March 5, 1968 L. O. WARD 3,371,645

DIRECTIONAL FLOW EXHAUST REGULATOR

Filed May 16, 1966

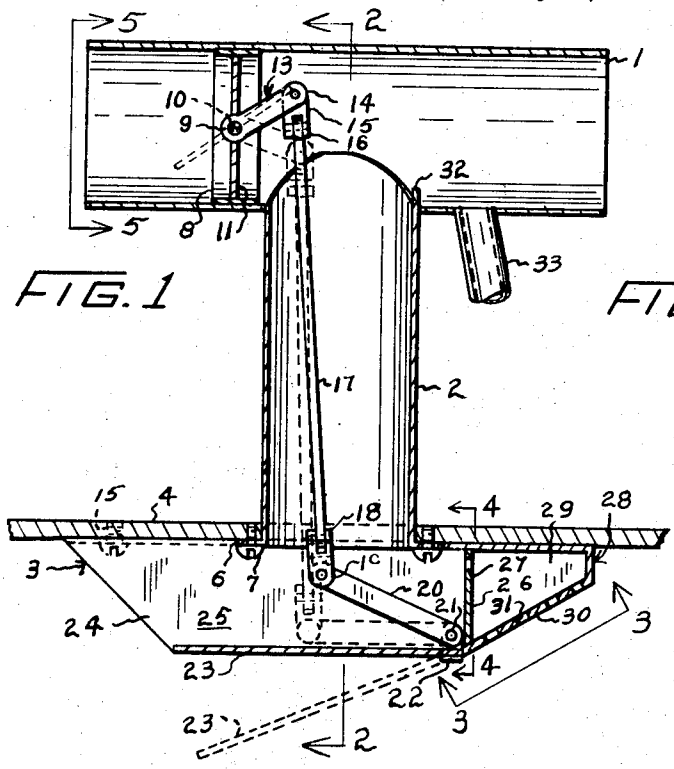

FIG. 1

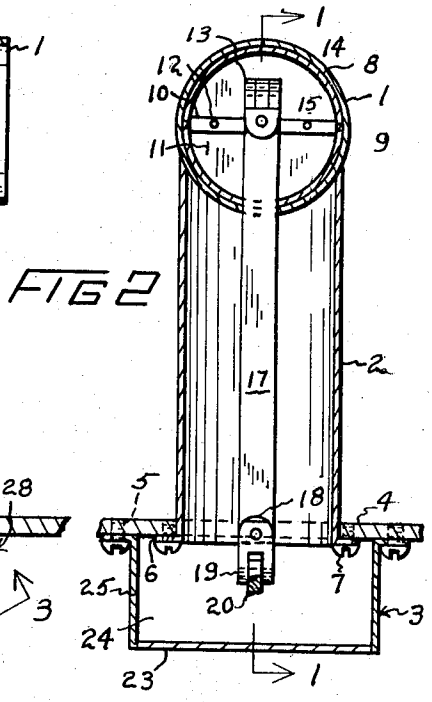

FIG 2

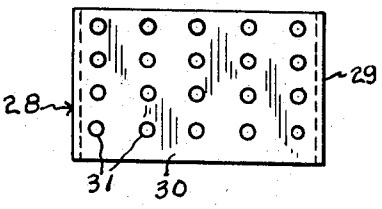

FIG. 3

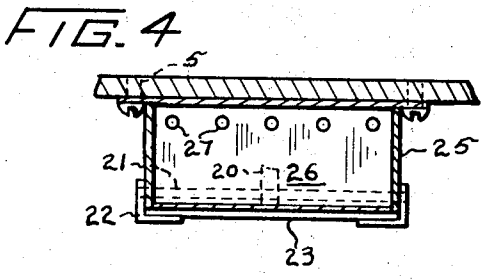

FIG. 4

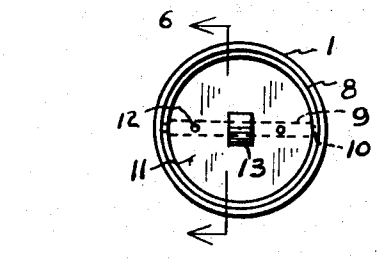

FIG. 5

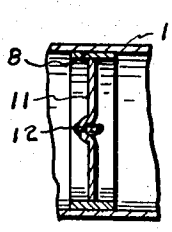

FIG. 6

INVENTOR

LYLE O. WARD

BY: Allan J. Murray

ATTORNEY

United States Patent Office

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DIRECTIONAL FLOW EXHAUST REGULATOR

Lyle O. Ward, 615 River St., Port Huron, Mich. 48060

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9 Claims. (Cl. 115—.5)

ABSTRACT OF THE DISCLOSURE

A directional flow exhaust regulator for boats having an internal combustion engine and including a first conduit to exhaust gases into the atmosphere, a second conduit to exhaust gases under water, a valve disposed in said first conduit and having an open position to allow exhaust of gases from said first conduit and a closed position to force gases to exhaust from said second conduit, an actuator movable by water flow to close said valve and movable in the absence of water flow to open said valve, and means interconnecting said valve and said actuator. Said second conduit opens into an exhaust chamber, which has a wall in common with a pressure chamber, said common wall being formed with a small plurality of holes, and the forward wall of said pressure chamber being formed with a larger plurality of holes, so that as the boat moves through water, water is forced into said chamber through the larger plurality of holes at a rate greater than it can escape through the smaller plurality of holes causing a jet-like stream of water to help clear exhaust gases from the exhaust chamber.

This invention relates to directional flow devices for the exhaust systems of internal combustion engines, and particularly to such devices as are associated with marine engines and the like.

An object of the invention is to provide a first conduit to exhaust gases into the atmosphere, a second conduit to exhaust gases under water to help muffle the sound, a valve movable in travel between an open position to exhaust gases from said first conduit, and a closed position to exhaust gases from said second conduit, and an actuator to actuate said valve in said travel.

Another object is to provide said actuator in the form of a substantially flat tab mounted on the boat, and responsive to the force of gravity to actuate said valve in travel to said first position, and responsive to the flow of water overcoming gravity when the boat moves, to actuate said valve in travel to said second position.

Another object is to provide means interconnecting said actuator and said valve so that the said two elements move in unison.

Another object is to dispose said second conduit so that one end thereof communicates with said first conduit, and to dispose said actuator at the opposite end of said second conduit, and to extend said connecting means between said valve and said actuator through said second conduit.

Still another object is to provide for an exhaust outlet chamber having an open end to afford the escape of gases under water, and to dispose said chamber to receive exhaust gases from said opposite end of said second conduit, and to provide said chamber with a wall, having a small plurality of holes to admit streams of water, flowing toward said open end, to said exhaust chamber once said boat is in motion, whereby the flow of water facilitates the exit of gases from said chamber.

Still a further object of the invention is to form on said exhaust chamber a pressure box, having said perforated wall in common with said chamber, and having spaced therefrom a wall having a greater plurality of perforations than said first mentioned wall, whereby

water is admitted into said pressure box at a rate faster than it can escape from said pressure box, to build up pressure within said pressure box to expel the water into said chamber under considerable force.

These and other objects are attained by the construction hereinafter described and illustrated in the accompanying drawing, wherein:

FIG. 1 is a vertical, longitudinal, sectional view on line 1—1 of FIG. 2.

FIG. 2 is a vertical, cross sectional view on line 2—2 of FIG. 1.

FIG. 3 is a view on line 3—3 of FIG. 1 illustrating said wall with the greater plurality of holes.

FIG. 4 is a sectional vertical view on line 4—4 of FIG. 1 illustrating said wall with the small plurality of holes.

FIG. 5 is a partial view of said first conduit showing said valve in a closed position.

FIG. 6 is a view on line 6—6 of FIG. 5.

In these views, the reference character 1 designates a first conduit which may be disposed in the exhaust outlet system of a marine motor, and may be disposed in a substantially horizontal position as illustrated. A second conduit 2 communicates with said first conduit, and may be disposed at approximately right angles thereto as shown in FIG. 1. The juncture of said first and second conduits is sealed as by brazing or welding. An exhaust outlet chamber 3 is secured to and beneath the hull 4 of a boat (not shown). Screws 5 secure said chamber in position. The conduit 2 extends through the hull 4 and is formed at its lower end with a flange 6 which may be secured as by screws 7 to said hull. As is clear from FIG. 1 of the drawings, the second conduit opens into the exhaust chamber 3.

An annular sleeve 8 is secured in the conduit 1 in the approximate position illustrated, and is maintained in that position by any convenient means. A pivot element 9 is a diametrically disposed in said sleeve, and is formed with reduced end portions 10 which are rotatably receive in the wall of said sleeve.

A circular butterfly valve 11 is mounted on said pivot element in any convenient manner, and may be secured thereon as by rivets 12. An upper lever 13 is rigidly secured to said pivot element 9, whereby said pivot element and the attached buttterfly valve will rotate with the lever when the latter is moved to swing about the axis of said pivot. A clevis 14 is formed on the end of said lever to receive the upper end portion of a pivotal link 15, which has its lower end portion formed with a clevis 16, to receive the upper end portion of a connecting rod 17. The lower end portion of said rod is received in an upper clevis 18 of a link having a lower and transversely formed clevis 19. The latter clevis receives the end portion of a lower lever 20, the opposite end of which is rigidly received upon a pivot element 21. A bracket 22 is also rigidly received upon said pivot element 22, and mounts a tab 23 extending substantially along the bottom of said exhaust outlet chamber 3.

Said exhaust outlet chamber has an open end 24 to afford the emission of exhaust gases therefrom, and is formed with side walls 25, and a front wall 26. Said front wall is formed with a small plurality of holes 27. When the boat is resting quietly in the water and is not in motion upon and through the water, gravity tends to pull the tab 23 into the position shown in dash line in FIG. 1. When the boat is moving forward, which would be to the right in FIG. 1, the pressure of water upon said plate as said plate moves through said water causes it to rise, moving the rigidly mounted lower lever 21 upwardly upon and with the pivot element 21 about the pivotal axis of said element. Through the interconnecting elements 15, 17, 18 and 19, this upward motion is

transmitted to the upper lever **13** and thence to the pivot element **9** and butterfly valve **11**.

Thus when the tab **23** is in the gravitationally established position shown in dash line, the butterfly valve is open and in the position shown in dash line. When the boat is moving, and the flow of water has moved the tab upwardly to the position shown in solid lines, the aforesaid linkage and levers actuate the butterfly valve to move into the position shown in section, in solid line in FIG. 1.

When the boat is moving forward in the water, pressure of the water against the wall **26** would tend to cause water to spurt through the small plurality of holes **27** into the pressure box, whereby the force of such water as it moves through the pressure box has been found to aid materially in emitting exhaust gases through said open end of said chamber. To intensify the pressure with which said streams of water are admitted into said chamber, the chamber is formed at its forward end with a pressure box **28** including side walls **29**, which may be forward extensions of side walls **25**, and further including a front wall **30**. Said front wall is disposed at an angle, and is formed with a larger pluraliaty of holes than is found on said first mentioned wall, to admit water into the pressure box at a speed greater than it can be emitted, so that water flowing from the small plurality of holes **27** is forced through said holes at a pressure greater than would otherwise be realized.

Marine engines normally pump water through the engine as a coolant and expel said water through the exhaust system. It is proposed to take advantage of this fact to provide at the forward circumferential portion of the vertical conduit **2** an upstanding lip **32** which intercepts a portion of the water being so exhausted, and to further provide said upper conduit with an escape tube **33**, the outlet end of which may be disposed as desired, but which serves the function of enabling an operator of a boat to detect at a glance whether the cooling system of his engine is operating properly by viewing the water being discharged from said tube.

The disclosed construction has the advantage of relieving back pressure from the exhaust system when the engine is idling or operating at a low speed. Without this system, this back pressure results from inability of the engine to completely exhaust the exhaust gases against the pressure of the water. The result of such back pressure is the depositing of excessive carbon in the engine. Further such back pressure tends to slow the operation of the water pump, which in turn, of course, slows the flow of coolant, tending to cause steam pockets, which result in hot spots around plugs, valves, gaskets, etc. Further, an exhaust so inhibited will cause vibrations to pulse through the entire boat, as exhaust gases do escape from the exhaust system against the pressure of water. Too, said back pressure has on occasion caused engine backfires, which have separated the exhaust system within the hull of a vessel, thus creating a fire hazard.

The above disclosed invention would tend to automatically eliminate many of the disadvantages inherent in prior systems, and it is believed within the ability of a person skilled in the art to apply a method of manually over-riding the natural tendencies of the system if desired.

What I claim is:

1. The combination with a boat having an internal combustion engine with an exhaust system, of an exhaust directional flow control assembly incorporated in said system, said assembly including:

a first conduit disposed to afford escape of exhaust gases into the atmosphere,

a second conduit disposed to afford escape of exhaust gases into the water,

a valve having an open position to exhaust gases from said first conduit and a closed position to exhaust gases from said second conduit,

an actuator movable to open said valve when the boat is still and having fluid flow responsive means to close said valve when the boat moves,

a connector interconnecting said valve and said actuator to effect said movement of the former by the latter.

2. The combinaton as set forth in claim **1**,

said actuator being formed as substantially a flat tab,

pivot means mounting said actuator to said boat for angular travel about the axis of the pivot to open or close said valve.

3. The combination as set forth in claim **1**,

said actuator being in the form of a flat tab,

pivot means having a pivotal axis mounting said actuator to said boat for downward angular travel about said axis responsive to gravity to open said valve, and for upward angular travel about said axis responsive to flow of water upon said actuator, to close said valve.

4. The combination as set forth in claim **3**,

said actuator being mounted at the exhaust opening of said second conduit,

said valve being disposed in said first conduit, and,

said connector extending between the actuator and the valve through said second conduit.

5. The combination as set forth in claim **1**, said second conduit opening into

an exhaust outlet chamber having an open end to afford escape of gases, and having its opposite end closed by a wall,

a small plurality of holes in said wall to admit streams of water into said chamber flowing toward said open end when said boat moves, said streams assisting to carry gases out said open end.

6. The combination as set forth in claim **5**,

a pressure box formed on said chamber and having said wall in common with said chamber, and having

a wall spaced from said chamber and formed with a greater plurality of holes than said common wall to admit water to said box faster than it can emit through said small plurality of holes, whereby pressure builds up in said box to expel water under pressure into said chamber.

7. The combination as set forth in claim **4**, said second conduit opening into

an exhaust outlet chamber having an open end to afford escape of gases, and having its opposite end closed by a wall,

a small plurality of holes in said wall to admit streams of water into said chamber when said boat moves, said streams assisting to carry gases out said open end.

8. The combination as set forth in claim **7**,

a pressure box formed on said chamber and having said wall in common with said chamber, and having

a wall spaced from said chamber and formed with a greater plurality of holes than said common wall to admit water to said box faster than it can emit through said small plurality of holes, whereby pressure builds up in said box to expel water under pressure into said chamber.

9. The combination as set forth in claim **3**,

a pressure box formed on said chamber and having said wall in common with said chamber, and having

a wall spaced from said chamber and formed with a greater plurality of holes than said common wall to admit water to said box faster than it can emit through said small plurality of holes, whereby pressure builds up in said box to expel water under pressure into said chamber.

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ANDREW H. FARRELL, *Examiner.*