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2,607,332

OUTBOARD MOTOR CRANKCASE AND OIL RESERVOIR CONSTRUCTION

Filed Nov. 13, 1948

2 SHEETS—SHEET 1

Fig. 1.

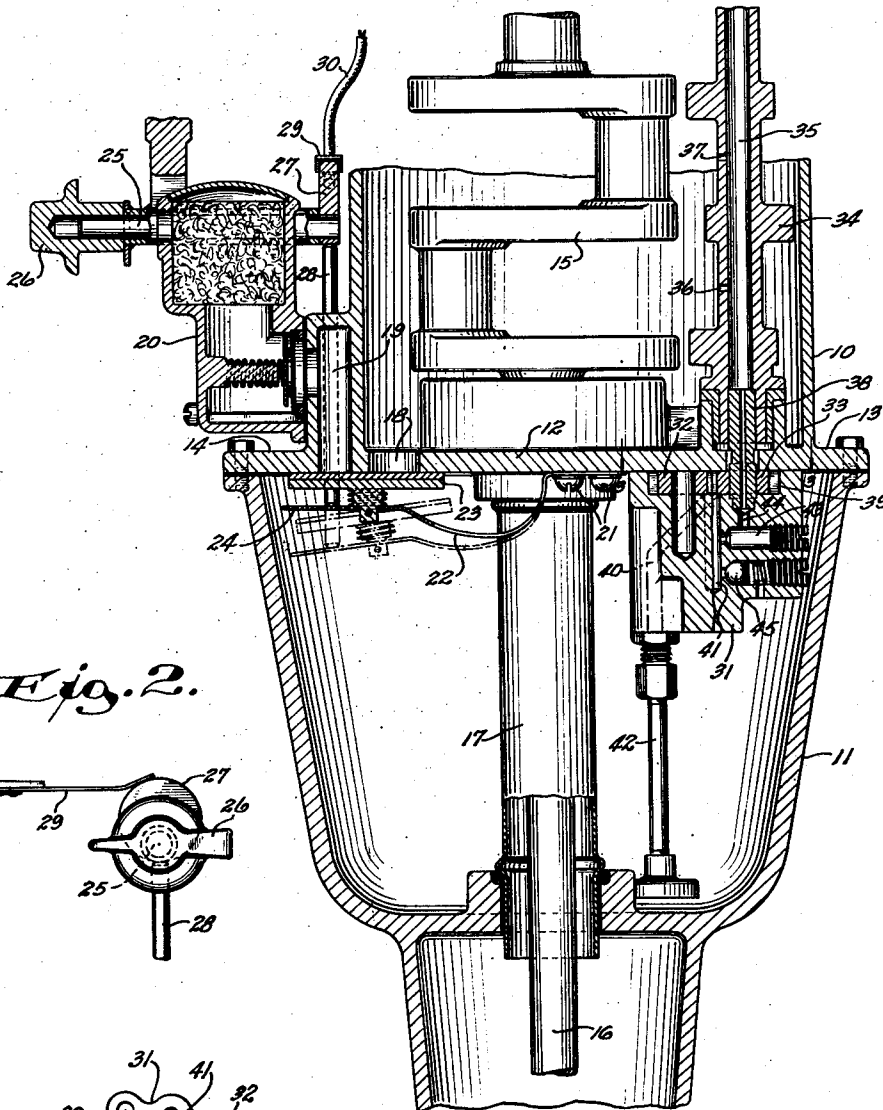


Fig. 2.

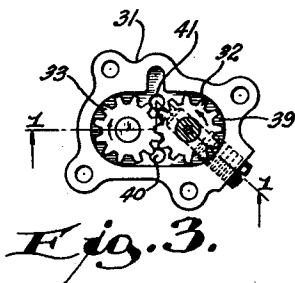
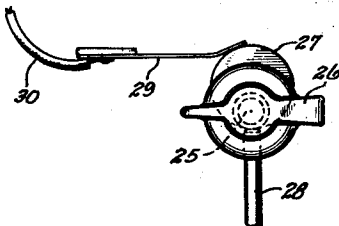


Fig. 3.

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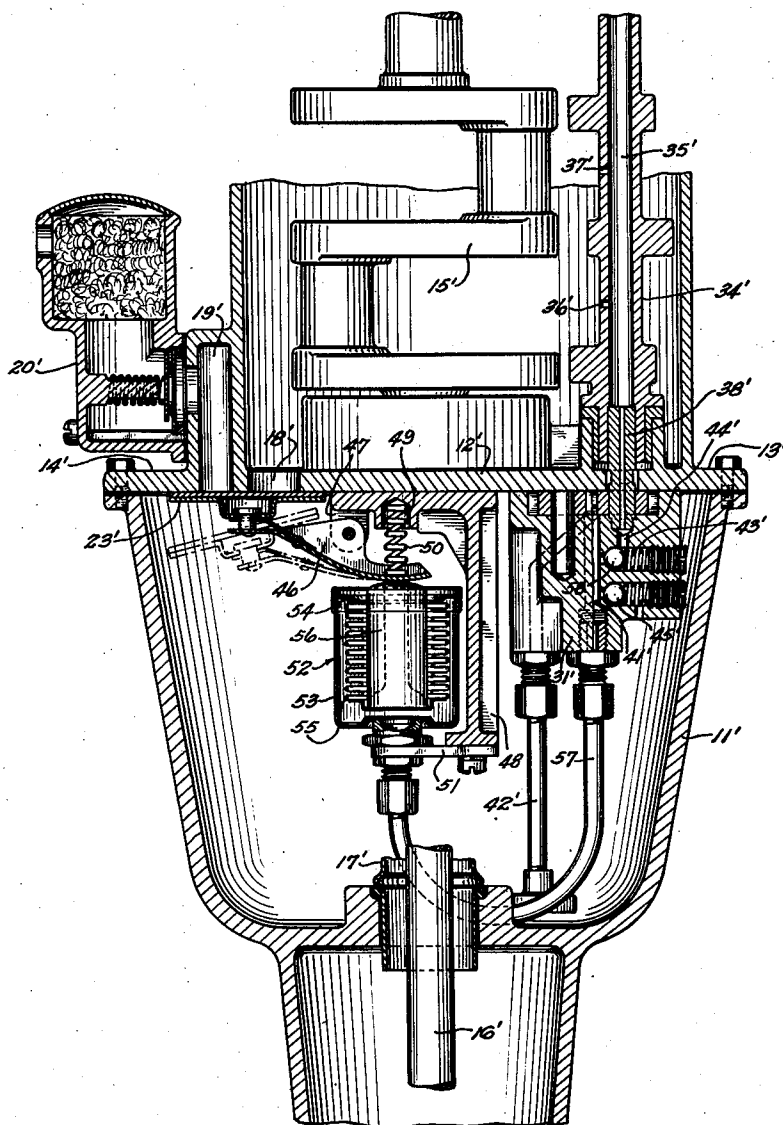
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2 SHEETS—SHEET 2

Fig. 4.



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OUTBOARD MOTOR CRANKCASE AND OIL
RESERVOIR CONSTRUCTIONAlfred S. Bosma, New Holstein, Wis., assignor to
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18 Claims. (Cl. 123—196)

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This invention relates to improvements in outboard motors.

In my prior Patent No. 2,346,148, a four cycle outboard motor is disclosed having an oil sump positioned below the crank case thereof to provide a reservoir into which oil can drain from the crank case and from which oil can be pumped to lubricate the various parts of the motor.

This patent was designed for the purpose of solving the problems which arise where this type of construction is employed and which are caused by the fact that an outboard motor is frequently tilted to a horizontal position, such as when it is being manually carried or while it is being transported in a vehicle. Tilting of motors of the above mentioned type, unless specially constructed as in the above mentioned patent, will cause the oil from the reservoir to flow back into the crankcase and into the cylinders and pistons. If excessive quantities of such oil are permitted to collect in and around the cylinders and pistons it will foul the latter and prevent proper motor operation. In addition, where a conventional breather is used to vent the crankcase to the atmosphere, excessive oil from the crankcase is likely to drain out through said breather when the motor is tilted or placed in a horizontal position.

It is one of the objects of the present invention to provide an improved four cycle outboard motor of the type having a separate oil reservoir, wherein positive means is provided to seal off the reservoir from the crankcase to thereby permit the motor to be tilted to any position without letting oil flow from the reservoir back into the crankcase.

A further object of the invention is to provide an outboard motor of the class described having means to prevent leakage of oil from the crankcase out through the crankcase breather when said motor is tilted or placed on its side.

A further object of the invention is to provide an outboard motor of the class described wherein a passage is provided between the crankcase and the oil reservoir which passage serves as a breather passage as well as an oil drain passage, and wherein a breather passage leads from said reservoir to the atmosphere, there being a single valve for simultaneously opening or closing both passages whereby the flow of oil either into the crankcase or out through the breather as a result of tilting the motor can be prevented.

A further object of the invention is to provide a motor of the class described having manually operated means for actuating the breather valve,

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said means having associated therewith a ground switch connected to the motor ignition system whereby the magneto is grounded whenever the breather valve is closed.

A further object of the invention is to provide in an outboard motor of the class described automatic means for operating the breather valve, said means being responsive to the pressure built up by the oil pump of said motor.

A more specific object of the invention is to provide in a motor of the class described a bellows unit having one end in communication with the discharge side of the oil pump and having a plunger movable by said bellows in response to oil pressure acting thereagainst for actuating the breather valve.

With the above and other objects in view, the invention consists of the improved outboard motor and all of its parts and combinations as set forth in the claims, and all equivalents thereof.

In the drawings accompanying and forming a part of this specification, wherein are shown two embodiments of the invention and wherein the same reference numerals indicate the same parts in all of the views:

Fig. 1 is a fragmentary vertical sectional view taken through a motor embodying one form of the invention;

Fig. 2 is a fragmentary side view of the manually engageable breather valve control mechanism together with the ground switch;

Fig. 3 is a view taken along the lines 3—3 of Fig. 1; and

Fig. 4 is a fragmentary vertical sectional view taken through a motor embodying a modified form of the invention.

Referring to Fig. 1 of the drawing, the numeral 10 indicates a substantially cylindrical crankcase superimposed on a cup-shaped sump or oil reservoir 11. The crankcase 10 has an integral bottom plate 12 extending thereacross and projecting beyond the walls thereof to form attaching flanges 13 and 14. A crank shaft 15 is mounted in the crankcase 10 for rotative movement on a vertical axis and a drive shaft 16 projects downwardly from said crank shaft through the plate 12 and through the reservoir 11. Suitable means such as the tube 17 provides a sealed off passage for the drive shaft 16 through the interior of the reservoir 11.

Formed in the plate 12 adjacent a side wall of the crankcase 10 is an aperture or passage 18 which communicates between the interior of the crankcase 10 and the interior of the reservoir 11. Formed in a side wall of the crankcase 10 adja-

cent the aperture 18 and communicating at its lower end with the interior of the reservoir 11 is a vertically extending breather passage 19. The breather passage 19 communicates at its upper end with a conventional breather 20.

Fixed at one end to the underside of the plate 12, as by the screws 21, is a band or leaf spring 22. Attached adjacent the free end of the spring 22 and normally held by said spring in sealing engagement with the plate 12 over the passages 18 and 19 is a disc valve 23. The spring 22 is provided with a portion 24 which projects laterally beyond the peripheral limits of the disc valve 23.

Suitably mounted adjacent the exterior of the crankcase 10 for rotative movement in a horizontal plane is a shaft 25 which is provided at one end with a manually engageable knob 26. Fixed to the opposite end of the shaft 25 is a cam 27. A vertical rod 28 is positioned directly below the cam 27 and slidably projects through the plate 12, being supported at its lower end by the portion 24 of the spring 22. The spring 22 maintains the upper end of the rod 28 in contact with the cam 27.

Referring to Fig. 2, it will be noted that the rod 28 is in its uppermost position when the cam 27 is positioned as shown, with the portion thereof having the longest radius being positioned directly above the shaft 25. Suitably mounted adjacent the cam 27 and in contact with said cam when said cam is in the position shown in Figs. 1 and 2, is an electrical contact member 29. A suitable electrical conductor 30 leads to the magnet of the motor. The support for the contact 29 is of the type which electrically insulates said contact from the portion of the motor on which it is mounted.

From Fig. 2 it is apparent that rotation of the shaft 25 by manual turning of the knob 26 causes the high portion of the cam 27 to move out of engagement with the spring 29 and to move into depressing engagement with the rod 28. Depression of the rod 28 to the dot and dash line position shown in Fig. 1, results in simultaneous movement of the spring 22 and the disc valve 23 to the dot and dash line position of Fig. 1. In this position there is no electrical connection between the contact 29 and the cam 27.

Referring to Figs. 1 and 3, a gear pump 31 is mounted within the reservoir 11 and fixed to the underside of the plate 12. The pump 31 is provided with gears 32 and 33 which are mounted for rotation on a vertical axis. A cam shaft 34 is mounted in the crankcase 10 for rotation on a vertical axis. The cam shaft 34 is formed with an axial passage 35 and with radial passages 36 and 37 communicating therewith. Projecting through the plate 12 and fixedly connected at one end to the lower end of the cam shaft 34 and having its other end projecting through the gear 33 of the pump 31, is a quill shaft 38. The axial passage in the quill shaft 38 communicates with the axial passage 35 in the cam shaft 34, as shown in Fig. 1, and the lower end of the quill shaft 38 is journaled for rotation in the body of the valve 31, as shown.

Referring to Fig. 3, the gears 32 and 33 are positioned in an oblong recess 39. An intake passage 40 communicates with the recess 39 on one side of the gears 32 and 33 and a discharge passage 41 communicates with the recess 39 adjacent the opposite side of the gears 32 and 33. The intake passage extends downwardly and transversely as shown by the dot and dash lines of Fig. 1

and communicates with an inlet pipe 42 which terminates at a point adjacent the bottom of the reservoir 11. The discharge passage 41 extends a predetermined distance vertically downwardly as shown. A horizontal passage 43 communicates with and extends laterally from the discharge passage 41 and communicates, through a vertical passage 44, with the lower end of the quill shaft 38. Communicating with the lower end of the discharge passage 41 is a spring loaded ball check pressure relief valve 45.

To put the motor in operation, the knob 26 is turned 180° from the position thereof shown in Fig. 2, thereby disengaging the contact 29 from the cam 27 and moving the rod 28 and the disc valve 23 with the spring 22 to the dot and dash position of Fig. 1. The motor is then started in the usual manner. When the motor is running, the oil pump 31, being driven by the cam shaft 34 through the quill shaft 38, pumps oil from the bottom of the reservoir 11 up through the inlet pipe 42 and the inlet passage 40 and out through the discharge passage 41, the transverse passage 43, the vertical passage 44, the quill shaft 38, and into the axial passage 35 of the cam shaft 34. From the passage 35, oil under pressure is squirted out the transverse passages 36 and 37 onto the motor bearings and the other parts in the crankcase which require lubrication.

The surplus oil in the crankcase 10 drains back into the reservoir 11 through the passage 18. Breathing action in the crankcase 10, due to piston displacement, causes movement of crankcase gases from the crankcase into the reservoir 11, and from the reservoir 11, through the passage 19 and the breather 20, to the atmosphere.

To stop the running motor it is merely necessary to turn the knob 26 back to the position shown in Figs. 1 and 2. This brings the cam 27 into electrical engagement with the contact 29, thereby grounding the ignition circuit and stopping the motor for lack of ignition spark. Simultaneously with the grounding of the ignition circuit the rod 28, the disc valve 23, and the spring 22 are allowed to return to the solid line position shown in Fig. 1. In this position, both the passage 18 and the passage 19 are effectively and simultaneously sealed off by the valve disc 23.

By sealing off the passages 18 and 19 the oil in the reservoir 11 is trapped therein and cannot flow into the crankcase or out through the breather 20. Neither is it possible for any oil draining off the walls of the crankcase to find its way out through the breather 20 as is the case with conventional motors. The spring 22 maintains the disc valve 23 in effective sealing engagement over the passages 18 and 19 regardless of the position of the motor, and therefore, when said valve is closed, the motor may be tilted to any desired position without danger of leakage of oil either out the breather 20 or into the crankcase 10.

Referring to Fig. 4, wherein is disclosed a modified form of the invention, the various parts are indicated by primed reference characters where the same parts are shown in Fig. 1 and are indicated by the same reference characters unprimed. Comparing Figs. 1 and 4, it will be noted that the manually operated mechanism for opening the disc valve 23 in Fig. 1 is missing in Fig. 4. In place thereof, is an automatic mechanism which will now be described.

Referring to Fig. 4, the valve disc 23' is resiliently mounted on one end of a lever 46. The lever 46 is pivotally mounted midway of its length

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on a lug 47 which depends from an L-shaped bracket 48 fixed to the underside of the plate 12'. Positioned in a recess 49 in the bracket 48, and in engagement with the other end of the lever 46, is a coil spring 50 which urges the end of the lever 46 with which it is in contact downwardly. This action of the spring 50 simultaneously urges the valve disc 23' upwardly into sealing engagement with the plate 12' over the passages 18' and 19'.

Supported on the lower end of the L-shaped bracket 48, as by the bracket 51, is a bellows assembly 52. The bellows assembly 52 has a cup-shaped case 53 having an inturned annular flange 54 at its upper end. A cup-shaped axially compressible bellows 55 is positioned within the case 53 and the upper margin thereof is sealingly connected to the inturned annular flange 54 of the case 53. Positioned in the bellows 55, and projecting upwardly beyond the case 53 into contact with the lever 46, is a plunger 56.

Communicating at one end with the discharge passage 41' of the pump 31' is a U-shaped extent of conduit 57. The conduit 57 at its other end communicates with the interior of the case 53 of the bellows assembly as shown. In addition to the ball check pressure relief valve 45', the gear pump 31' is provided with a spring-loaded ball check valve 58 positioned in the transverse passage 43'. Experience has shown that satisfactory results are obtained when a check valve 58 is used which opens in response to an oil pressure of 12 pounds per square inch. The pressure relief valve 45' preferably opens when the oil pressure reaches twenty to twenty-five pounds per square inch.

In operation, the motor is started in the usual manner, the disc valve 23' being in the full line closed position shown in Fig. 4. As soon as the motor starts, the gear pump 31' builds up oil pressure in the discharge passage 41' thereof. This pressure is transmitted through the conduit 57 to the enclosed space between the interior of the case 35 and the exterior of the bellows 55. This pressure urges the plunger 56 upwardly. However, since the spring 50 urges the end of the lever 46 downwardly against the plunger 55 with a predetermined force, nothing happens until this force is overcome. When the oil pressure built up by the pump 31' reaches a predetermined level, it compresses the bellows 53 longitudinally and forces the plunger 55 upwardly. This pivots the lever 46 and causes the valve disc 23' to uncover the passages 18' and 19' and to move to the dot and dash line position of Fig. 4. Experience has shown that a spring 50 and bellows assembly 52 which opens the disc valve 23' in response to an oil pressure of eight pounds per square inch gives satisfactory results.

It is apparent that the disc valve 23' must open in response to a lower pressure than that which is necessary to open the ball check valve 58. As the oil pressure builds up beyond that necessary to open the disc valve 23', it pushes the ball check valve 58 open and oil then flows up through the quill shaft 38' and the cam shaft 34' and out the transverse passages 36' and 37' to lubricate the various motor parts. During operation of the motor the surplus oil in the crankcase drains back into the reservoir 11' through the passage 18', and crankcase breathing action occurs as in the operation of the form of the invention shown in Fig. 1.

When the motor is stopped, the oil pressure drops since the oil pump 31' no longer is operat-

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ing. This causes the ball check valve 58 to close, and in addition, the spring 50 closes the disc valve 23', since the hydraulic pressure acting against the bellows 55 is insufficient to cause the plunger 56 to any longer depress said spring. Since the disc valve 23' is operated in response to oil pressure which is built up only when the motor is running, the valve 23' is held closed by the spring 50 at all times except when said motor is running. This provides an automatic control for the valve 23' and eliminates the need for any manual control mechanism therefor.

Various changes may be made without departing from the spirit of the invention and all of such changes are contemplated as may come within the scope of the claims.

What I claim is:

1. In an outboard motor, an enclosed oil reservoir; an enclosed crankcase positioned adjacent said reservoir, there being a first passage connecting said crankcase with said reservoir and there being a second passage venting the interior of said reservoir to the atmosphere; a valve normally closing said first and second passages; a resilient mounting for said valve normally urging said valve to closed position; a reciprocable plunger in engagement with said valve; and exteriorly accessible means for moving said plunger to open said valve.

2. In an outboard motor, an enclosed oil reservoir; an enclosed crankcase positioned adjacent said reservoir, there being a first passage connecting said crankcase with said reservoir, and there being a second passage venting the interior of said reservoir to the atmosphere; a valve normally closing said first and second passages; a resilient mounting for said valve normally urging said valve to closed position; a reciprocable plunger in engagement with said valve; and exteriorly accessible means including a cam for moving said plunger to open said valve.

3. In an outboard motor having an electrical ignition circuit; an enclosed oil reservoir; a separately enclosed crankcase positioned adjacent said reservoir, there being a first passage connecting said crankcase with said reservoir and there being a second passage venting the interior of said reservoir to the atmosphere; a valve normally closing said first and second passages; means including a cam for opening said valve; and means for causing grounding of said circuit when said valve is closed.

4. In an outboard motor having an electrical ignition circuit; an enclosed oil reservoir; a separately enclosed crankcase positioned adjacent said reservoir, there being a first passage connecting said crankcase with said reservoir and there being a second passage venting the interior of said reservoir to the atmosphere; a valve normally closing said first and second passages; means including a cam for opening said valve; and a contact member in said electrical circuit engageable with said cam when said valve is closed for causing grounding of said circuit.

5. In an outboard motor having a crankcase and having an enclosed oil reservoir and having a hydraulic circuit including an oil pump for delivering oil from said reservoir to said crankcase, there being a first passage connecting said crankcase with said reservoir and there being a second passage venting the interior of said reservoir to the atmosphere; a valve normally closing said first and second passages; and means responsive to pressure of oil in said hydraulic circuit for opening said valve.

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6. In an outboard motor having a crankcase and having an enclosed oil reservoir and having an hydraulic circuit including an oil pump for delivering oil from said reservoir to said crankcase, there being a first passage connecting said crankcase with said reservoir and there being a second passage venting the interior of said reservoir to the atmosphere; a valve normally closing said first and second passages; and means including a bellows responsive to pressure of oil in said hydraulic circuit for opening said valve.

7. In an outboard motor having a crankcase and having an enclosed oil reservoir and having an hydraulic circuit including an oil pump for delivering oil from said reservoir to said crankcase, there being a first passage connecting said crankcase with said reservoir and there being a second passage venting the interior of said reservoir to the atmosphere; a valve normally closing said first and second passages; a pivotally mounted lever connected at one end to said valve; and a bellows in engagement with the other end of said lever and responsive to pressure of oil in said hydraulic circuit for moving said lever in a valve opening direction.

8. In an outboard motor having a crankcase and having an enclosed oil reservoir and having an hydraulic circuit including an oil pump for delivering oil from said reservoir to said crankcase, there being a first passage connecting said crankcase with said reservoir and there being a second passage venting the interior of said reservoir to the atmosphere; a valve normally closing said first and second passages; a pivotally mounted lever resiliently connected at one end to said valve; and a bellows responsive to pressure of oil in said hydraulic circuit and having a portion in engagement with the other end of said lever for moving said lever in a valve opening direction.

9. In an outboard motor having a crankcase and having an enclosed oil reservoir and having an hydraulic circuit including an oil pump for delivering oil from said reservoir to said crankcase, there being a first passage connecting said crankcase with said reservoir and there being a second passage venting the interior of said reservoir to the atmosphere; a valve normally closing said first and second passages; a pivotally mounted lever resiliently connected at one end to said valve; a pressure responsive bellows having a portion in engagement with the other end of said lever; and a conduit connecting said bellows with said hydraulic circuit whereby said bellows moves said lever in a valve opening direction in response to oil pressure in said hydraulic circuit.

10. In an outboard motor: an enclosed oil reservoir; and an enclosed, normally drained crankcase positioned above said reservoir, there being a first crankcase breather passage connecting said crankcase with said reservoir and positioned to permit oil to drain by gravity therethrough from said crankcase into said reservoir, and there being a second crankcase breather passage opening into the reservoir above the oil level thereof; and movably mounted valve means positioned for movement between closed position with respect to said passages and open position where said passages are in free communication with said reservoir.

11. In an outboard motor: an enclosed oil reservoir; an enclosed, normally drained crankcase positioned above said reservoir, there being a first crankcase breather passage connecting said

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crankcase with said reservoir and positioned to permit oil to drain by gravity therethrough from first crankcase into said reservoir, and there being a second crankcase breather passage opening into the reservoir above the oil level thereof; movably mounted valve means in said reservoir normally closing both of said passages; a resilient mounting for said valve means normally urging said valve means to closed position; and actuating mechanism connected to said valve means for opening the latter.

12. In an outboard motor: an enclosed oil reservoir; an enclosed, normally drained crankcase positioned above said reservoir, there being a first crankcase breather passage connecting said crankcase with said reservoir and positioned to permit oil to drain by gravity therethrough from said crankcase into said reservoir, and there being a second crankcase breather passage opening into the reservoir above the oil level thereof; valve means in said reservoir normally closing both of said passages; means normally urging said valve means toward closed position; and means for opening said valve means.

13. In an outboard motor: an oil reservoir; a normally drained crankcase superimposed on said reservoir; a common wall separating said crankcase from said reservoir, said wall being formed with a first crankcase breather passage communicating between said crankcase and said reservoir and positioned to permit oil to drain by gravity therethrough from said crankcase into said reservoir, and there being a second crankcase breather passage opening into the reservoir above the oil level thereof; a valve in said reservoir normally closing both of said passages; a resilient mounting for said valve normally urging said valve to closed position; and actuating mechanism connected to said valve for moving the latter to open position.

14. In an outboard motor: an oil reservoir; a normally drained crankcase superimposed on said reservoir; a common wall separating said crankcase from said reservoir, said wall being formed with a first crankcase breather passage communicating between said crankcase and said reservoir and positioned to permit oil to drain by gravity therethrough from said crankcase into said reservoir, and there being a second crankcase breather passage opening into the reservoir above the oil level thereof; a valve in said reservoir for closing said first and second passages; a spring normally urging said valve toward closed position; and means for opening said valve.

15. In an outboard motor: an oil reservoir; a normally drained crankcase superimposed on said reservoir; a common wall separating said crankcase from said reservoir, said wall being formed with a first crankcase breather passage communicating between said crankcase and said reservoir and positioned to permit oil to drain by gravity therethrough from said crankcase into said reservoir, and there being a second crankcase breather passage opening into the reservoir above the oil level thereof, whereby the interior of the crankcase is vented to the atmosphere through said reservoir and said first passage; a valve in said reservoir for closing said first and second passages; means normally urging said valve toward closed position; and means for opening said valve.

16. In an outboard motor having a crankcase and having an enclosed oil reservoir and having an hydraulic circuit including an oil pump for

delivering oil from said reservoir to said crankcase, there being a first passage connecting said crankcase with said reservoir and there being a second passage venting the interior of said reservoir to the atmosphere: a valve normally closing said first and second passages; a pivotally mounted lever connected to said valve; spring means urging said lever in a valve closing direction; and means responsive to pressure of oil in said hydraulic circuit for moving said lever in a valve opening direction. 10

17. In an outboard motor having an electrical ignition circuit: an enclosed oil reservoir; a separately enclosed crankcase positioned adjacent said reservoir, there being a passage connecting said crankcase with said reservoir; a valve normally closing said passage; mechanism for opening said valve, said mechanism including an electrical contact member; and means for causing grounding of said circuit through said electrical contact member when said valve is closed. 20

18. In an outboard motor having an electrical

ignition circuit: a crankcase, there being a breather passage venting the interior of the crankcase to the atmosphere; a valve normally closing said passage; mechanism for opening said valve, said mechanism including an electrical contact member; and means for causing grounding of said circuit through said electrical contact member when said valve is closed.

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