanism.

There will now be described the operation of the exhaust gas purifying device of this invention. Exhaust gas drawn off from the internal combustion engine is

brought into the exhaust gas discharge pipe 32 through the discharge port 36, and then into the exhaust gas expansion chamber 34 through the opening 40. Since, as previously described, the opening 40 is fully narrower than the expansion chamber 34, the ejected gas is rapidly expanded and effectively cooled due to reduced pressure. While being subsequently carried along with inner wall of the expansion chamber 34, the gas is further cooled by the cooling chamber 46 surrounding the expansion chamber 34.

When cooled, the volatilized ingredients of the exhaust gas such as the vapors of lubricant and fuel and water steam are condensed or liquefied to settle on the walls of the pipe 32 and chamber 34 in the form of liquid particle, together with carbon particles contained in the gas. A sluddy mixture consisting of such liquefied ingredients and carbon particles falls down the walls to be collected at the bottom 38 of the chamber 34 and then in the reservoir 60 through the connection port 62. The oily substance and carbon particles of the mixture are captured by the adsorbent 64, while cleaned water alone is discharged outside through the holes 66, passage 68 and opening 70.

The exhaust gas stripped of harmful ingredients flows into the outermost pipe 44 through the opening 42 and expelled into the water through the silencer 76 and discharge outlet 74.

According to the foregoing embodiment, the purified exhaust gas is drawn off into the water, but may be released into the open air.

Further, the device of this invention is applicable not only to a water-cooled but also an air-cooled engine.

What we claim is:

1. An exhaust gas purifying device for an outboard propulsion unit having a driving section comprising: an upper casing connected to the driving section; passageway means accommodated in the upper casing to conduct the exhaust gas out of the driving section and to cool the gas in the passageway means for liquefying vaporous ingredients contained in the gas, said passageway means having a bottom part with a port where the liquified ingredients are gathered; a reservoir connected to the port for receiving the liquefied ingredients.
2. An exhaust gas purifying device according to claim 1, wherein said passageway means includes a first portion having a small cross section and a second portion having a large cross section, whereby the exhaust gas is ejected from the first into the second to be rapidly expanded.
3. An exhaust gas purifying device according to claim 1, further comprising a cooling chamber surrounding the passageway means to cool it.
4. An exhaust gas purifying device according to claim 2, wherein said first portion of the passageway means consists of an exhaust gas discharge pipe extending from the drive section into the upper casing and said second portion consists of an exhaust gas expansion chamber in which the discharge pipe is inserted, said discharge pipe having at its end an opening for ejecting the exhaust gas into said expansion chamber and the chamber also having an opening apart from said opening of the discharge pipe for drawing off the gas.
5. An exhaust gas purifying device according to claim 4, further comprising a cooling chamber defined by the outer wall of the passageway means and the inner wall

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of the upper casing, said cooling chamber having at its upper portion a water inlet for conducting cooling water into the cooling chamber and having at its lower portion a water outlet for discharging the water therein.

6. An exhaust gas purifying device according to claim 5, further comprising an oil adsorbent contained in the reservoir.

7. An exhaust gas purifying device according to claim 6, wherein said adsorbent is made of one material selected from the group consisting of foamed polypropylene resin and fibrous polypropylene resin.

8. An exhaust gas purifying device according to claim 7, wherein said reservoir has at least one hole at the bottom thereof.

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9. An exhaust gas purifying device according to claim 4, wherein said passageway means further comprises a conduit connected to the exhaust gas expansion chamber through the opening thereof and extending downward on the outer wall of the upper casing, said conduit having an exhaust gas outlet at its lower end.

10. An exhaust gas purifying device according to claim 9, wherein said conduit has a silencer therein.

11. An exhaust gas purifying device according to claim 6, wherein said reservoir has an opening in one side wall thereof and a cap detachably fitted the opening.

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