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(54) **Outboard motor**

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- **PATENT ABSTRACTS OF JAPAN vol. 1997, no. 06, 30 June 1997 (1997-06-30) & JP 09 041928 A (SANSHIN IND CO LTD), 10 February 1997 (1997-02-10)**

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Description

[0001] This invention relates to an outboard motor with an engine mounted over an exhaust guide and with an oil sump, in which lubrication oil is collected, being disposed below the exhaust guide, said engine comprising cylinders in each of which a piston is slidably disposed, a cylinder block forming the cylinders; a crankcase covering the crankshaft side of the cylinder block to form a crank chamber; a cylinder head covering the combustion chamber side of the cylinders; an intake passage formed through the cylinder head to supply air to the combustion chambers, and an exhaust passage formed through the cylinder head to discharge exhaust gas from the combustion chambers.

[0002] Outboard motors are prevalently of the so-called cross flow type in which the intake and exhaust passages are disposed separately on right and left sides. In that case, the crank chamber return oil passage for lubrication oil to return from the crank chamber to the oil sump is in most cases disposed without taking into consideration the layout of the intake and exhaust passages. An example of such a construction is shown in US 5 687 686 A.

[0003] Incidentally, in addition to the cross flow type, there is also the counter flow type as for such engines. In the counter flow type, the intake and exhaust passages are disposed on the same, right or left side. Employment of the counter flow type in outboard motors has been examined. In another situation, when an outboard motor is stored to lie on its side, sometimes it occurs that lubrication oil in the crank chamber collects not in the oil sump but in the crank chamber. And it sometimes occurs that the lubrication oil in the crank chamber finds its way through the gap between the cylinder and piston into the combustion chamber. This sometimes results in poor ignition of the engine and dirtier exhaust gases.

[0004] Accordingly, it is an objective of the present invention to provide an improved outboard motor as indicated above which facilitates with simple technical means an optimal lubrication as well as the maintenance concerning the lubrication system.

[0005] According to the present invention, this objective is solved for an outboard motor as indicated above in that the intake and exhaust passages are disposed on either, right or left side of the engine, and that a crank chamber return oil passage making communication between the crank chamber and the oil sump is disposed on the same side as the intake and exhaust passages.

[0006] Therefore, in the outboard motor of the invention, an engine 13 is mounted on an exhaust guide 7 while an oil sump 81 for lubrication oil to collect is disposed below the exhaust guide. The engine comprises; cylinders 26 in which pistons 28 are slidably disposed, a cylinder block 32 in which the cylinders are formed, a crankcase 33 covering the crankshaft 24 side of the cylinder block to form a crank chamber 30, a cylinder head 36 covering the combustion chamber 34 side of the cylinder, intake passages 41 formed through the cylinder head to supply air to the combustion chambers, and exhaust passages 42 formed through the cylinder head to discharge exhaust gas from the combustion chambers. Moreover, both of the intake and exhaust passages are disposed on the same, right or left side of the engine, and crank chamber return oil passages 146, 7k making communication between the crank chamber and the oil sump are disposed on the same side as the intake and exhaust passages.

[0007] In one case, the engine is also provided with opening-closing valves 46 for opening and closing the ports of the intake and exhaust passages, a camshaft 48 for driving the opening-closing valves, a cam chamber 108 in which the camshaft is disposed. The cam chamber is communicated with the oil sump through breathing passages 106,107, 108 located on the opposite side to the intake and exhaust passages.

[0008] In another case, a plurality of crank chamber return oil passages are provided. And in another case, the exhaust guide is formed with an exhaust passage 76 for guiding exhaust gas from the engine downward. And the top surface of the exhaust guide is formed with a cooling water groove 7e for cooling water to flow along the periphery of the exhaust passage.

[0009] In another case, oil passages 7m, 7i for lubrication oil to flow are formed through the exhaust guide, a cooling water groove for the cooling water to flow is formed in the top surface of the exhaust guide, and open-ended relief grooves 151, 152 are formed between the cooling water groove and the oil passages in at least one of the top surface of the exhaust guide and the underside of the engine.

[0010] In another case, the oil passages are oil intake passages.

[0011] In another case, an attachment bracket 1 to be attached to small vessels or the like is provided at its rear end with a rotatable pivot shaft 3 to which is attached through an upper mount 6 the exhaust guide, and the center of gravity G in plan view of the main part of the outboard motor is located about the same as that of the upper mount.

[0012] In another case, a groove 6e in the fore-and-aft direction is formed in the top surface of the upper mount, and a cooling water passage 93 for cooling water to flow is disposed in the groove.

[0013] In another case, a handlebar 12 for steering the outboard motor is disposed on the opposite side to the intake and exhaust passages.

[0014] Oil sumps of outboard motors are disposing oil drain in the center or rear of the bottom. And, an insert opening in which an oil gauge can be inserted is located appropriately, leaving the location of the oil drain out of consideration.

[0015] Incidentally, the lubrication oil in the oil sump ages and deteriorates day by day. Therefore, it is needed to change the oil in the oil sump appropriately. On the changing of oil, a plug of the oil drain is removed,

the lubrication oil is drawn from the oil sump, then the plug is refitted on the oil drain, and new lubrication oil is refilled from the insert opening. This process, however, takes a lot of labor such as removing the plug of the oil drain to draw the lubrication oil, so that there are some cases of inserting a sucking pipe from the insertion opening and sucking to draw the lubrication oil in the oil sump. In this case, old lubrication oil may be remained in the oil sump and mixed with newly refilled oil. That may cause the deterioration of quality of lubrication oil in the oil sump.

[0016] In that case, it is advantageous when a rod oil gauge for measuring the amount of the lubrication oil in said oil sump, an insert opening that the oil gauge is inserted, and an oil drain for draining the lubrication oil in the oil sump, wherein the oil drain is disposed in lower end of one of left or right hand side of the oil sump, and wherein said insert opening is disposed in upper side of the other of left or right hand side of the oil sump, and wherein an axis of the insert opening is headed for the oil drain in top plan view.

[0017] Therefore, the outboard motor of the invention disposes an oil sump 81 on the lower part of the engine 13 and circulates the lubrication oil in the oil sump to supply it to the engine. A rod oil gauge 147 for measuring the amount of the lubrication oil in the oil sump, an insert opening 149 that the oil gauge is inserted, and an oil drain 81a for draining the lubrication oil in the oil sump are also provided. The oil drain is disposed in the lower end of either left or right hand side of the oil sump, and the insert opening is disposed in the upper part of the other side of left or right of the oil sump and headed its axis for the oil drain in the plain view.

[0018] In one case, the bottom of the oil sump is descended to be the lower side in proportion to approach the oil drain.

[0019] In another case, a throttle body 67 for controlling air-intakes to the engine is provided above the insert opening.

[0020] In another case, on the same side with the insert opening are provided crank chamber return oil passages 146, 7k that the lubrication oil returns from the crankcase of the engine to the oil sump.

[0021] And, in another case, the insert opening is formed in the crank chamber return oil passage.

[0022] Further, in the crank chamber of an engine for an outboard motor a crankshaft is vertically disposed to rotate. Lubrication oil is supplied from an oil sump located below the engine to the crank chamber to lubricate the bearing or the like for the crankshaft.

[0023] The lubrication oil sprays into the crank chamber and falls to collect in the bottom of the crank chamber. Then the lubrication oil passes through a crank chamber return oil channel open into the bottom of the crank chamber and returns to the oil sump.

[0024] Incidentally, as the lubrication oil spraying within the crank chamber is subject to air stream generated by the rotation of the crank shaft, resulting in flowing down along the inner side surface of the crank chamber, it takes long time for lubrication oil to fall on the bottom surface of the oil sump. The collection of lubrication oil will be delayed to cause a large amount of lubrication to be needed.

[0025] Therefore, it is advantageous when the crank shaft is disposed in vertical direction within the crank chamber, said crank chamber return oil passage is open into the inner side surface of said crank chamber.

[0026] Therefore, in the outboard motor of the invention, an oil sump 81 is disposed below an engine, the lubrication oil in the oil sump is supplied to the crank chamber 30 of the engine, and the lubrication oil in the crank chamber is returned to the oil sump through a crank chamber return oil channel 146, 7k. In the crank chamber of the engine a crank shaft 24 is disposed in vertical direction and the crank chamber return oil channel is open into the inner side surface 30a of the crank chamber.

[0027] In one case, the crank chamber return oil channel is also open into the inner side surface and the bottom surface 30b of the crank chamber.

[0028] In one case, a plurality of said crank chamber return oil channels are provided and the height of the top end of the opening 61, 162 of each crank chamber return oil channel is different from each other.

[0029] Other preferred embodiments of the present invention are laid down in further dependent claims.

[0030] In the following, the present invention is explained in greater detail with respect to several embodiments thereof in conjunction with the accompanying drawings, wherein:

FIG. 1 is a side view of an outboard motor as an embodiment of the invention;

FIG. 2 is a cross-sectional view of the outboard motor shown in FIG. 1;

FIG. 3 is an enlarged view of an essential part of FIG. 2;

FIG. 4 is a cross-sectional view, partially broken away, of the upper part of the outboard motor as seen from the right hand side;

FIG. 5 shows a cross-section of an essential part of the engine;

FIG. 6 shows the interior of the outboard motor in plan view;

FIG. 7 is a cross-sectional plan view of the engine of the outboard motor;

FIG. 8 shows an essential part in cross-section of the outboard motor taken along the line VIII in FIGs. 16 and 17;

FIG. 9 shows an essential part in cross-section of the outboard motor taken along the line IX in FIGs. 16 and 17;

FIG. 10 shows an essential part in cross-section of the outboard motor taken along the line X-X in FIG. 15;

FIG. 11 is a front view of the cylinder block;

FIG. 12 is a back view of the cylinder block;

FIG. 13 is a front view of the cylinder head;

FIG. 14 shows the cylinder block and the crankcase in bottom view;

FIG. 15 is a plan view of the exhaust guide;

FIG. 16 shows the exhaust guide and the exhaust pipe in bottom view, with (a) showing the exhaust guide, and (b) the exhaust pipe;

FIG. 17 shows a connecting case and the exhaust pipe in plan view, with (a) showing the connecting case, and (b) the exhaust pipe;

FIG. 18 is an oblique view of the exhaust pipe;

FIG. 19 is an explanatory drawing of an intake passage cooling jacket, as an enlarged view of an essential part of FIG. 4;

FIG. 20 is a schematic, perspective view for the description of the crank chamber oil return passage in the first embodiment; and

FIG. 21 is a schematic, perspective view of a crank chamber oil return passage in another embodiment.

[0031] An outboard motor as the first embodiment of the invention will be described in reference to FIGs. 1 to 20. FIG. 1 is a side view of an outboard motor as an embodiment of the invention. FIG. 2 is a cross-sectional view of the outboard motor shown in FIG. 1. FIG. 3 is an enlarged view of an essential part of FIG. 2. FIG. 4 is a cross-sectional view, partially broken away, of the upper part of the outboard motor as seen from the right hand side. FIG. 5 shows a cross-section of an essential part of the engine. FIG. 6 shows the interior of the outboard motor in plan view. FIG. 7 is a cross-sectional plan view of the engine of the outboard motor. FIG. 8 shows an essential part in cross-section of the outboard motor taken along the line VIII in FIGs. 16 and 17. FIG. 9 shows an essential part in cross-section of the outboard motor taken along the line IX in FIGs. 16 and 17. FIG. 10 shows an essential part in cross-section of the outboard motor taken along the line X-X in FIG. 15. FIG. 11 is a front view of the cylinder block. FIG. 12 is a back view of the cylinder block. FIG. 13 is a front view of the cylinder head. FIG. 14 shows the cylinder block and the crankcase in bottom view. FIG. 15 is a plan view of the exhaust guide. FIG. 16 shows the exhaust guide and the exhaust pipe in bottom view, with (a) showing the exhaust guide, and (b) the exhaust pipe. FIG. 17 shows a connecting case and the exhaust pipe in plan view, with (a) showing the connecting case, and (b) the exhaust pipe. FIG. 18 is an oblique view of the exhaust pipe. FIG. 19 is an explanatory drawing of an intake passage cooling jacket, as an enlarged view of an essential part of FIG. 4. FIG. 20 is a schematic, perspective view for the description of the crank chamber oil return passage in the first embodiment. FIG. 21 is a schematic, perspective view of a crank chamber oil return passage in another embodiment.

[0032] In addition to the above description of the drawings, in FIG. 3, a strainer and an intake pipe are not shown. In FIG. 5, the front parts of a communication passage for cooling the combustion chamber and a distribution passage communicating with the combustion chamber cooling communication passage are shown with solid lines, although they are actually invisible. In FIG. 7, the underside of the cylinder block is shown with phantom line. In FIG. 8, the cylinder block is shown as seen from the back side, and the positions of the intake and exhaust passages through the cylinder head are shown with phantom line, although they are actually invisible. In FIG. 9, the left hand part of the cylinder block is a cross-sectional view of part of the cylinder block where the breathing passages are located. In FIG. 17 (a), the position of an exhaust pipe 77 is shown with phantom line, an oil gauge shown with actual line and the extension of the axis of the oil gauge 147 with phantom line. In FIG. 19, the position of an intake passage cooling jacket is shown with broken lines. In FIG. 20, the flow of lubrication oil is shown with arrows in actual line, the air flow from the oil sump section shown with arrows in broken lines. In this specification, the term "rear side" refers to the side where the cylinders are disposed relative to the crankshaft, and "right side" refers to the starboard. As far as not specified, the crank shaft in the description herein shall be extended in vertical direction.

[0033] The outboard motor is securely attached to a transom 2 or the like of a small vessel by means of an attachment bracket 1. In the rear part of the attachment bracket 1 is provided a pivot shaft 3 for free rotation. The pivot shaft 3 is connected at its top end to an exhaust guide 7 through an upper mount 6, and at its bottom end to an upper casing 11 through a lower mount 9. The top end of the pivot shaft 3 projects forward to form a steering bracket 10. A handlebar 12 is rotatably attached to the steering bracket 10 and is rotatable between a forward projecting position for use as shown with solid line in FIG. 1 and a stowed position shown in phantom line. An engine 13 is placed on the exhaust guide 7 and secured with bolts and others. The upper mount 6 com-

prises; paired right and left rods 6a secured to the pivot shaft 3, an attachment member 6c with paired right and left cylindrical portions 6b into which the rods 6a are inserted, and a rubber member 6d as an elastic member intervening between the cylindrical portions 6b and the rods 6a. The top surface of the attachment member 6c of the upper mount 6 is formed with a groove 6e extending between the right and left cylindrical portions 6b in the fore-and-aft direction.

[0034] The outside of the engine 13 is covered with an upper cowling 16 and a lower cowling 17. The lower cowling 17, while being supported with the exhaust guide 7, supports the upper cowling 16. When the handlebar 12 is in the stowed position, it is located on the left side of the cowlings 16 and 17, namely on the outside. On the underside of the exhaust guide 7 are connected in succession; a connecting case 21, an upper easing 11, and a lower easing 23. The exhaust guide 7 and the connecting case 21 are interconnected with their right and left sides flush with each other. The outer sides of the exhaust guide 7 and the connecting case 21 are covered with an apron 25 which is not a constitutional member and made of a plastic material for better external appearance. The apron 25 is detachably attached by appropriate means to the connecting case 21.

[0035] The engine 13, an internal combustion engine, is of the L-type with 4-cycle two cylinders, and is a counter-flow type in which the intake and exhaust passages are formed on the same, right side relative to the combustion chamber. The crankshaft 24 of the engine 13 is disposed with its axis generally vertical, or in the up and down direction. Behind the crankshaft 24 are disposed two cylinders 26, one over the other. The crankshaft 24 is connected to two pistons 28 respectively through connecting rods 29. The pistons 28 are disposed for sliding within the cylinders 26. The case 31 of the engine 13 comprises; a cylinder block 32 forming the two cylinders 26, a crankcase 33 covering the crankshaft 24 side of the cylinder block 32 to form a crank chamber 30, and a cylinder head 36 covering and closing the combustion chamber 34 side of the cylinder block 32. The cylinder block 32 and the crankcase 33 of the engine 13 are placed on and secured to the top surface of the exhaust guide 7. However, the cylinder head 36 is not in contact with and is not attached to the exhaust guide 7. Constituting in this way, unlike the case in which the cylinder head 36 is attached to both of the cylinder block 32 and the exhaust guide 7, the cylinder head 36 has to be finished with a high precision only on its front face which is attached to the cylinder block 32. Thus, low finishing precision on the underside raises less problems, and machining and assembly are made easier.

[0036] The lower end of the crankshaft 24 projects from the engine case 31 and connected to a drive shaft 38. The drive shaft 38 is disposed to extend vertically through the connecting case 21, the upper easing 11, and the lower easing 23. The rotation of the drive shaft 38 is transmitted through bevel gears, etc. (not shown) to a propeller 39 rotatably disposed at the rear end of the lower easing 23.

[0037] In the cylinder head 36 are also formed for each cylinder 26; an intake passage 41 with its fore-end opening to the combustion chamber 34 for supplying air to the cylinder 26, and an exhaust passage 42 with its fore-end likewise opening to the combustion chamber 34 for discharging combustion gas from the cylinder 26. The ports of the intake passage 41 and the exhaust passage 42 are disposed on the right side of the combustion chamber 34, with the port of the intake passage 41 being disposed above the port of the exhaust passage 42. Both of the ports are opened and closed with opening-closing valves 46. The opening-closing valves 46 are driven with a camshaft 48 through rocker arms 47. The camshaft 48 extends in the vertical direction.

[0038] The top end of the crankshaft 24 projects from the engine case 31. A drive pulley 51 is secured by tightening with a nut to the top end of the crankshaft 24. A flywheel 52 is attached over the drive pulley 51. A driven pulley 54 is attached to the top end of the camshaft 48. An endless transmitting member, a timing belt 56 is routed around the drive pulley 51 on the crankshaft 24 and the driven pulley 54 on the camshaft 48, so that the crankshaft 24 and the camshaft 48 rotate as interlocked. An oil pump 57 is attached to the underside of the cylinder head 36 so as to be driven with the camshaft 48.

[0039] Rear ends of an intake pipes 66 are respectively connected to the ends of the intake passages 41 of the cylinder head 36. The paired, upper and lower intake pipes 66 are joined together and connected to a carburetor 67 as a throttle body, which in turn is connected to an air intake section 68.

[0040] The cylinder block 32 is also formed with a joint flow exhaust passage 71 extending in the vertical direction. Two branch flow passages 72 bifurcating from the joint flow exhaust passage 71 are respectively connected to the exhaust passages 42 of the cylinder head 36. The lower end of the joint flow exhaust passage 71 is connected to an exhaust passage 76 formed through the exhaust guide 7. The exhaust pipe 77 is connected to the lower end of the exhaust passage 76 of the exhaust guide 7. A cooling water pipe 78, with its lower end extending downward lower than the exhaust pipe 77, is formed integrally with the exhaust pipe 77. The top end of the cooling water pipe 78 is connected to a water passage 79 for cooling the exhaust pipe of the exhaust guide 7.

[0041] The connecting case 21 is formed with an oil sump section 81 for collecting oil, a space 82 for exhaust passage, an idling expansion chamber 83, a front upper chamber 84, and a front lower chamber 86. Those spaces are separated from each other with partition walls 87. The oil sump section 81 is formed to be open upward and to extend between right and left side walls 21a and 21b of the connecting case 21. A strainer 88 is disposed in the oil sump section 81. The strainer 88 is connected to the suction port of the oil pump 57 through a suction

pipe 90, etc. At the lower end on the left side of the oil sump section 81, an oil drain 81 a is formed through the wall of the oil sump section 81a and the opening of the oil drain 81 a is not opened just below, but opened toward the left side or the side direction. A plug 81b is detachably mounted on the opening of the oil drain 81 a. The bottom surface 81 a inside the oil sump section is sloped downward to the left side (or, in the manner of being lowered as closer to the oil drain 81 a).

[0042] The exhaust passage space 82 is formed to extend vertically behind the oil sump section 81 through the connecting case 21. The exhaust pipe 77 is disposed in the exhaust passage space 82. The idling expansion chamber 83 is formed with its top surface open and with an exhaust port 89 formed in its rear wall. The top surface of the connecting case 21 is formed with an idling exhaust groove 91 between the exhaust passage space 82 and the idling expansion chamber 83. The front upper chamber 84 and the front lower chamber 86 serving as spaces for a drive shaft and upward cooling water flow are separated up and down with the partition wall 87. The drive shaft 38 and a cooling water upward flow pipe 93 as a cooling water passage are vertically disposed to penetrate the partition wall 87. The front side of the front upper chamber 84 is open. The front lower chamber 86 communicates with a front space 94 in the upper casing 11 and forms a water reservoir together with the front space 94. A cooling water pump 96 is disposed in the front space 94 in the upper casing 11. The cooling water pump 96 is driven with the drive shaft 38 and its delivery port is connected to the cooling water upward flow pipe 93. In the upper casing 11, an exhaust passage 102 is formed behind the front space 94 separated with a partition wall.

[0043] In the state of the connecting case 21 being attached to the underside of the exhaust guide 7 as described above, the exhaust guide 7 serves as a lid over the oil sump section 81. On the underside of the exhaust guide 7 is formed an idling exhaust groove 92 in a position opposite the idling exhaust groove 91 of the connecting case 21. When the connecting case 21 is attached to the exhaust guide 7, both of the idling exhaust grooves 91 and 92 form an idling exhaust passage to draw exhaust gas from the exhaust passage space 82 to the idling expansion chamber 83. The lower rear part of the exhaust guide 7 has an extending part 7a extending under the cylinder head 36. The extending part 7a is not secured to the cylinder head 36 as described before, like a cantilever having a low strength. In the connecting case 21, part of the exhaust passage space 82 and the idling expansion chamber 83 are disposed under the extending part 7a of the exhaust guide 7, and the oil sump section 81 is not disposed there. In other words, the rear end of the oil sump section 81 is located more forward than the cylinder head 36. Therefore, the extending part 7a need not support the oil sump section 81 which becomes heavy when it collects lubrication oil, so that the strength of the extending part 7a may be made relatively low. As a result, although the length of the oil sump section 81 in the fore-and-aft direction becomes short, which is disadvantageous to secure the capacity of the oil sump section 81, since the oil sump section 81 is formed to span the right and left side walls 21a and 21b of the connecting case 21, the capacity can be secured as practicable as possible.

[0044] Next, the structure for supplying cooling water to the engine 13 will be described.

[0045] The lower casing 23 is formed with a cooling water intake port 101. An intake water passage 23e is formed from the cooling water intake port 101 to the cooling water pump 96. The cooling water upward flow pipe 93 is connected to the delivery port of the cooling water pump 96. The cooling water upward flow pipe 93 extends upward passing through the front space 94 of the upper easing 11, the front lower chamber 86 in the connecting case 21, the front upper chamber 84 in the connecting case 21, and backward through the groove 6e in the top surface of the upper mount 6, and is connected to a distribution flow passage 111. The distribution flow passage 111 is constituted with a distribution groove 7e as a cooling water groove in the top surface of the exhaust guide 7 and a distribution groove 32e in the underside surface of the cylinder block 32. In the state of the cylinder block 32 being attached to the exhaust guide 7, the distribution groove 7e in the exhaust guide 7 and a distribution groove 32e in the cylinder block 32 are made to face each other to constitute the distribution flow passage 111. The cooling water intake port 101, the intake water passage 23e, the cooling water upward flow pipe 93, and the distribution flow passage 111 constitute a cooling water upward flow passage.

[0046] The distribution groove 7e of the exhaust guide 7 is formed with water down-flow hole 7h communicating with the exhaust pipe cooling water passage 79. The water down-flow hole 7h, the exhaust pipe cooling water passage 79, and the cooling water pipe 78 constitute an exhaust pipe cooling flow passage. The distribution groove 32e in the cylinder block 32 is provided with a water drain hole 113 communicating with a flow passage 114 formed around the cylinders 26 in the cylinder block 32. The rear side of the flow passage 114 around the cylinders is open. The distribution groove 32e of the cylinder block 32 is formed with a combustion chamber cooling communication passage 32f and an intake-exhaust cooling communication passage 32g extending rearward. The cylinder head 36 is formed with a combustion chamber cooling communication passage 36f and an intake-exhaust cooling communication passage 36g. Those passages 36f and 36g are respectively connected to the passages 32f and 32g of the cylinder block 32.

[0047] The combustion chamber cooling communication passage 36f in the cylinder head 36 is communicated with a flow passage 117 formed around the combustion chamber 34 of the cylinder head 36. The combus-

tion chamber surrounding flow passage 117 in the cylinder head 36 is open on its front side and connected to the rear side opening of the cylinder surrounding flow passage 114 in the cylinder block 32. A thermostat 119 is disposed at the top end of the cylinder surrounding flow passage 114. The thermostat 119 is connected to a first water drain pipe 121. When the cooling water temperature is below a preset value (such as 60°'C), flow from the cylinder surrounding flow passage 114 to the first water drain pipe 121 is almost stopped and when the cooling water temperature exceeds the preset value, the flow from the cylinder surrounding flow passage 114 to the first water drain pipe 121 is permitted. The first water drain pipe 121 is connected to a water drain passage 122 provided in the cylinder block 32. The water drain passage 122 in turn is connected to a second water drain pipe 123. The second water drain pipe 123 is routed downward between the exhaust guide 7 and the apron 25. The combustion chamber cooling communication passage 36f, the combustion chamber surrounding flow passage 117, the cylinder surrounding flow passage 114, the first water drain pipe 121, the water drain passage 122, and the second water drain pipe 123 constitute a cylinder cooling flow passage.

[0048] The intake-exhaust cooling communication passage 36g in the cylinder head 36 is connected to an intake passage cooling jacket 131. The intake passage cooling jacket 131, when seen in side view (or when seen from outside), is disposed in the state of being superimposed on the intake passage 41 in the lower level (in other words, in the state of covering the outside of the intake and the exhaust passages) and both of the exhaust passages 42 in the cylinder head 36, and cools them. However, it is not superimposed on the upper level intake passage 41 and little cools the upper level intake passage 41. A pilot water pipe 133 is connected to the intake passage cooling jacket 131. The intake-exhaust cooling communication passage 32g, the intake-exhaust cooling communication passage 36g, the intake passage cooling jacket 131, and the pilot water pipe 133 constitute an intake cooling flow passage.

[0049] Next, the structure for supplying lubrication oil to the engine 13 will be described. The exhaust guide 7 is formed with an oil upward flow passage 7i extending in the vertical direction. The oil upward flow passage 7i is connected at its lower end to the strainer 88 through the suction pipe 90. The cylinder block 32 is formed with an oil connection passage 32i with its one end connected to the oil upward flow passage 7i and the other end is open to the rear face of the cylinder block 32. The cylinder head 36 is formed with a suction port passage 36i connected to the suction port of the oil pump 57 and a delivery port passage 36j connected to the delivery port of the oil pump 57. The suction port passage 36i of the cylinder head 36 is connected to the oil connection passage 32i of the cylinder block 32. The strainer 88, the suction pipe 90, the oil upward flow passage 7i of the exhaust guide 7, the oil connection passage 32i of the cylinder block 32, and the suction port passage 36i of the cylinder head 36 constitute an oil suction passage for the oil pump 57 to draw in lubrication oil. The oil suction passage is under a negative pressure when the oil pump 57 is operating.

[0050] The delivery port passage 36j of the cylinder head 36 is connected to an oil supply passage 32j in the cylinder block 32. The oil supply passage 32j extends forward to communicate with a main gallery 140 and is provided with a relief valve 141. The relief valve 141 extends downward from the underside of the cylinder block 32 and is disposed in a through hole 142 for the relief valve in the exhaust guide 7. The main gallery 140 extends vertically in the cylinder block 32, with a branch passage 143 branching forward from the main gallery 140 to supply lubrication oil to the crankshaft 24. The lubrication oil supplied to the crankshaft 24 is sprayed in the crank chamber 30. The cylinder block 32 is formed with a crank chamber oil return passage 146. The crank chamber oil return passage 146 comprises two passages 146a and 146b and disposed on the right hand side, or on the side where the intake passages 41 and the exhaust passages 42 are disposed. The top ends of the oil return passages 146a and 146b are respectively open at the inner side surface 30a and the bottom surface 30b of the crank chamber 30 while their bottom ends are open into the underside of' the cylinder block 32. The top end of the upper opening 161 of the oil return passage on the front side is positioned lower than the top end of the upper opening 162 of the oil return passage on the rear side.

[0051] A crank chamber oil return hole 7k is formed through the exhaust guide 7 and the oil return hole 7k is connected with the oil return passage 146. Both of the crank chamber oil return hole 7k and the crank chamber oil return passage 146 configure the crank chamber return oil channel. An insert opening 149 in which the rod-like oil gauge 147 is inserted is formed at the passage 146b behind the crank chamber oil return passage 146. The oil gauge 147 comprises grip section 147a, lid section 147b, and measurement section 147c. The lid section 147b prevents the leakage of the lubrication oil from the insert opening 149 or the invasion of dust into the oil sump section 81. The axis of the oil gauge 147 and the insert opening 149 is, as shown in the plan view of FIG. 17 (or, seen from the upper side of the crankshaft 24), oriented to the oil drain 81a. The insert opening 149 is located below the carburetor 67 so as to effectively use the space below the carburetor 67.

[0052] It is also possible that on the passage 146b in the rear of the crank chamber oil return passage 146, an insert opening 149 in which a rod oil gauge 147 can be inserted is formed. The oil gauge 147 comprises a grabbed section 147a, a cap section 147b and measuring section 147c, and the cap section 147b prevents leaking of the lubrication oil from the insert opening 149 and entering of foreign particles from the insert opening 149 into oil sump section 81. An axis of the oil gauge

147 or insert opening 149 is headed for the oil drain 81a in the top plain view of Fig. 17 (or, in the view from the above of the crank shaft 24).

[0053] The cylinder head 36 is covered with a head cover 105 on the side where the camshaft 48 is disposed so as to form a cam chamber 108. The oil pump 57 supplies lubrication oil also to the cam chamber 108 where the camshaft 48 is disposed. The lubrication oil in the cam chamber 108 returns to the oil sump section 81 after passing through a cam chamber return passage 36m in the cylinder head 36, a cam chamber return passage 32m in the cylinder block 32, and a cam chamber oil return hole 7m in the exhaust guide 7. The cam chamber return passages 36m, 32m, and the cam chamber oil return hole 7m are disposed on the right hand side, like the crank chamber oil return passage 146 and the crank chamber oil return hole 7k, but nearer to the central axis of the outboard motor.

[0054] Breathing passages 106, 107, and 109 are formed through the exhaust guide 7, the cylinder block 32, and the cylinder head 36 so that communication is made between the oil sump section 81 and the cam chamber 108. The breathing passage 109 in the cylinder head 36 is open to the cam chamber 108 at a position higher than the cam chamber return passage 36m in the cylinder head 36. The breathing passages 106, 107, and 109 are disposed on the left hand side, opposite the side where the crank chamber oil return passage 146 and the crank chamber oil return hole 7k are disposed.

[0055] As shown in FIG. 15, in the top surface of the exhaust guide 7 is formed a relief groove 152 among the distribution groove 7e as a groove for the cooling water passage for the cooling water to flow through, the cam chamber oil return hole 7m as an oil flow passage for the lubrication oil to flow through, and the oil upward flow passage 7i. The end of the relief groove 152 is released to a space inside the cowlings 16, 17. The relief groove 152 prevents cooling water from seeping into the cam chamber oil return hole 7m and the oil upward flow passage 7i, and prevents lubrication oil from seeping into the distribution groove 7e, and releases those liquids to the interior of the cowlings 16, 17. Likewise, in the underside surface of the cylinder block 32 is formed a relief groove 151 among the distribution groove 32e, the opening of the cam chamber return passage 32m, and the opening of the oil connection passage 32i. The end of the relief groove 151 is also released to the space inside the cowlings 16, 17 to prevent cooling water and lubrication oil from finding their ways into other passages, same as the relief groove 152.

[0056] The cooling water upward flow pipe 93 is disposed to extend from under the upper mount 6, and through the space in front of the upper mount 6 and the groove 6e in the top surface of the upper mount 6, and rearward. As a result, the upper mount 6 can be located more rearward than in the case the cooling water upward flow pipe 93 is disposed to extend from under the upper mount 6, and through the space behind and over the upper mount 6. In FIG. 15 of plan view (namely as seen from above the crankshaft 24), the center of gravity (G) of the main body of the outboard motor (the part that is supported with the mounts 6 and 9, or the outboard motor in the state without the mounts 6 and 9) is approximately located in the same position as that of the upper mount 6, or more forward than the rear end of the upper mount 6. Therefore, the outboard motor is supported with stability, and the vibration of the outboard motor is reduced.

[0057] With the outboard motor constituted as described above, when the crankshaft 24 rotates in the direction of the arrow in FIG. 7, air is drawn from the air intake section 68 into the carburetor 67 where fuel is supplied to produce fuel-mixed gas. The fuel-mixed gas flows through the intake pipe 66 and the intake passage 41 in the cylinder head 36, into the combustion chamber 34 of the cylinder 26. The fuel-mixed gas that has flowed into the combustion chamber 34 is ignited with an ignition plug (not shown) and burned. The exhaust gas produced by the burning is discharged from the boss of the propeller 39, etc. after passing through the exhaust passage 42 in the cylinder head 36, the branch flow passages 72 in the in the cylinder block 32, the joint flow exhaust passage 71, the exhaust passage 76 in the exhaust guide 7, the exhaust pipe 77, the exhaust passage space 82 in the connecting case 21, and the exhaust passage 102 of the upper casing 11. When the engine is idling, the exhaust gas in the connecting case 21 flows through idling exhaust grooves 91, 92 between the exhaust guide 7 and the connecting case 21, into the idling expansion chamber 83, and is discharged from the exhaust opening 89. The piston 28 is reciprocated with the expansion force produced by the combustion of the fuel-mixed gas. The reciprocating motion of the piston 28 is transmitted through the connecting rod 29 to the crankshaft 24 for its rotation.

[0058] The rotation of the crankshaft 24 rotates the camshaft 48 through the drive pulley 51, the timing belt 56, and the driven pulley 54, to operate the oil pump 57. The operation of the oil pump 57 sends the lubrication oil in the oil sump section 81 in the connecting case 21 through the strainer 88, the suction pipe 90, the oil upward flow passage 7i in the exhaust guide 7, the oil connection passage 32i in the cylinder block 32, and the suction port passage 36i in the cylinder head 36, and into the oil pump 57. The lubrication oil drawn into the oil pump 57 is delivered from the delivery port of the oil pump 57, and supplied to the crankshaft 24 through the delivery port passage 36j, as a crank chamber oil supply passage, in the cylinder head 36, the oil supply passage 32j of the cylinder block 32, the main gallery 140, and the branch passage 143, and into the crank chamber 30. If the pressure of the lubrication oil is higher than a pressure preset with the relief valve 141 when the lubrication oil is flowing through the oil supply passage 32j of the cylinder block 32, the relief valve 141 opens, and the lubrication oil is discharged to the oil sump section

81 to maintain the lubrication oil pressure to the preset value. The lubrication oil in the crank chamber 30 returns through the crank chamber oil return passage 146 and the crank chamber oil return hole 7k of the exhaust guide 7 to the oil sump section 81. In the crank chamber 30, lubrication oil is flowing along the inner side surface 30a of the crank chamber 30 by air flow involved with the rotation of the crankshaft 24. As shown in FIG. 20, the lubrication oil flowing along the inner side surface 30a can directly flow into the crank chamber oil return passage 146 without falling onto the bottom surface 30b of the crank chamber 30, because the openings 161, 162 of the crank chamber oil return passage 146 on the crank chamber 30 side extend to the inner side surface 30a of the crank chamber 30. The lubrication oil is therefore recovered quickly in the oil sump 81. Further, lubrication oil is also supplied from the oil pump 57 to the cam chamber 108 in which the camshaft 48 is disposed. The oil in the cam chamber 108 returns to the oil sump section 81 through the cam chamber return passage 36m in the cylinder head 36, the cam chamber return passage 32m of the cylinder block 32, and the cam chamber oil return hole 7m of the exhaust guide 7.

[0059] Along with the reciprocating movement of the piston 28, pressure in the crank chamber 30 increases and decreases. In some cases, gas in the combustion chamber 34 leaks as blow-by gas through the gap between the piston 28 and the cylinder 26 into the crank chamber 30. As a result, the gas reciprocates up and down between the crank chamber 30 and the oil sump section 81 through the crank chamber oil return passage 146 and the crank chamber oil return hole 7k in the exhaust guide 7. The gas, when flowing in the same direction as the lubrication oil, flows smoothly. However, when the gas flows in the direction opposite the lubrication oil flow, or in the direction from the oil sump section 81 to the crank chamber 30, the lubrication oil flow runs counter to the gas flow. However, since a plural number of the crank chamber oil return passages 146 are provided, lubrication oil can flow through one crank chamber oil return passage 146 while the gas can flow through another in the reverse direction. In this way, the lubrication oil and the gas can flow relatively smoothly. Particularly, as the heights of the openings 161, 162 (that is, the positions of the top ends) of the oil return passage 146a, 146b are different each other, it tends to that air flows through the oil return passage 146b on the higher opening 162 side and lubrication oil flows through the oil return passage 146a on the lower opening 161 side.

[0060] The gas in the oil sump section 81 can flow through the breathing passage 106 in the exhaust guide 7 and the breathing passage 107 in the cylinder block 32 into the cam chamber 108. The gas in the cam chamber 108 is discharged through a breathing chamber 148 to the air intake member 68 which is part of an air intake system.

[0061] The rotation of the crankshaft 24 also operates the cooling water pump 96. The cooling water pump 96 draws water from outside the outboard motor through the cooling water intake port 101 formed in the lower easing 23, and supplies the water to the distribution flow passage 111 through the cooling water upward flow pipe 93, etc. In the distribution flow passage 111, the cooling water is distributed to a cylinder cooling flow passage, an intake air cooling flow passage, and an exhaust pipe cooling flow passage. That is to say, part of the cooling water flows through the combustion chamber cooling communication passage 32f, the combustion chamber cooling communication passage 36f, the combustion chamber surrounding flow passage 117, the cylinder surrounding flow passage 114, the thermostat 119, the first water drain pipe 121, the drain water passage 122, and the second water drain pipe 123, and is discharged outside the outboard motor through a gap between the apron 25 and the upper casing 11. While the cooling water is flowing through the combustion chamber surrounding flow passage 117 and the cylinder surrounding flow passage 114, it cools the combustion chamber 34 and the cylinder 26. Another part of the cooling water flows through the intake-exhaust cooling communication passage 32g, the intake-exhaust cooling communication passage 36g, the intake passage cooling jacket 131, and a pilot water pipe 133, to cool the exhaust passages 42 in the cylinder head 36, and the intake passage 41 located between the exhaust passages 42, and discharged outside the outboard motor. Still another part of the cooling water flows through the water down-flow hole 7h, the exhaust pipe cooling water passage 79, and the cooling water pipe 78 to cool the exhaust pipe 77. The cooling water that has flowed out of the cooling water pipe 78 flows through the exhaust passage space 82 in the connecting case 21 the exhaust passage 102 in the upper casing 11, etc. and is discharged from the boss of the propeller 39. Since the lower end of the cooling water pipe 78 is located lower than the exhaust pipe 77, the cooling water flowing out of the cooling water pipe 78 is effectively prevented from finding its way through the exhaust pipe 77 into the engine 13.

[0062] The cooling water pump 96 delivers cooling water to the cooling water upward flow pipe 93. At the same time, cooling water leaking from the housing of the cooling water pump 96 is supplied to the front space 94 which serves as a water sump in the upper casing 11. The front space 94 in the upper casing 11 is communicated with the front lower chamber 86 which serves as a water sump in the connecting case 21. The front lower chamber 86 is also filled with cooling water which cools the lower part of the oil sump section 81. The partition wall 87 separating the front lower chamber 86 from the front upper chamber 84 is provided with holes for passing the drive shaft 38 and the cooling water upward flow pipe 93. The cooling water in the front lower chamber 86 flows through those holes into the front upper chamber 84. Since the front upper chamber 84 is open to the outside, the cooling water in the front upper cham-

ber 84 is discharged outside through the opening.

[0063] When lubrication oil contained in the oil sump 81 is to be discharged, the plug 81b of the drain 81a may be removed. Particularly in case the outboard motor is mounted on a small craft or the like with a mount bracket 1, the opening of the oil drain 81a comes to the position toward the beneath side as the outboard motor is tilted up and steered so that the oil drain 81a may be located at lower position. As the result, the lubrication oil in the oil sump 81 is quickly discharged. The discharge of lubrication oil may be done by inserting a suction pipe (not shown) into the insert opening 149 without removing the plug 81b. In this case, the distal end of the suction pipe is inserted toward the oil drain 81a where the lubrication oil tends to stay since the axis of the insert opening 149 directs to the oil drain 81a. Generally all amount of lubrication oil can be therefore discharged. Since the bottom surface 81c of the oil sump 81 is inclined toward the oil drain 81a, the distal end of the suction pipe is guided to the bottom surface 81c of the oil sump section 81 to move smoothly toward the oil drain 81a.

[0064] In this embodiment described above, the cylinder cooling flow passage, the intake cooling flow passage, and the exhaust pipe cooling flow passage branch from the cooling water upward flow passage. The thermostat 119 provided in the cylinder cooling flow passage prevents the cylinder 26 from being overcooled during idling or the like. The intake air cooling flow passage can intensely cool the intake passage 41 in the cylinder head 36. In particular, the temperature of the intake passage 41 located between the exhaust passages 42 tends to be higher than that of the other intake passage 41. However, since the intake air cooling flow passage is located nearer to the intake passage 41 located between the exhaust passages 42 than the other intake passage 41, temperature rise of the former intake passage 41 can be prevented. As a result, temperature difference between the intake passages 41 can be effectively reduced.

[0065] Part of the distribution groove 7e as a cooling water groove in the exhaust guide 7 is disposed along the exhaust passage 76, so that the exhaust passage 76 can be cooled. As the distribution groove 7e is disposed between the exhaust passage 76 and the oil passages (the cam chamber oil return hole 7m and oil upward flow passage), influence of heat of the exhaust gas flowing through the exhaust passage 76 on the lubrication oil flowing through the oil passages can be effectively prevented.

[0066] The intake air cooling flow passage is not provided with a thermostat and so the cooling water from the cooling water pump 96 can always flow through the intake air cooling flow passage. Therefore, the cooling water pump 96 is prevented from being applied with a heavy load without providing a pressure valve.

[0067] Cooling water of a relatively low temperature in the cooling water upward flow passage is also supplied to the exhaust pipe cooling flow passage, and so the exhaust pipe 77 can be intensely cooled.

[0068] The engine 13 is of the counter flow type in which the intake passages 41 and the exhaust passages 42 are located on one, right hand side of the engine 13. Therefore, a relatively large space is provided on the other, left hand side and it is easy to arrange other components such as auxiliary devices there.

[0069] The intake passage cooling jacket 131, when seen from outside, is disposed to be superimposed on the intake passage 41 located between the exhaust passages 42 and also on the exhaust passages 42, and not to be superimposed on the intake passage 41 that is not located between the exhaust passages 42. Therefore, the intake passage cooling jacket 131 can cool the intake passage 41 which is likely to become hot as it is located between the exhaust passages 42. As a result, temperatures of the intake passages 41 can be made almost equal.

[0070] The breathing passage 107, and the handlebar 12 in the stowed state are disposed on the left hand side. On the other hand, the intake passages 41, the exhaust passages 42, and the crank chamber oil return passage 146 are disposed on the right hand side. In other words, the handlebar 12, the intake passages 41, the exhaust passages 42, and the crank chamber oil return passage 146 are disposed on right and left sides of a center, the cylinder 26. In the case as when the outboard motor is placed to lie on its side on the ground or the like, since the handlebar 12 comes to the underside while the intake passages 41 and the exhaust passages 42 comes to the upper side, fuel and lubrication oil are prevented from collecting in the intake passages 41 and the exhaust passages 42. Since the crank chamber oil return passage 146 also comes to the upper side, the lubrication oil in the crank chamber 30 is smoothly recovered into the oil sump section 81. The breathing passage 107 is located on the opposite side to the crank chamber oil return passage 146 so that its layout space can be easily secured.

[0071] Moreover, it is possible that the breathing passage 107, the handlebar 12 in the stowed state, and the oil drain 81a are disposed on the left hand side. On the other hand, the intake passages 11, the exhaust passages 42, the carburetor 67, the crank chamber oil return passage 146, and the insert opening 149 are disposed on the right hand side. In other words, a group of the breathing passage 107, the handlebar 12, and the oil drain 81a, and another group of the intake passages 41, the exhaust passages 42, the carburetor 67 and the crank chamber oil return passage 146 are disposed on right and left sides of a center, the cylinder 26. In the case as when the outboard motor is placed to lie on its side on the ground or the like, since the handlebar 12 comes to the underside while the intake passages 41 and the exhaust passages 42 comes to the upper side, fuel and lubrication oil are prevented from collecting in the intake passages 41 and the exhaust passages 42.

Since the crank chamber oil return passage 146 also comes to the upper side, the lubrication oil in the crank chamber 30 is smoothly recovered into the oil sump section 81. The breathing passage 107 is located on the opposite side to the crank chamber oil return passage 146 so that its layout space can be easily secured. As the insert opening 149 is located upper side, leakage of lubrication oil from the insert opening 149 can be prevented as possible. When lying the outboard motor for discharging lubrication oil via oil drain 81a, the carburetor 67 can be prevented from being damaged by the contact with the ground since the carburetor 67 is positioned opposite the ground.

[0072] Remote control cables (not shown) for operating the carburetor 67, etc. are located on the starboard side of the small vessel on which the outboard motor is mounted. Therefore, routing of the remote control cables becomes easy when the carburetor 67 is located on the right hand side.

[0073] Now referring to FIG. 21, the second embodiment of the outboard motor according to this invention will be described hereinafter. FIG. 21 is a schematic, perspective view of a crank chamber oil return passage in the second embodiment. The components in the second embodiments, corresponding to those in the first embodiment are given with same reference numerals and the description thereof is omitted. In FIG. 21, the flow of lubrication oil is shown with arrows in actual line and air flow from the oil sump section shown with arrows in broken line.

[0074] FIG. 21 is a drawing corresponding to FIG. 20 of the first embodiment. In FIG. 21, the opening 162 of the oil return passage 146b at the rear side is formed in only the inner side surface 30a, but not formed in the bottom surface 30b of the crank chamber 30. Other configuration of this embodiment is generally the same as in the second embodiment. In the same manner as in the first embodiment, lubrication oil in the crank chamber 30 is recovered, through the crank chamber oil return passage 146, in the oil sump 81, and air flows to-and-fro between the crank chamber 30 and oil sump section 81.

[0075] While embodiments of the invention is described in great detail above, the invention should not be limited to the above embodiment but may be modified in different ways within the spirit and scope of the invention as stipulated in the appended claims. The invention may be changed for example as follows:

(1) While the engine 13 in the above embodiment is of the L-type with 4-cycle two cylinders, the number of cylinders and their layout may be changed appropriately. For instance, the number of cylinders may be three or six. It is also able to employ an engine having fuel injection system.

(2) The right and left relation in the layout may be reversed.

(3) The number and locations of the crank chamber oil return passages 146 may be changed appropriately. The top end of the crank chamber oil return passage 146 may be opened into the inner side surface 30a of the crank chamber 30a (in other words, not opened into the bottom surface 30b of the crank chamber 30). However, if they are provided in a plural number, the flow of lubrication oil and gas becomes smooth. Also, the crank chamber oil return passages 146 are all located on the side where the intake and exhaust passages are located.

(4) While the relief grooves 151 and 152 are provided in the underside surface of the engine 13 and in the top surface of the exhaust guide 7, they may be provided at least on one side. However, it is preferable that they are provided in the top surface of the exhaust guide 7.

(5) The crank chamber oil return passages 146 may be opened into the inner side surfaces 30a on both right and left sides, though those in the embodiments are opened into the inner side surface 30a on the right side of the crank chamber 30.

(6) An oil pan may be provided in place of the oil sump.

(7) The insert opening 149 may be formed in a position different from the crank chamber oil return passage 146, though it is located therein, in the embodiments.

(8) The camshaft may be provided in a plural number.

(9) The material, etc. of the cooling water upward flow pipe may be chosen appropriately.

[0076] According to the invention, the intake and exhaust passages in the cylinder head are located on the one, right or left hand side of the engine to be of the counter flow type, Therefore, a relatively large space is provided on the other, left side and it is easy to arrange other components such as auxiliary devices there. Moreover, since the crank chamber oil return passage is located on the same side as the intake and exhaust passages, when the outboard motor is placed to lie on its side with the intake and exhaust passage side up, the crank chamber oil return passage also comes to the upper side, so that fuel and lubrication oil are prevented from collecting in the intake passages, and also the lubrication oil is prevented from collecting in the crank chamber. As a result, the lubrication oil in the crank chamber is effectively prevented from finding its way into the combustion chamber.

[0077] In the case the breathing passage is located on the opposite side to the intake and exhaust passages, its layout space can be easily secured.

[0078] In the case the crank chamber return oil passages are provided in a plural number, the lubrication oil flowing from the crank chamber toward the oil sump and the gas flowing from the oil sump toward the crank chamber flow through respectively different crank chamber return oil passages, and the oil and gas are

effectively prevented from interfering with each other. As a result, lubrication oil and gas can flow smoothly.

[0079] In the case the cooling water groove for the cooling water to flow is formed in the top surface of the exhaust guide to extend along the periphery of the exhaust passage, the cooling water groove can cool the exhaust passage. Moreover, since the top surface of the cooling water groove is covered with the underside of the engine to constitute a cooling water passage, the cooling water passage can be formed more easily than boring a hole through the exhaust guide.

[0080] In the case the open-ended relief groove is provided between the cooling water groove and the oil passage in at least one of the exhaust guide top surface and the engine underside, the cooling water leaking from the cooling water groove is prevented from finding its way into the oil passage, or in turn, the oil leaking from the oil passage is prevented from finding its way into the cooling water groove by the presence of the relief groove.

[0081] In the case the oil passage is an oil intake passage, although the pressure in the oil intake passage is negative, the cooling water leaking from the cooling water groove is prevented from finding its way into the oil intake passage by the presence of the relief groove.

[0082] In the case the center of gravity of the outboard motor in plan view is in about the same position as that of the upper mount, the weight of the outboard motor is supported in relatively stabilized manner with the upper mount. As a result, vibration of the outboard motor is effectively reduced.

[0083] In the case the cooling water passage is provided in the groove running in the fore-and-aft direction in the top surface of the upper mount, spaces are efficiently utilized so that the height of the outboard motor is effectively reduced.

[0084] In the case the handlebar for steering the outboard motor is located opposite the side where the intake and exhaust passages are located, when the outboard motor is placed to lie on its side on the ground or the like with the intake and exhaust passage sides up, since the handlebar comes to the underside, or the ground surface side. Therefore, the handlebar protects the cowling, etc. of the outboard motor.

[0085] Moreover, according to the invention, the oil drain and insert opening are dividedly located on the left and right, and the axis of the insert opening is headed for the oil drain in the top plain view. Therefore, when the sucking pipe is inserted into the insert opening, the tip of the sucking pipe can be led to the insert opening to move toward the oil drain. The sucking pipe draws the lubrication oil collected around the oil drain. As the result, almost all amount of the lubrication oil in the oil sump can be drawn. Also, the oil drain is located in either left or right side, so that at the state of that the outboard motor attached to the small marine vessel is tilted up, the oil drain can be at the lower side by steering, and the lubrication oil can be drained smoothly from the oil drain.

[0086] In the case that the bottom of the oil sump is descended to be lower side in proportion to approach the oil drain, the lubrication oil flows toward the oil drain smoothly, and the tip of the sucking pipe can be led to the bottom of the oil sump to move toward the oil drain. As the result, the lubrication oil in the oil sump can be drawn smoothly, and almost all amount of the lubrication oil can be drained.

[0087] In the case that a throttle body for controlling air-intakes to the engine is provided above the insert opening, space below the throttle body can be effectively used for the space of the insert opening and the oil gauge.

[0088] In the case that on the same side with the insert opening are provided crank chamber return oil passages that the lubrication oil returns from the crankcase of the engine to the oil sump, both of the crank chamber return oil passage and insert opening can be at the upper side when the outboard motor is laid laterally to store. Therefore, when the outboard motor is laid, the lubrication oil in the crank chamber returns to the oil sump smoothly, so that floating of the lubrication oil from the crank chamber into the combustion chamber can be prevented as much as possible, and leaking of the lubrication oil from the insert opening can be also prevented as much as possible.

[0089] And, in the case that the insert opening is formed in the crank chamber return oil passage, there is no need to form the additional oil gauge passage heading from the insert opening toward the oil sump, so that processes can be made easily and compact.

[0090] Further, according to the invention, the crankshaft is vertically disposed and the crank chamber return oil channel is opened into the inner side surface. Therefore, even if the lubrication oil within the crank chamber is flowing along the inner side surface by the effect of air flow generated with the rotation of the crankshaft, it flows into the crank chamber return oil channel opened into the inner side surface of the crank chamber. As the result, lubrication oil flowing along the inner side surface of the crank chamber can be recovered quickly in the oil sump.

[0091] In the case the crank chamber return oil channel is opened into the inner side surface and the bottom surface of the crank chamber, the lubrication oil flowing along the inner side surface of the crank chamber as well as the lubrication oil staying on the bottom surface of the crank chamber is efficiently recovered in the oil sump.

[0092] In the case the crank chamber return oil passages are provided in a plural number and the height of the top end of the opening of each crank chamber return oil channel is different each other, air tends to flow through the crank chamber return oil channel having the higher top end when the gas contained in the oil sump flows in the direction opposite the flow of lubrication oil, toward the crank chamber, while lubrication oil tends to

flow through the crank chamber return oil channel having the lower top end. Therefore, the oil and gas are effectively prevented from interfering with each other.

Claims

1. An outboard motor with an engine (13) mounted over an exhaust guide (7) and with an oil sump (81), in which lubrication oil is collected, being disposed below the exhaust guide (7), said engine (13) comprising cylinders (26) in each of which a piston (28) is slidably disposed, a cylinder block (32) forming the cylinders (26); a crankcase (33) covering the crankshaft (24) side of the cylinder block (32) to form a crank chamber (30); a cylinder head (36) covering the combustion chamber side of the cylinders (26); an intake passage (41) formed through the cylinder head (36) to supply air to the combustion chambers (34), and an exhaust passage (42) formed through the cylinder head (36) to discharge exhaust gas from the combustion chambers (34), **characterized in that**
the intake and exhaust passages (41,42) are disposed on the same side, either right or left, of the engine (13), and that a crank chamber return oil passage (146,7k) making communication between the crank chamber (30) and the oil sump (81) is disposed on the same side as the intake and exhaust passages (41,42).

2. An outboard motor according to claim 1, **characterized in that** the engine is provided with opening-closing valves (46) for opening and closing the ports of the intake and exhaust passages (41,42), a camshaft (48) for driving the opening-closing valves (46), and a cam chamber where the camshaft (48) is disposed; the cam chamber is communicated with the oil sump (81) through breathing passages (106,107,108); and the breathing passages (106,107,108) are disposed on the opposite side to the intake and exhaust passages (41,42).

3. An outboard motor according to claim 1 or 2, **characterized in that** a plurality of the crank chamber return oil passages (146,7k) are provided.

4. An outboard motor according to at least one of the preceding claims 1 to 3, **characterized in that** the exhaust guide (7) is formed with an exhaust passage (76) for guiding exhaust gas from the engine (13) downward, and a cooling water groove (7e) for cooling water to flow is formed in the top surface of the exhaust guide (7) along the periphery of the exhaust passage (76)

5. An outboard motor according to at least one of the preceding claims 1 to 4, **characterized in that** an oil passage (7m,7i) is formed through the exhaust guide (7) for allowing lubrication oil to flow, a cooling water groove (7e) for allowing cooling water to flow is formed in the top surface of the exhaust guide (7), and an open-ended relief groove between the cooling water groove (7e) and the oil passage is formed in at least one of the exhaust guide top surface and the underside of the engine (13).

6. An outboard motor according to claim 5, **characterized in that** the oil passage is an oil intake passage (7i).

7. An outboard motor according to at least one of the preceding claims 1 to 6, **characterized in that** an attachment bracket (1) for attachment to small vessels or the like is provided at its rear end with a rotatable pivot shaft (3) to which is attached through an upper mount the exhaust guide (7), and the center of gravity (G) in plan view of the main body of the outboard motor is located about the same as that of the upper mount.

8. An outboard motor according to claim 7, **characterized in that** a groove (6e) in the fore-and-aft direction is formed in the top surface of the upper mount, and a cooling water passage (93) for allowing cooling water to flow is disposed in the groove (6e).

9. An outboard motor according to at least one of the preceding claims 1 to 8, **characterized in that** a handlebar (12) for steering the outboard motor is disposed opposite the side where the intake and exhaust passages (41,42) are disposed.

10. An outboard motor according to at least one of the preceding claims 1 to 9, **characterized by** a rod oil gauge (147) for measuring the amount of the lubrication oil in said oil sump, an insert opening (149) that the oil gauge (147) is inserted, and an oil drain (81 a) for draining the lubrication oil in the oil sump (81), wherein the oil drain (81a) is disposed in lower end of one of left or right hand side of the oil sump (81), and wherein said insert opening (149) is disposed in upper side of the other of left or right hand side of the oil sump (81), and wherein an axis of the insert opening (149) is headed for the oil drain (81a) in top plan view.

11. An outboard motor according to at least one of the preceding claims 1 to 10, **characterized in that** the bottom of said oil sump (81) is descended to be the lower side in proportion to approach the oil drain (81a).

12. An outboard motor according to at least one of the preceding claims 1 to 11, **characterized in that** a throttle body (67) for controlling air-intakes to said

engine (13) is provided above said insert opening (149).

13. An outboard motor according to at least one of the preceding claims 10 to 12, **characterized in that** crank chamber return oil passages (146;7k), that the lubrication oil returns from a crankcase of said engine (13) to the oil sump (81), are provided on the same side with the insert opening (149).

14. An outboard motor according to at least one of the preceding claims 1 to 13, **characterized in that** said insert opening (149) is formed in said crank chamber return oil passage (146).

15. An outboard motor according to at least one of the preceding claims 1 to 14, **characterized in that** the crank shaft (24) is disposed in vertical direction within the crank chamber, said crank chamber return oil passage (7k) is open into the inner side surface (30a) of said crank chamber (30).

16. An outboard motor according to at least one of the preceding claims 1 to 15, **characterized in that** said crank chamber return oil passage (7k) is open into both the inner side surface (30a) and the bottom surface (30b) of said crank chamber (30).

17. An outboard motor according to at least one of the preceding claims 3 to 16, **characterized in that** a plurality of said crank chamber return oil passages (146,7k) are provided, and the height of the top end of an opening (61,162) of each crank chamber return oil passage (146,7k) is different from each other.

18. An outboard motor according to at least one of the preceding claims 1 to 17, **characterized in that** the engine (13) is of the L-type having at least two cylinders (26).

19. An outboard motor according to at least one of the preceding claims 1 to 18, **characterized in that** the engine (13) comprises a fuel injection system.

Patentansprüche

1. Außenbordmotor mit einem Motor (13), montiert über einer Abgasführung (7) und mit einem Ölsumpf (81), in dem Schmieröl gesammelt wird, der unter der Abgasführung (7) angeordnet ist, wobei der Motor (13) Zylinder aufweist, wobei in jedem von ihnen ein Kolben (28) gleitbar aufgenommen ist, einem Zylinderblock (32), der die Zylinder (26) bildet; einem Kurbelgehäuse (33), das die Kurbelwellenseite (24) des Zylinderblocks (32) abdeckt, um eine Kurbelkammer (30) zu bilden; einem Zylinderkopf (36), der die Brennkammerseite des Zylinders (26) abdeckt; einem Einlasskanal (41), gebildet durch den Zylinderkopf (36), um Luft in die Brennkammer (34) zuzuführen, und einem Auslasskanal (42), gebildet durch den Zylinderkopf (369, um Abgas aus den Brennkammern (34) abzugeben,
dadurch gekennzeichnet, dass
die Einlass- und Auslasskanäle (41, 42) auf derselben Seite, entweder rechts oder links des Motors (13), angeordnet sind, und dass ein Kurbelkammer-Rückführungsölkanal (146, 7k), der die Verbindung zwischen der Kurbelkammer (30) und dem Ölsumpf (81) herstellt, auf derselben Seite wie die Einlass- und die Auslasskanäle (41, 42) angeordnet ist.

2. Außenbordmotor nach Anspruch 1, **dadurch gekennzeichnet, dass** der Motor mit sich öffnenden / schließenden Ventilen (46) für das Öffnen oder Schließen der Öffnungen der Einlass- und die Auslasskanäle (41, 42) versehen ist, einer Nockenwelle (48) für das Antreiben der sich öffnenden / schließenden Ventilen (46), und einer Nockenkammer, in der die Nockenwelle (48) angeordnet ist; wobei die Nockenkammer mit dem Ölsumpf (81) durch Atmungskanäle (106, 107, 108) verbunden ist; und die Atmungskanäle (106, 107, 108) auf der zu den Einlass- und die Auslasskanälen (41, 42) gegenüberliegenden Seite angeordnet sind.

3. Außenbordmotor nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** eine Mehrzahl der Kurbelkammer- Rückführungsölkanäle (146, 7k) vorgesehen ist.

4. Außenbordmotor nach zumindest einem der vorhergehenden Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Abgasführung (7) mit einem Abgaskanal (76) gebildet ist, um das Abgas von dem Motor (13) nach unten zu führen, und wobei eine Kühlwassernut (7e) zum Strömen von Kühlwasser, in der Oberseite der Abgasführung (7) entlang des Umfangs des Abgaskanals (76) gebildet ist.

5. Außenbordmotor nach zumindest einem der vorhergehenden Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** ein Ölkanal (7m, 7i) durch die Abgasführung (7) gebildet ist, das Strömen des Schmieröles zu gestatten, wobei eine Kühlwassernut (7e), um das Strömen des Kühlwassers zu gestatten, in der Oberseite der Abgasführung (7) gebildet ist, und eine offen- endende Entlastungsnut zwischen der Kühlwassernut (7e) und dem Ölkanal in zumindest einem von Abgasführungsoberseite und der Unterseite des Motors (13) gebildet ist.

6. Außenbordmotor nach Anspruch 5, **dadurch gekennzeichnet, dass** der Ölkanal ein Öleinlasskanal (7i) ist.

7. Außenbordmotor nach zumindest einem der vorhergehenden Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** ein Befestigungshalter (1) für die Befestigung an kleinen Booten oder dergleichen an seinem hinteren Ende mit einer drehbaren Schwenkwelle (3) vorgesehen ist, mit dem durch eine obere Halterung die Abgasführung (7) verbunden ist, und der Schwerpunkt (G) in der Draufsicht des Hauptkörpers des Außenbordmotors über demselben wie der der oberen Halterung angeordnet ist.

8. Außenbordmotor 7, **dadurch gekennzeichnet, dass** eine Nut (6e) in der nach vom- und nach hinten- Richtung in der Oberseite der oberen Halterung gebildet ist und ein Kühlwasserkanal (93), um dem Kühlwasser zu gestatten, zu fließen, in der Nut (6e) angeordnet ist.

9. Außenbordmotor nach zumindest einem der vorhergehenden Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** eine Lenkstange (12) zum Lenken des Außenbordmotors gegenüberliegend zu der Seite, wo die Einlass- und die Auslasskanäle (41, 42) angeordnet sind, angeordnet ist.

10. Außenbordmotor nach zumindest einem der vorhergehenden Ansprüche 1 bis 9, **gekennzeichnet durch** ein Stabölmessgerät (147) für das Messen der Menge des Schmieröls in dem Ölsumpf, eine Einsetzöffnung (149), in die das Stabölmessgerät (147) eingesetzt wird, und einen Ölablauf (81a) für das Ablaufen des Schmieröls in dem Ölsumpf (81), wobei der Ölablauf (81a) in dem unteren Ende einer linken oder rechten Seite des Ölsumpfs (81) angeordnet ist, und wobei die Einsetzöffnung (149) in der oberen Seite der anderen der linken oder rechten Seite des Ölsumpfs (81) angeordnet ist, und wobei eine Achse der Einsetzöffnung (149) sich in Richtung zu dem Ölablauf (81a) in der Draufsicht erstreckt.

11. Außenbordmotor nach zumindest einem der vorhergehenden Ansprüche 1 bis 10, **dadurch gekennzeichnet, dass** der Boden des Ölsumpfs (81) abwärts geneigt ist, um mit der unteren Seite im Verhältnis zu sein, den Ölablauf (81a) zu erreichen.

12. Außenbordmotor nach zumindest einem der vorhergehenden Ansprüche 1 bis 11, **dadurch gekennzeichnet, dass** ein Drosselkörper (67) für das Steuern von Luftansaugmengen in den Motor (13) oberhalb der Einsetzöffnung (149) vorgesehen ist.

13. Außenbordmotor nach zumindest einem der vorhergehenden Ansprüche 10 bis 12, **dadurch gekennzeichnet, dass** die Kurbelkammer- Ölrückführungskanäle (146, 7k), die das Schmieröl aus der Kurbelkammer des Motors (13) in den Ölsumpf (81) zurückführen, auf derselben Seite wie die Einsetzöffnung (149) vorgesehen sind.

14. Außenbordmotor nach zumindest einem der vorhergehenden Ansprüche 1 bis 13, **dadurch gekennzeichnet, dass** die Einsetzöffnung (149) in dem Kurbelkammer-Ölrückführungskanal (146) gebildet ist.

15. Außenbordmotor nach zumindest einem der vorhergehenden Ansprüche 1 bis 14, **dadurch gekennzeichnet, dass** die Kurbelwelle (24) in vertikaler Richtung innerhalb der Kurbelkammer angeordnet ist, wobei der Kurbelkammer- Ölrückführungskanal (7k) in die innere Seitenoberfläche (30a) der Kurbelkammer (30) offen ist.

16. Außenbordmotor nach zumindest einem der vorhergehenden Ansprüche 1 bis 15, **dadurch gekennzeichnet, dass** die Kurbelkammer- Ölrückführungskanal (7k) in sowohl die innere Seitenoberfläche (30a), als auch die Unterseite (30b) der Kurbelkammer (30) offen ist.

17. Außenbordmotor nach zumindest einem der vorhergehenden Ansprüche 3 bis 16, **dadurch gekennzeichnet, dass** eine Mehrzahl der Kurbelkammer- Ölrückführungskanäle (146, 7k) vorgesehen ist und die Höhe des oberen Endes einer Öffnung (61, 162) von jedem Kurbelkammer- Ölrückführungskanal (146, 7k) voneinander verschieden ist.

18. Außenbordmotor nach zumindest einem der vorhergehenden Ansprüche 1 bis 17, **dadurch gekennzeichnet, dass** der Motor (13) von dem L- Typ ist, mit zumindest zwei Zylindern (26) hat.

19. Außenbordmotor nach zumindest einem der vorhergehenden Ansprüche 1 bis 18, **dadurch gekennzeichnet, dass** der Motor (13) ein Kraftstoff-Einspritzsystem aufweist.

Revendications

1. Moteur hors-bord comprenant un moteur (13) monté sur un guide d'échappement (7), un carter d'huile (81), dans lequel une huile lubrifiante est recueillie, étant situé sous le guide d'échappement (7), ledit moteur (13) comprenant des cylindres (26) dans chacun desquels un piston (28) est installé de façon à coulisser, un bloc-cylindres (32) formant les cylindres (26) ; un carter de vilebrequin (33) couvrant le côté vilebrequin (24) du bloc-cylindres (32) pour former un carter-moteur (30) ; une culasse (36) couvrant le côté chambre d'explosion des cylindres (26) ; un passage d'admission (41) traversant la cu-

lasse (36) pour alimenter en air les chambres d'explosion (34) ; et un passage d'échappement (42) traversant la culasse (36) pour évacuer les gaz des chambres d'explosion (34),
caractérisé en ce que
les passages d'admission et d'échappement (41, 42) sont situés du même côté, gauche ou droit, du moteur (13), et **en ce qu'**un passage de retour d'huile vers le carter-moteur (146, 7k), établissant une communication entre le carter-moteur (30) et le carter d'huile (81), est situé du même côté que les passages d'admission et d'échappement (41, 42).

2. Moteur hors-bord selon la revendication 1, **caractérisé en ce que** le moteur comprend des soupapes d'ouverture/fermeture (46) pour l'ouverture et la fermeture des orifices des passages d'admission et d'échappement (41, 42), un arbre à cames (48) pour l'entraînement des soupapes d'ouverture/fermeture (46) et une chambre de cames dans laquelle se situe l'arbre à cames (48) ; la chambre de cames est mise en communication avec le carter d'huile (81) par l'intermédiaire de reniflards (106, 107, 108) ; et les reniflards (106, 107, 108) sont situés du côté opposé aux passages d'admission et d'échappement (41, 42).

3. Moteur hors-bord selon la revendication 1 ou 2, **caractérisé en ce qu'**une pluralité des passages de retour d'huile vers le carter-moteur (146, 7k) est prévue.

4. Moteur hors-bord selon au moins l'une des revendications 1 à 3 ci-dessus, **caractérisé en ce que** le guide d'échappement (7) est formé avec un passage d'échappement (76) pour le guidage vers le bas des gaz d'échappement sortant du moteur (13), et **en ce qu'**une gorge d'eau de refroidissement (7e), pour l'écoulement d'eau de refroidissement, est formée dans la surface supérieure du guide d'échappement (7), sur la périphérie du passage d'échappement (76).

5. Moteur hors-bord selon au moins l'une des revendications 1 à 4 ci-dessus, **caractérisé en ce qu'**un passage d'huile (7m, 7i) traverse le guide d'échappement (7) pour permettre l'écoulement d'huile lubrifiante, une gorge d'eau de refroidissement (7e) permettant l'écoulement d'eau de refroidissement est formée dans la surface supérieure du guide d'échappement (7), et une rainure en relief à extrémités ouvertes est formée entre la gorge d'eau de refroidissement (7e) et le passage d'huile dans au moins une surface choisie parmi la surface supérieure du guide d'échappement et la surface inférieure du moteur (13).

6. Moteur hors-bord selon la revendication 5, **caractérisé en ce que** le passage d'huile est un passage d'entrée d'huile (7i).

7. Moteur hors-bord selon au moins l'une des revendications 1 à 6 ci-dessus, **caractérisé en ce qu'**un support de fixation (1) pour une fixation à de petits bateaux ou analogues comprend, sur son extrémité arrière, un axe d'articulation rotatif (3) auquel est attaché, par l'intermédiaire d'un moyen de fixation supérieur, le guide d'échappement (7), et **en ce que**, en vue en plan, le centre de gravité (G) du corps principal du moteur hors-bord se trouve approximativement au même endroit que celui du moyen de fixation supérieur.

8. Moteur hors-bord selon la revendication 7, **caractérisé en ce qu'**une gorge (6e) est formée, vers l'avant et vers l'arrière, dans la surface supérieure du moyen de fixation supérieur, et un passage d'eau de refroidissement (93) permettant l'écoulement d'eau de refroidissement est situé dans la gorge (6e).

9. Moteur hors-bord selon au moins l'une des revendications 1 à 8 ci-dessus, **caractérisé en ce qu'**une barre (12) de direction du moteur hors-bord est située du côté opposé au côté où se trouvent les passages d'admission et d'échappement (41, 42).

10. Moteur hors-bord selon au moins l'une des revendications 1 à 9 ci-dessus, **caractérisé par** une jauge d'huile (147) pour la mesure de la quantité d'huile lubrifiante présente dans ledit carter d'huile, une ouverture d'insertion (149) dans laquelle la jauge d'huile (147) est insérée et une vidange d'huile (81a) pour la récupération de l'huile lubrifiante dans le carter d'huile (81), dans lequel la vidange d'huile (81a) est située dans la partie inférieure d'un des côtés gauche et droit du carter d'huile (81), et dans lequel ladite ouverture d'insertion (149) est située dans la partie supérieure de l'autre des côtés gauche et droit du carter d'huile (81), et dans lequel l'axe de l'ouverture d'insertion (149) est dirigé vers la vidange d'huile (81a) dans une vue en plan du dessus.

11. Moteur hors-bord selon au moins l'une des revendications 1 à 10 ci-dessus, **caractérisé en ce que** le fond dudit carter d'huile (81) est incliné pour être le côté inférieur au fur et à mesure que l'on s'approche de la vidange d'huile (81a).

12. Moteur hors-bord selon au moins l'une des revendications 1 à 11 ci-dessus, **caractérisé en ce qu'**un corps de papillon des gaz (67) pour la régulation des admissions d'air dans ledit moteur (13) est prévu au-dessus de ladite ouverture d'insertion (149).

13. Moteur hors-bord selon au moins l'une des revendications 10 à 12 ci-dessus, **caractérisé en ce que** les passages de retour d'huile vers le carter-moteur (146, 7k) et les passages de retour d'huile lubrifiante allant depuis un carter de vilebrequin dudit moteur (13) vers le carter d'huile (81) sont situés du même côté que l'ouverture d'insertion (149).

14. Moteur hors-bord selon au moins l'une des revendications 1 à 13 ci-dessus, **caractérisé en ce que** ladite ouverture d'insertion (149) est formée dans ledit passage de retour d'huile vers le carter-moteur (146).

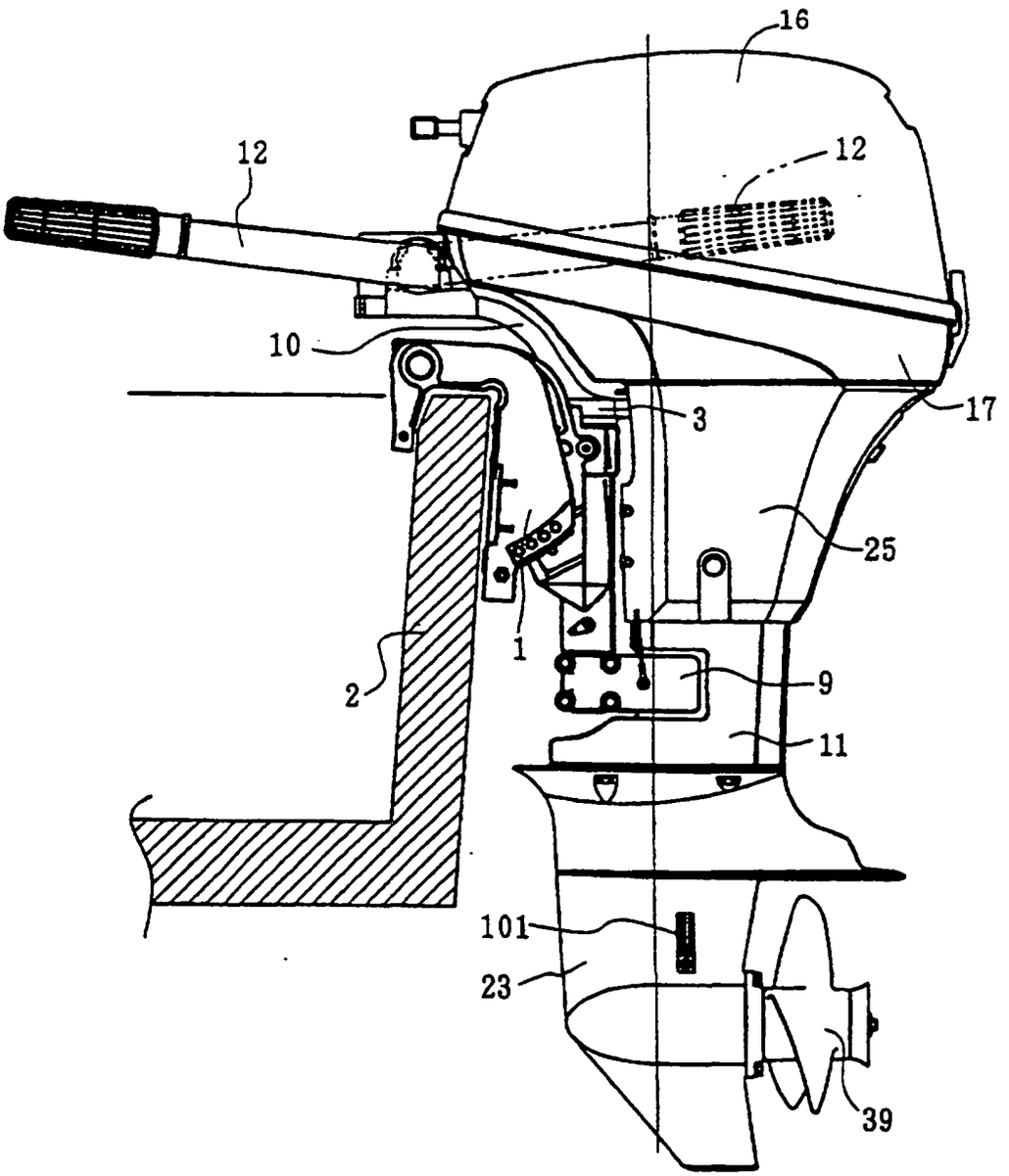
15. Moteur hors-bord selon au moins l'une des revendications 1 à 14 ci-dessus, **caractérisé en ce que** le vilebrequin (24) est orienté verticalement à l'intérieur du carter-moteur et ledit passage de retour d'huile vers le carter-moteur (7k) est ouvert dans la surface intérieure (30a) dudit carter-moteur (30).

16. Moteur hors-bord selon au moins l'une des revendications 1 à 15 ci-dessus, **caractérisé en ce que** ledit passage de retour d'huile vers le carter-moteur (7k) est ouvert à la fois dans la surface intérieure (30a) et dans la surface de fond (30b) dudit carter-moteur (30).

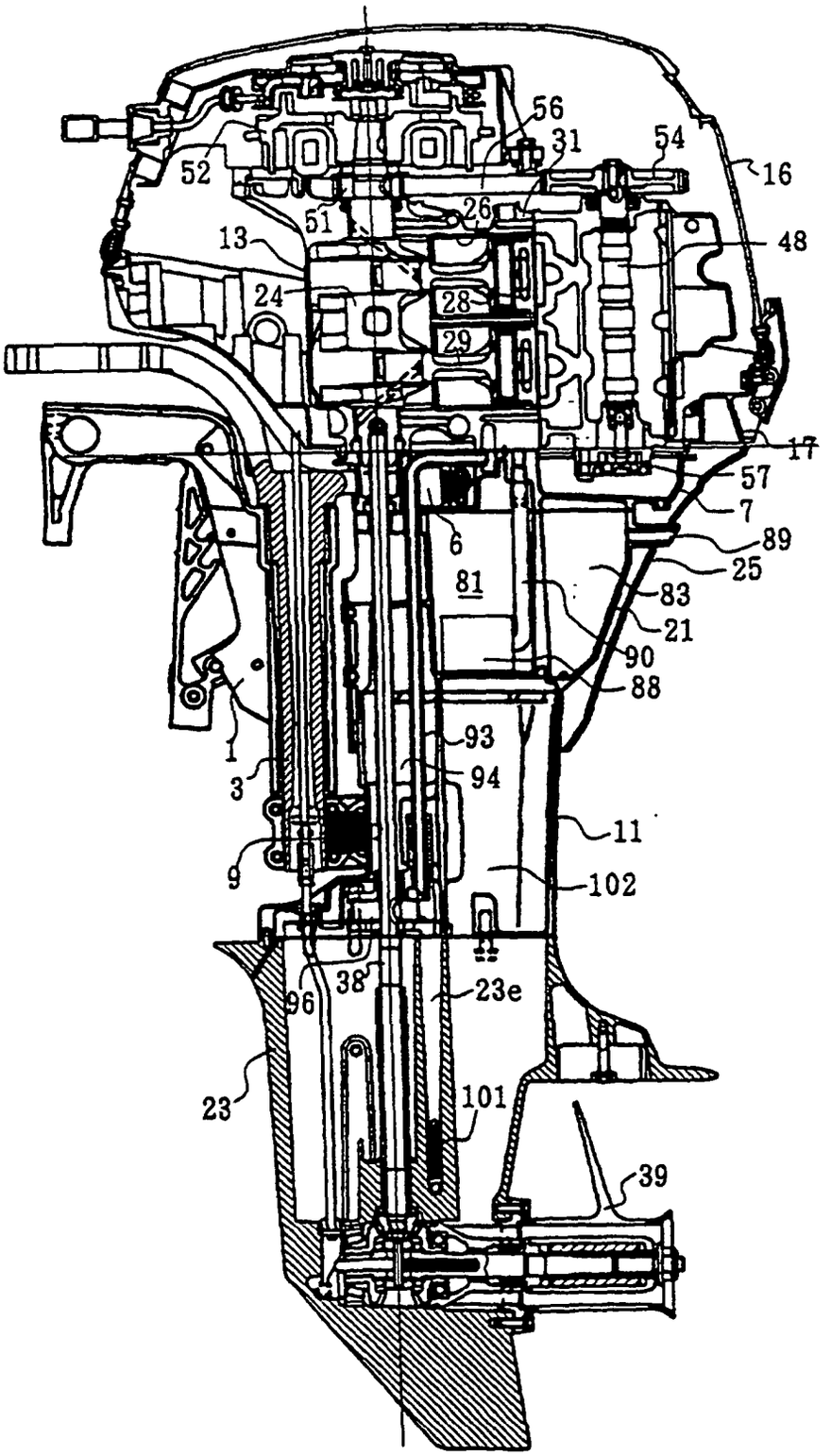
17. Moteur hors-bord selon au moins l'une des revendications 3 à 16 ci-dessus, **caractérisé en ce qu'**une pluralité desdits passages de retour d'huile vers le carter-moteur (146, 7k) est prévue, et **en ce que** la hauteur de l'extrémité supérieure d'une ouverture (61, 162) de chaque passage de retour d'huile vers le carter-moteur (146, 7k) est différente d'un passage à l'autre.

18. Moteur hors-bord selon au moins l'une des revendications 1 à 17 ci-dessus, **caractérisé en ce que** le moteur (13) est un moteur à soupapes latérales comprenant au moins deux cylindres (26).

19. Moteur hors-bord selon au moins l'une des revendications 1 à 18 ci-dessus, **caractérisé en ce que** le moteur (13) comprend un système d'injection de carburant.



EIGURE 1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94
3
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9
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38
23e
96
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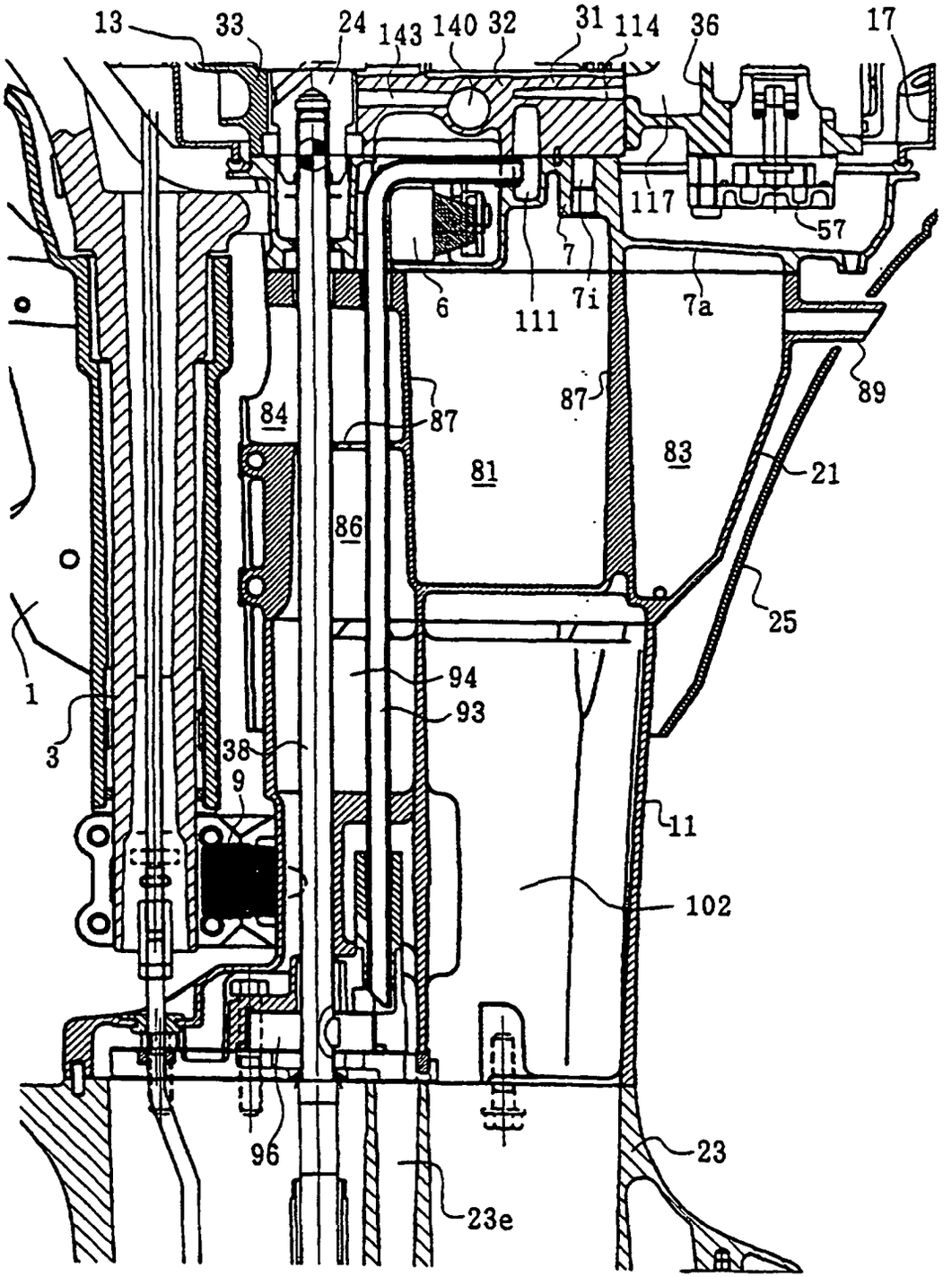
101
39

FIGURE 2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7a
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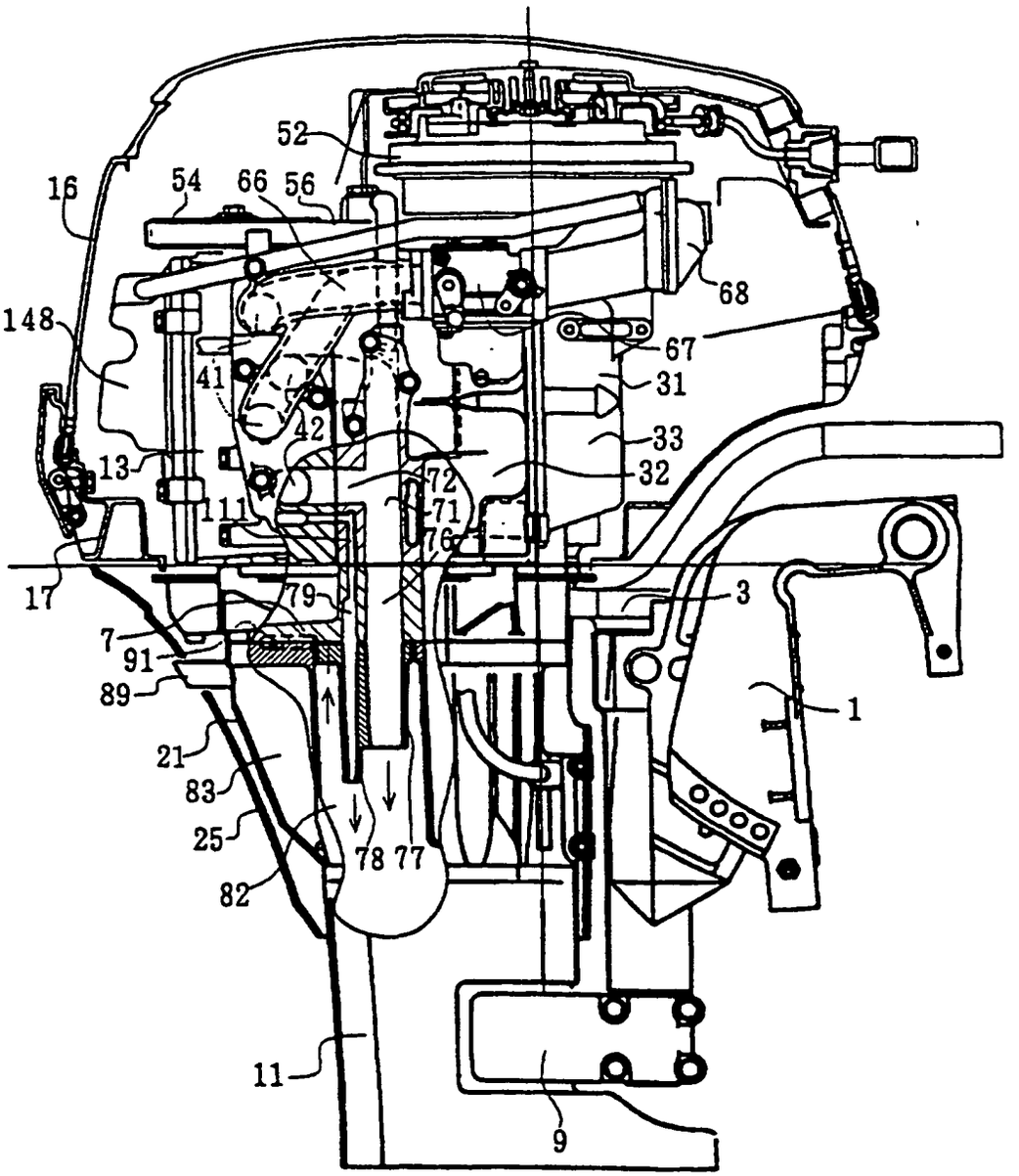
FIGURE 3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91
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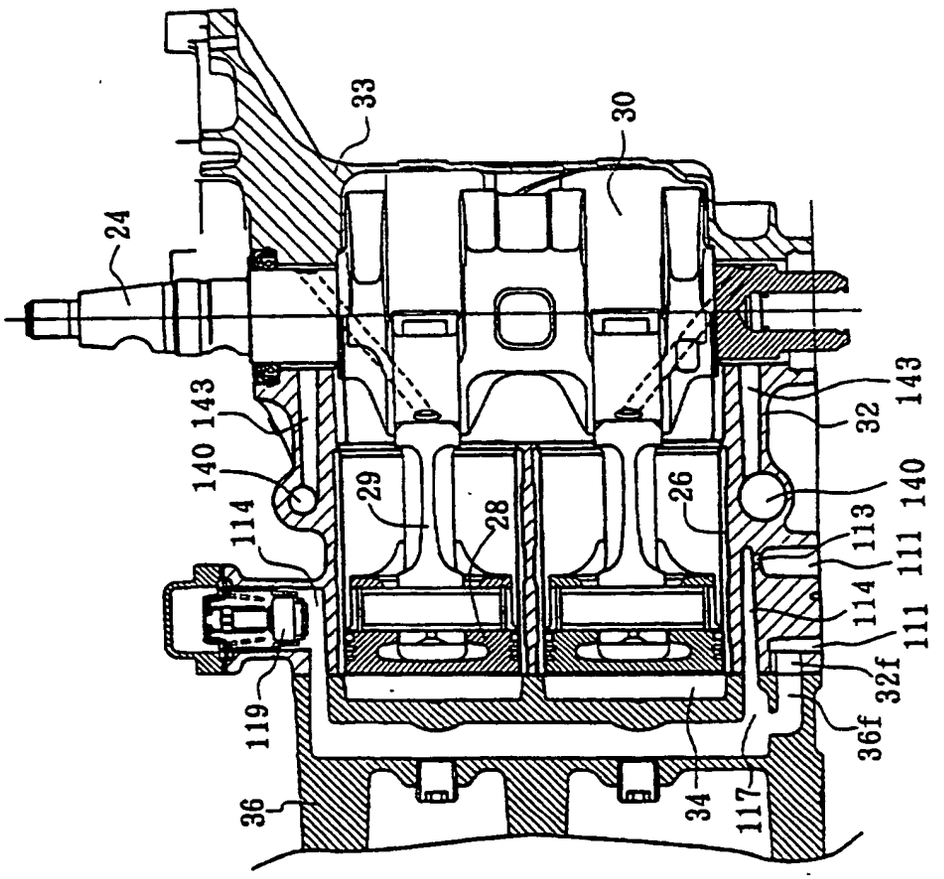
9

FIGURE 4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36

FIGURE 5

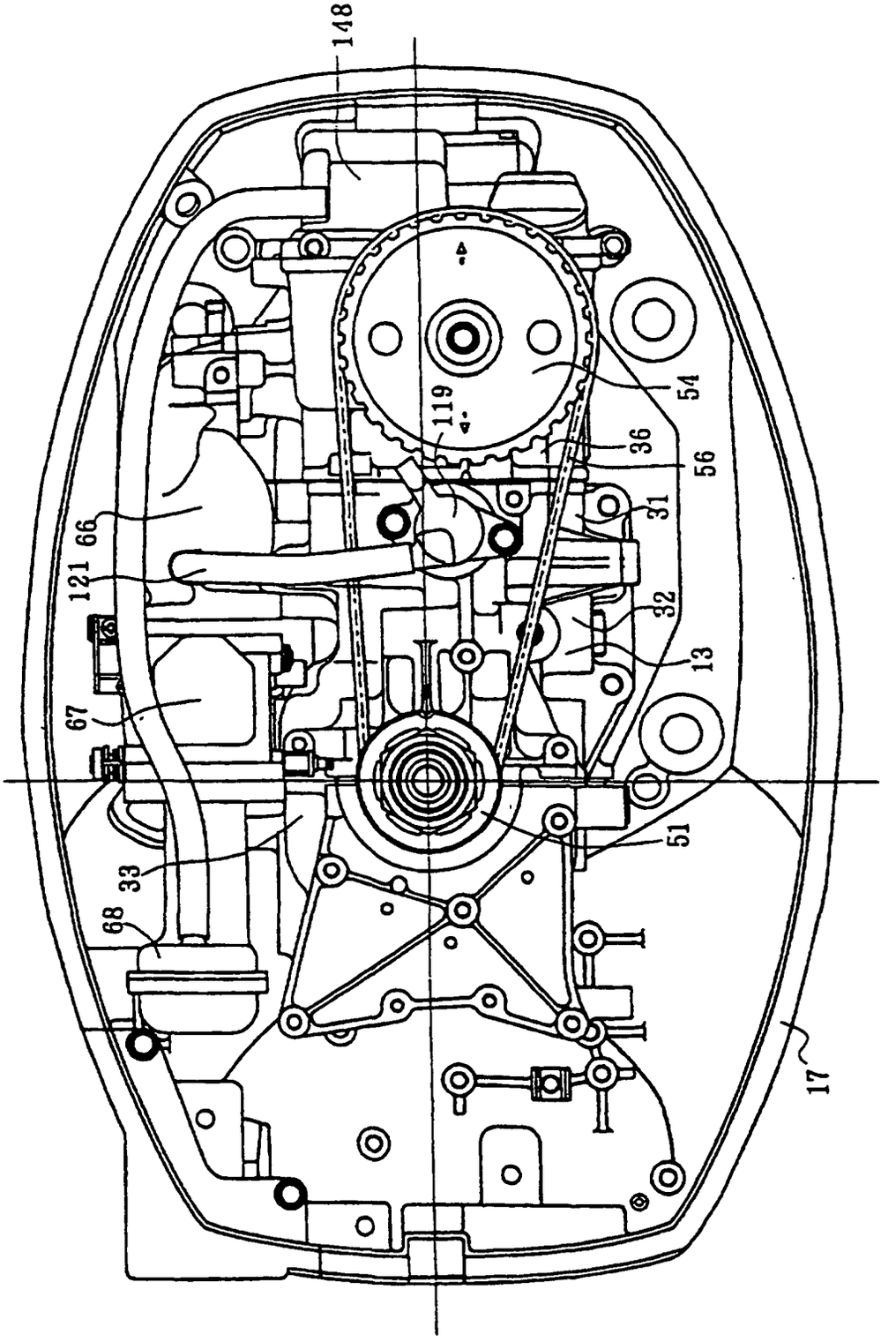
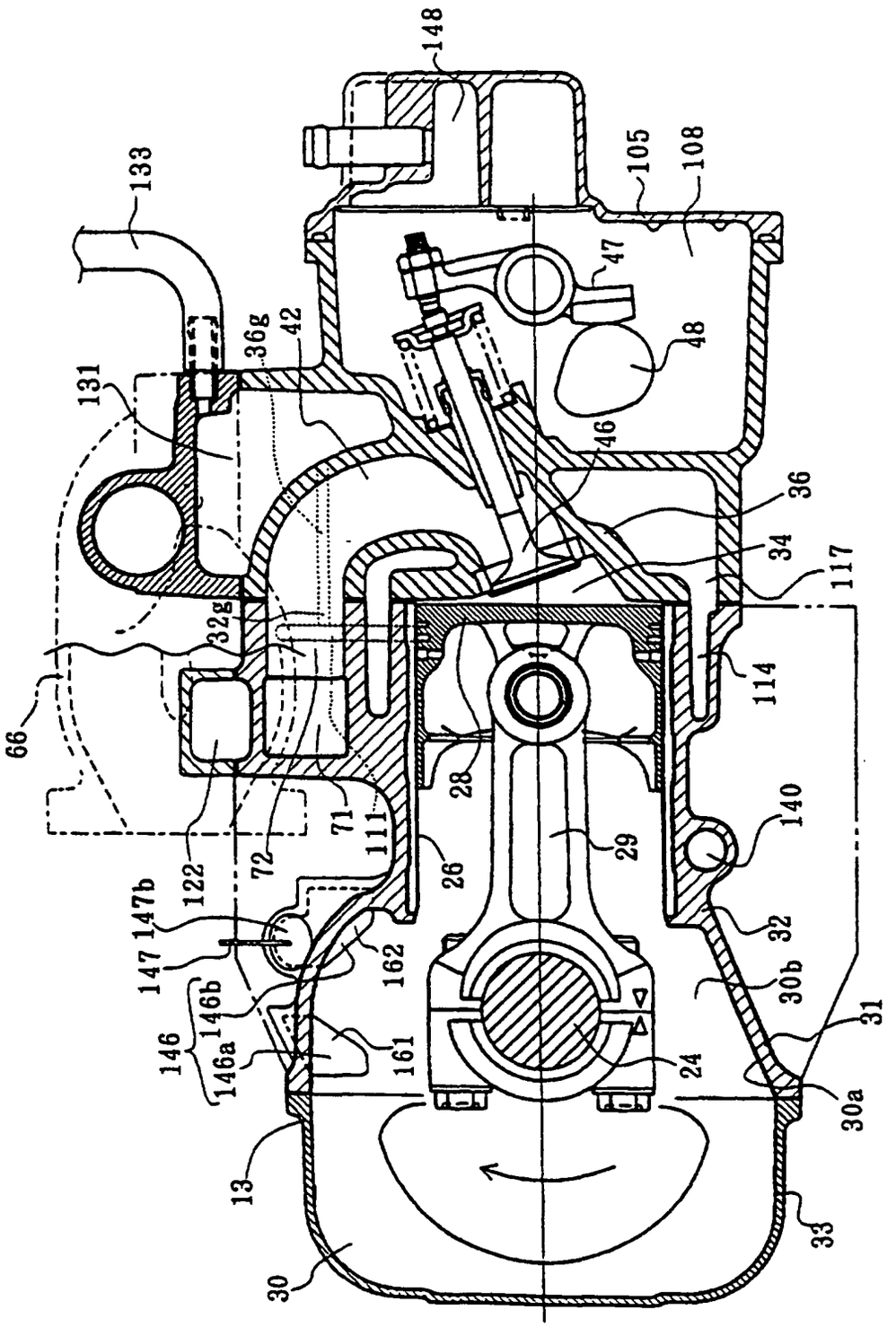


FIGURE 6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36g
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131
46
36
34
117
32g
66
114
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140
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111
72
122
26
29
147b
147
146b
162
32
30b
146
146a
161
24
31
30a
13
33
30

FIGURE 7

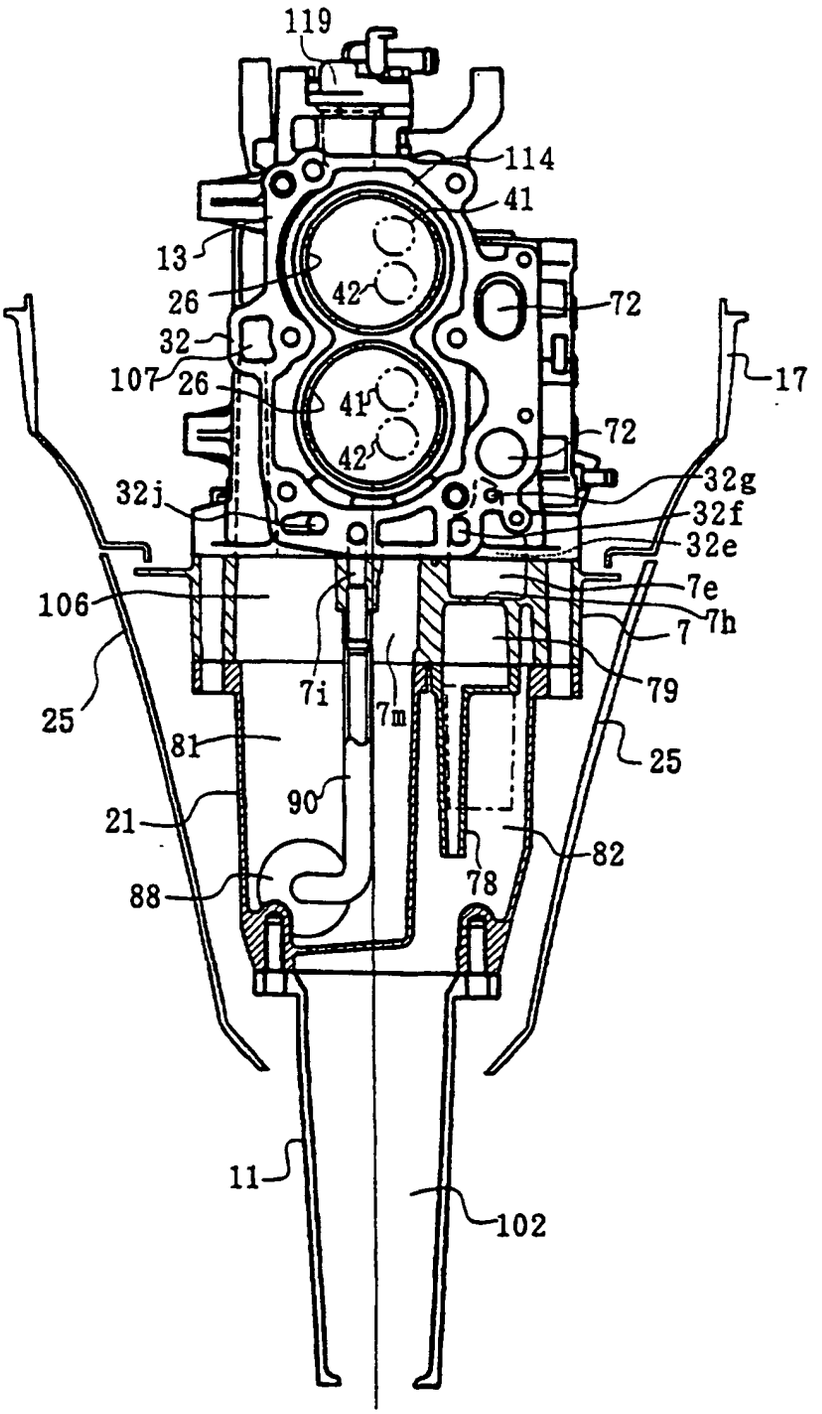
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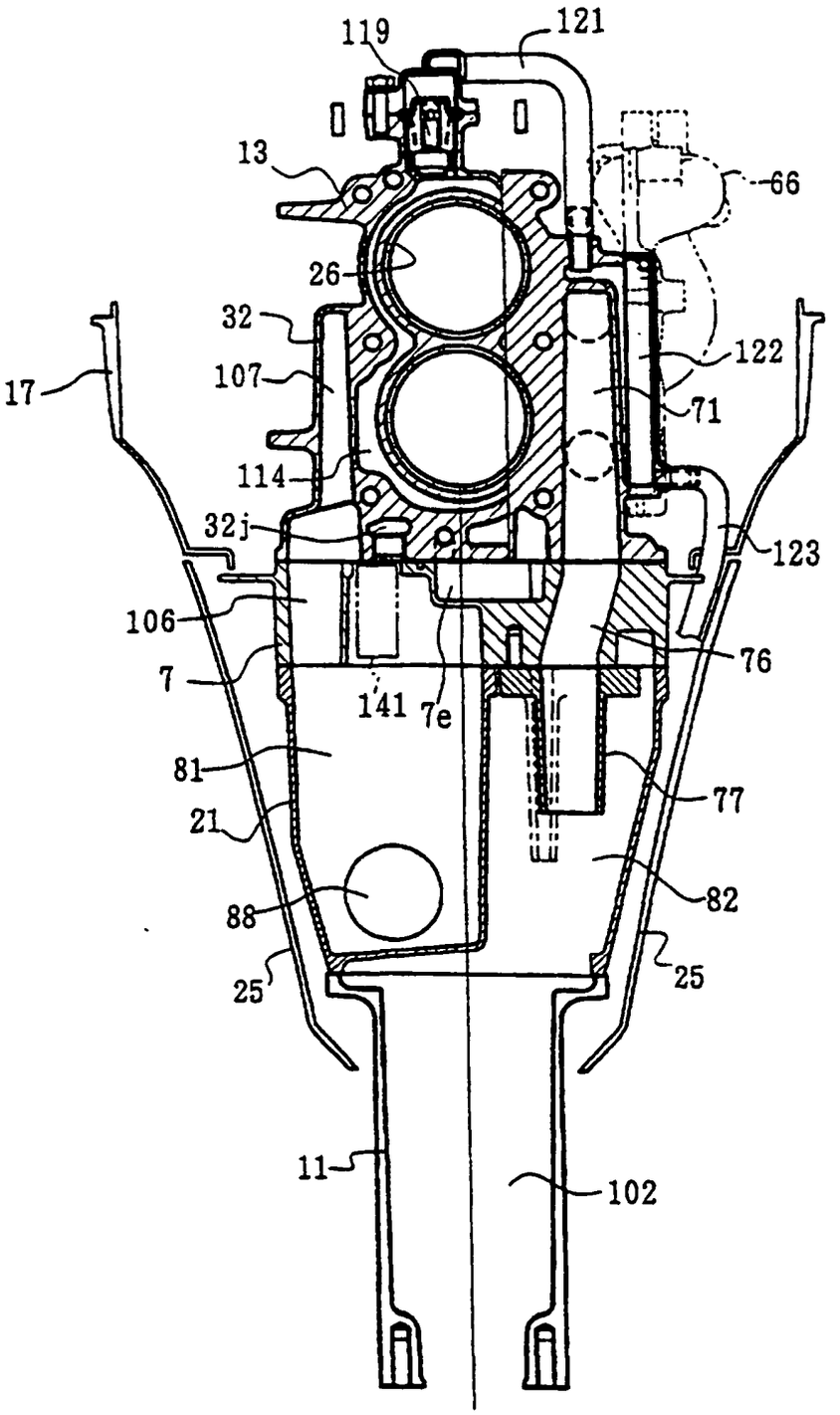
FIGURE 8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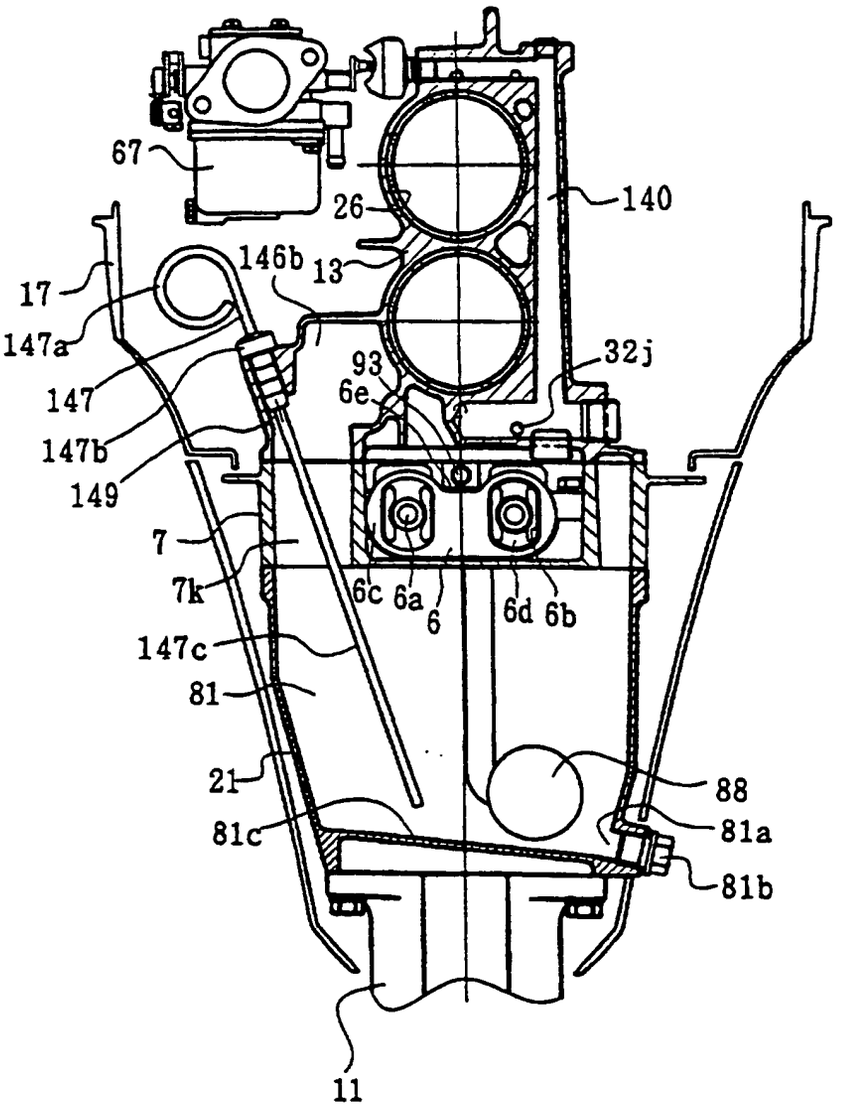
88
25
25
11
102

FIGURE 9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146b
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147
147b
149
93
6e
32j
7
7k
6c
6a
6
6d
6b
147c
81
21
88
81c
81a
81b
11

FIGURE 10

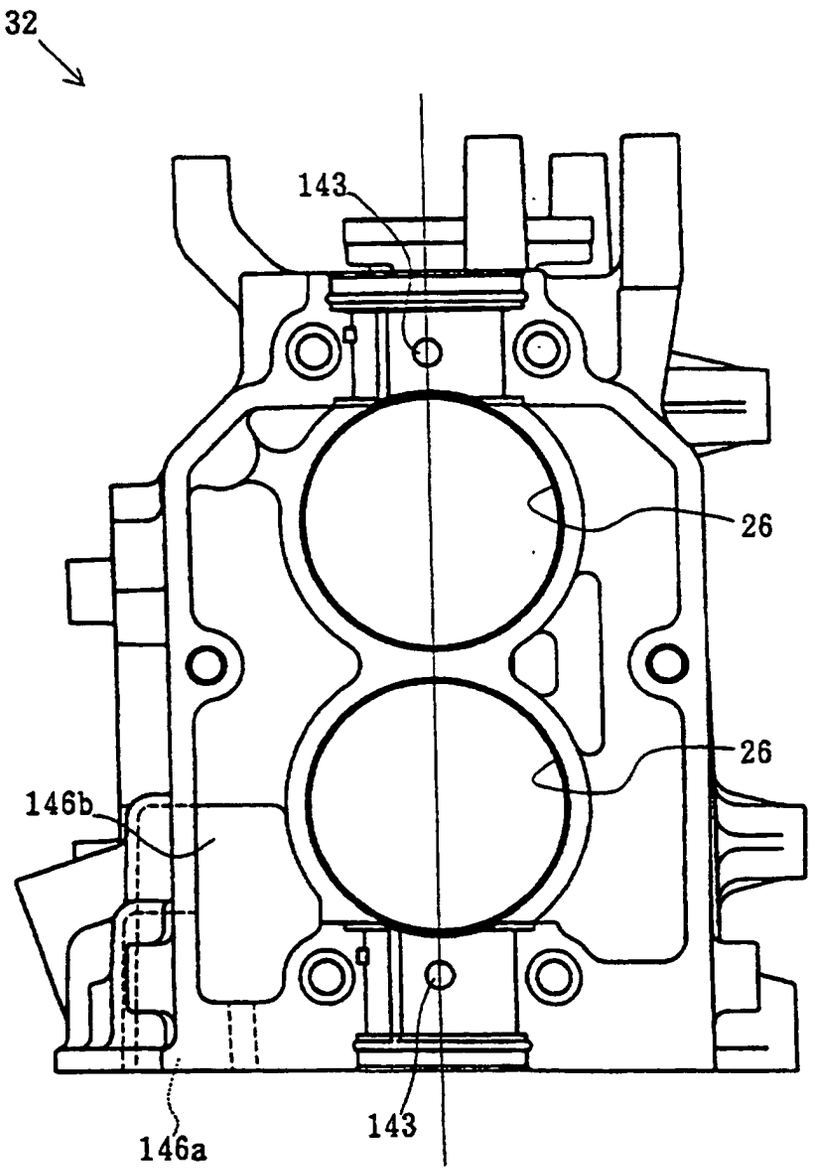

FIGURE 11

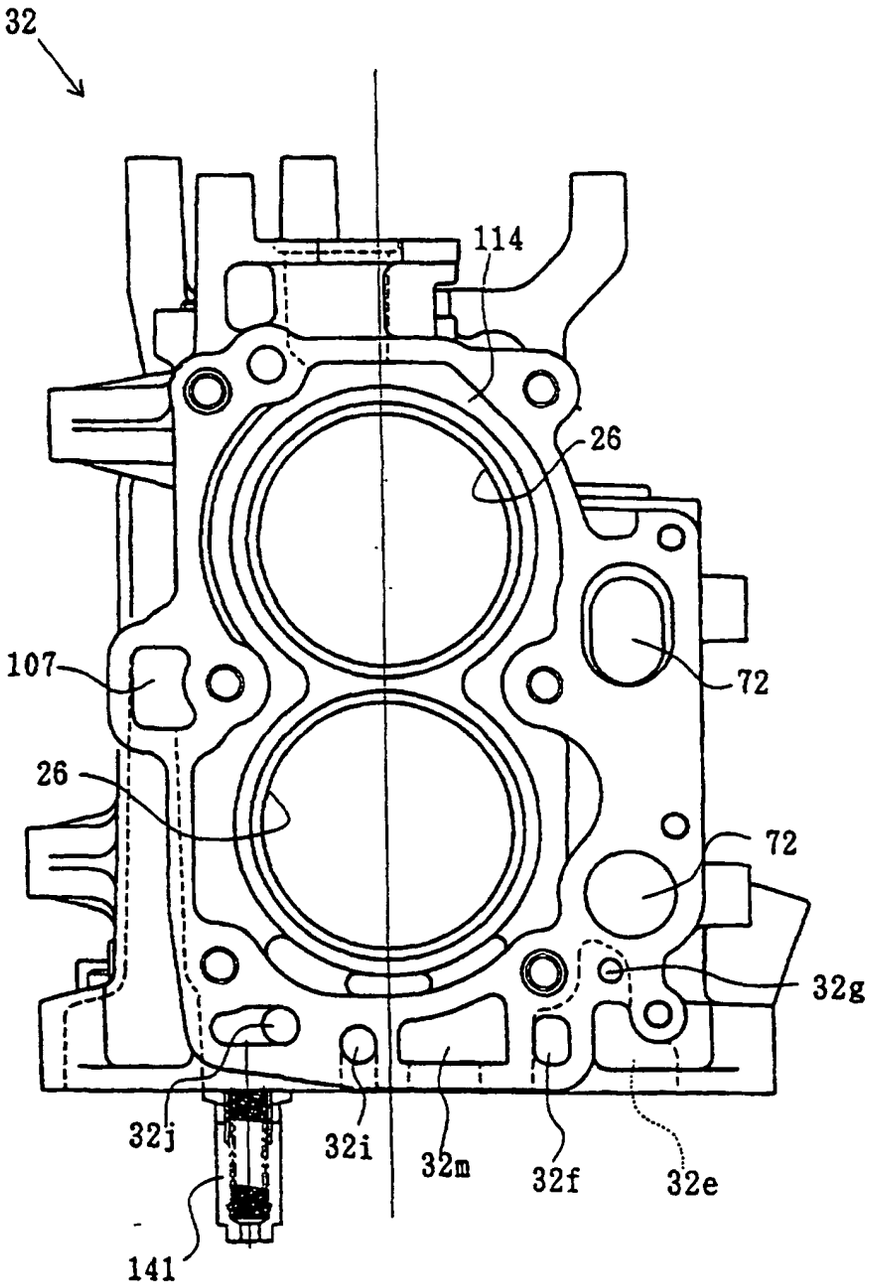

FIGURE 12

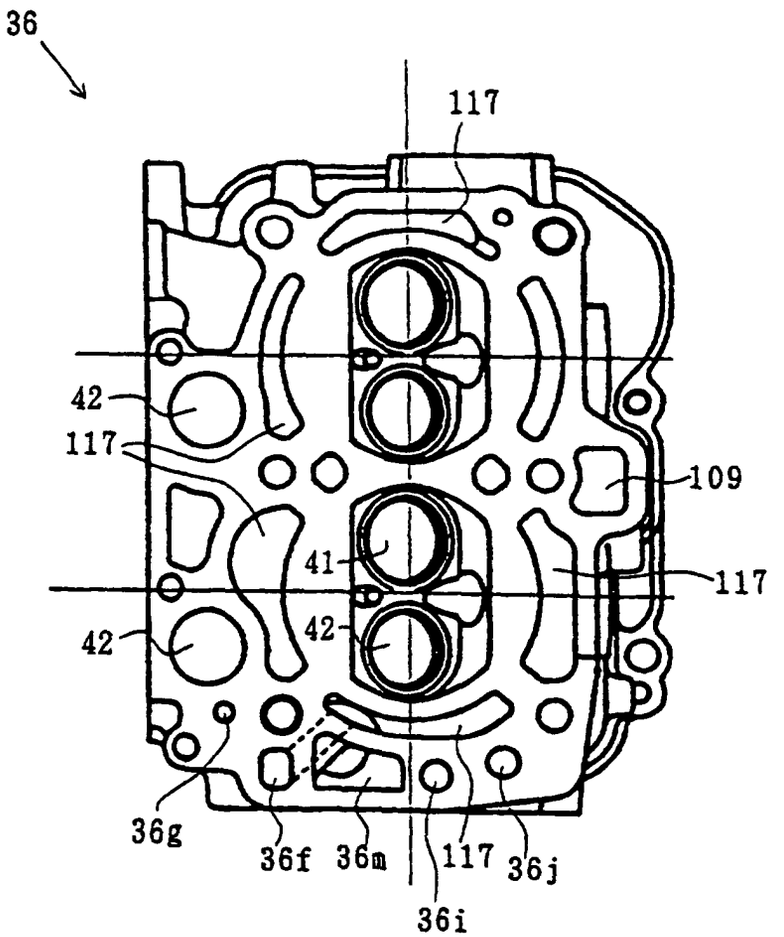

FIGURE 13

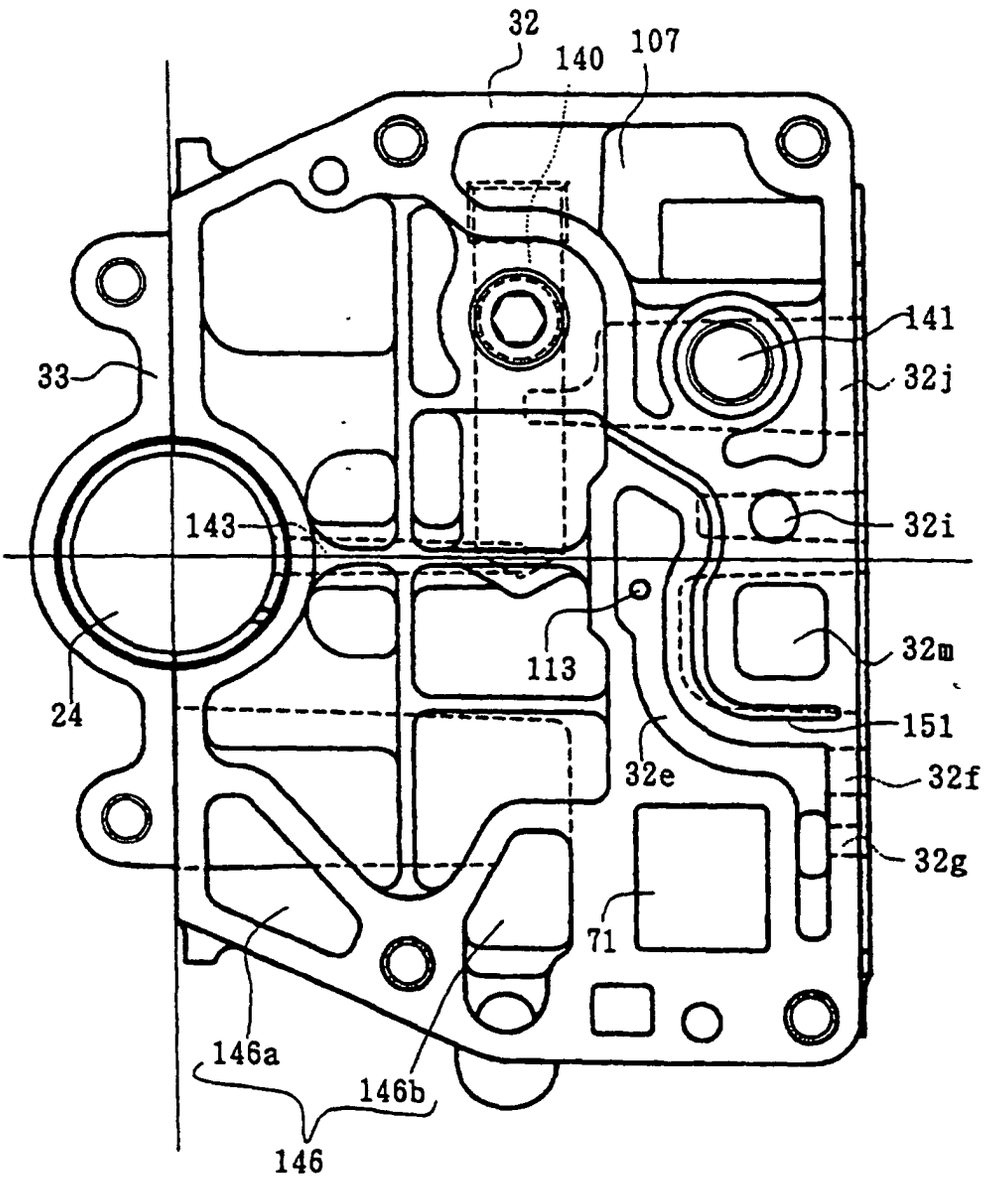
32
140
107
141
33
32j
143
32i
113
32m
24
151
32e
32f
32g
71
146a
146b
146

FIGURE 14

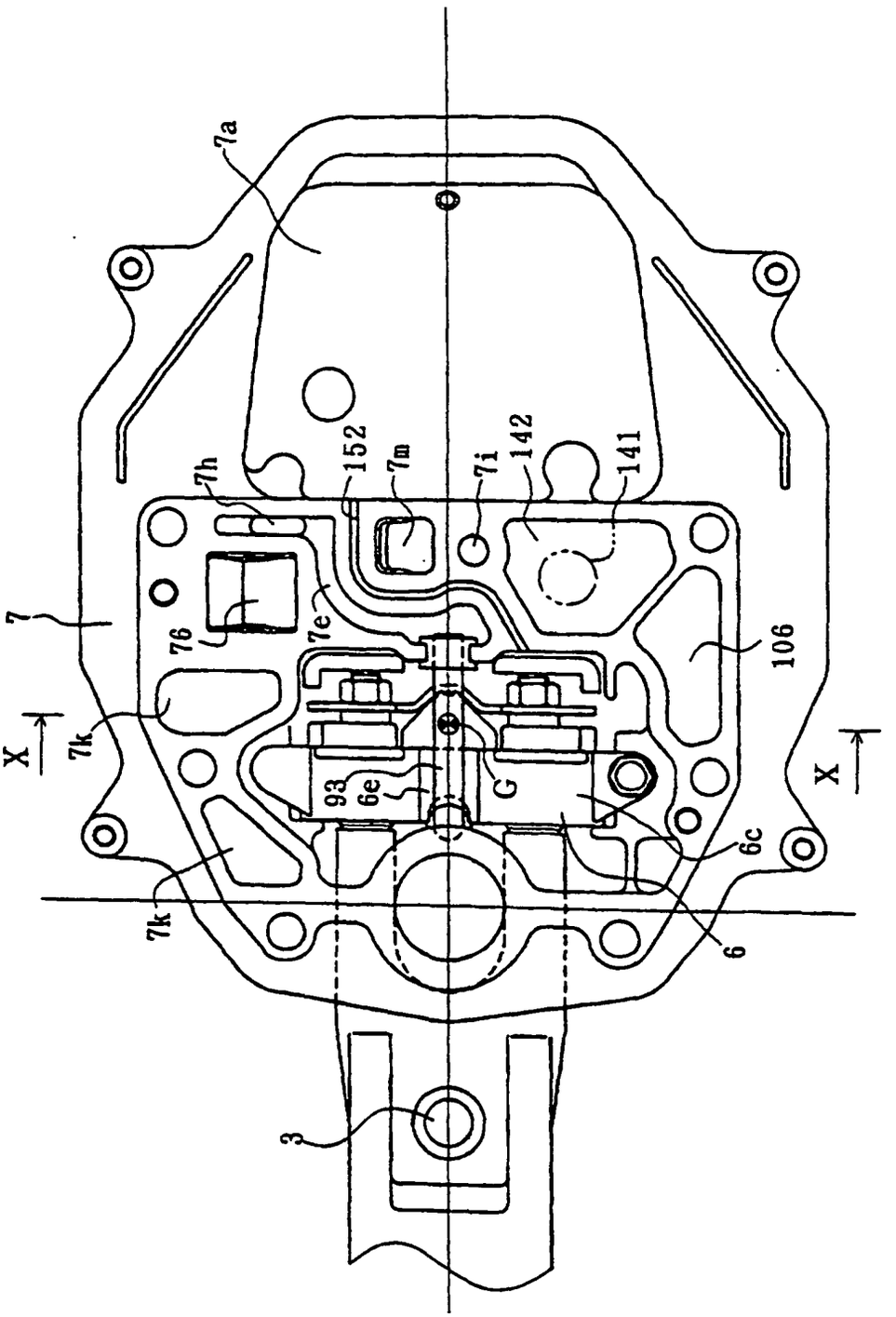

FIGURE 15

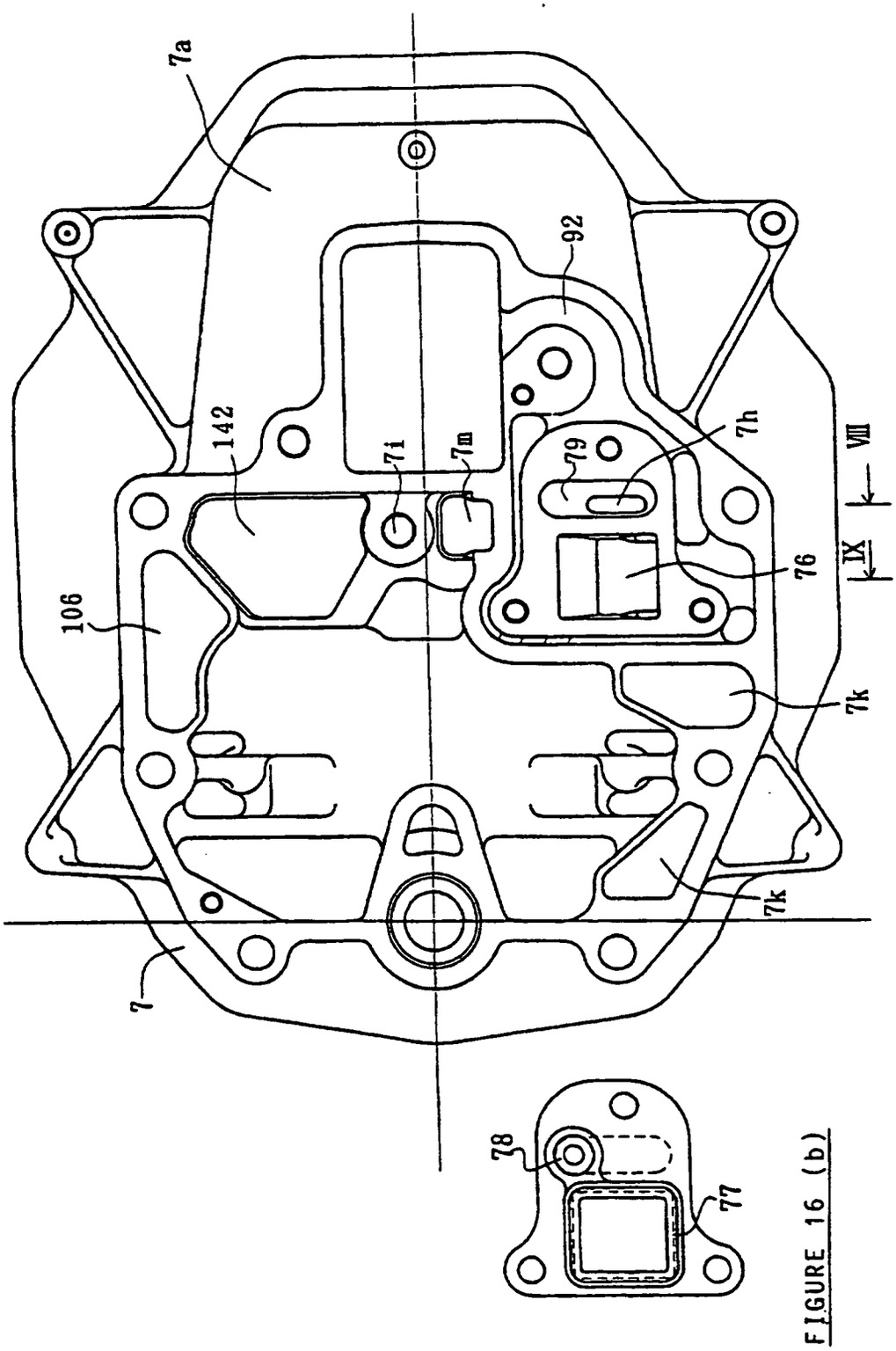

FIGURE 16 (a)

FIGURE 16 (b)

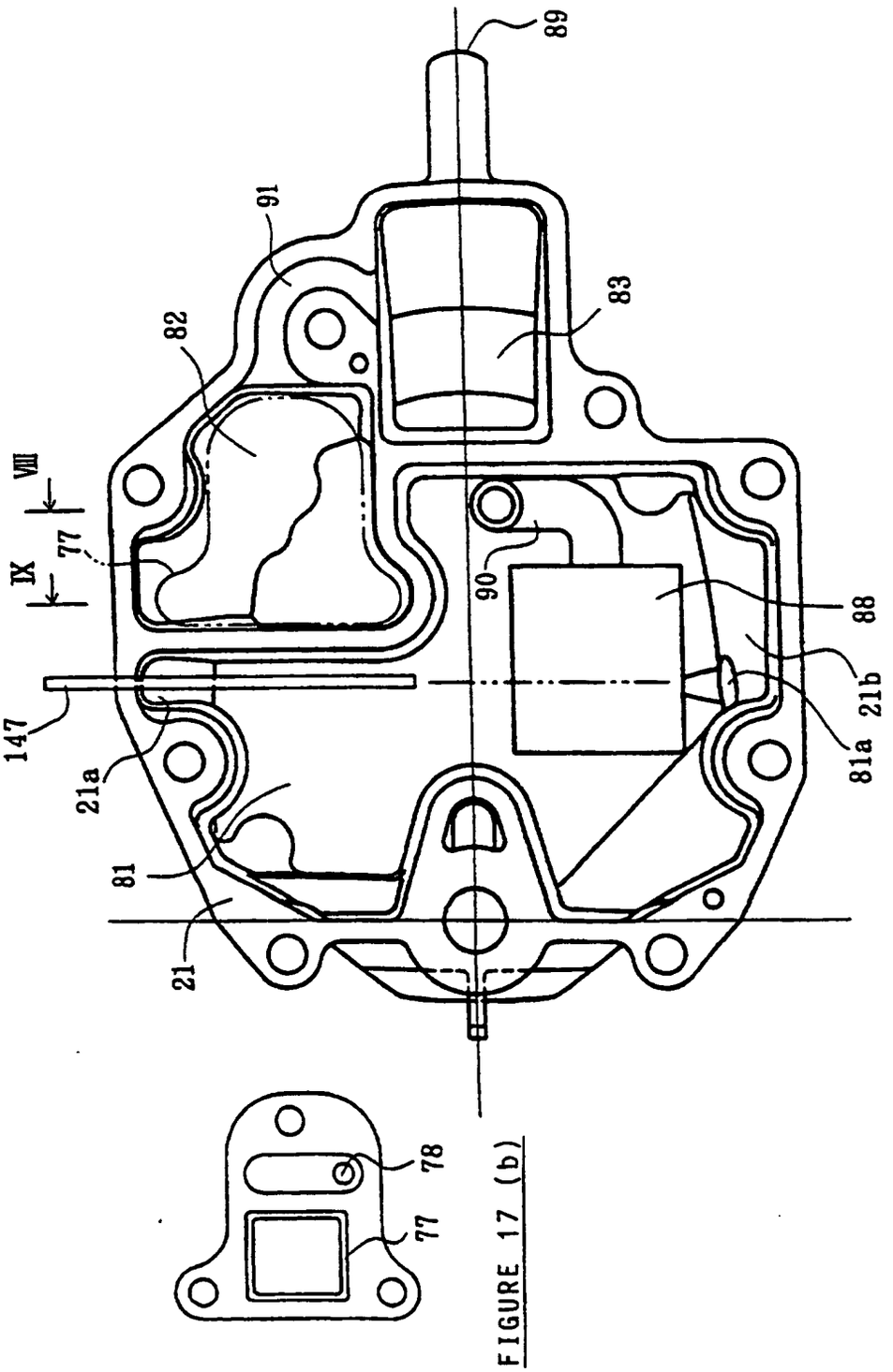

FIGURE 17 (a)

FIGURE 17 (b)

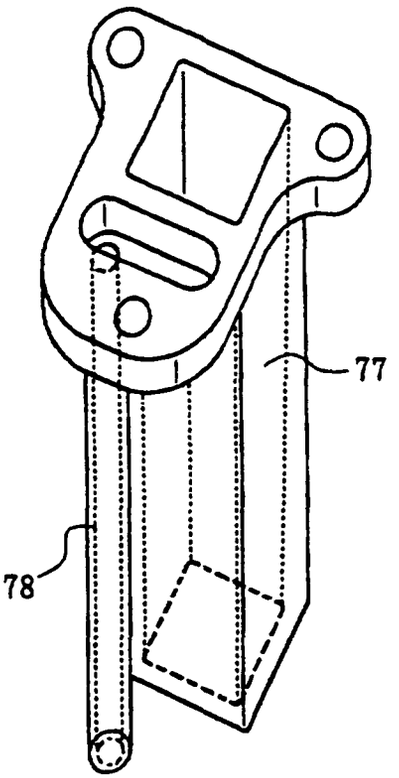

FIGURE 18

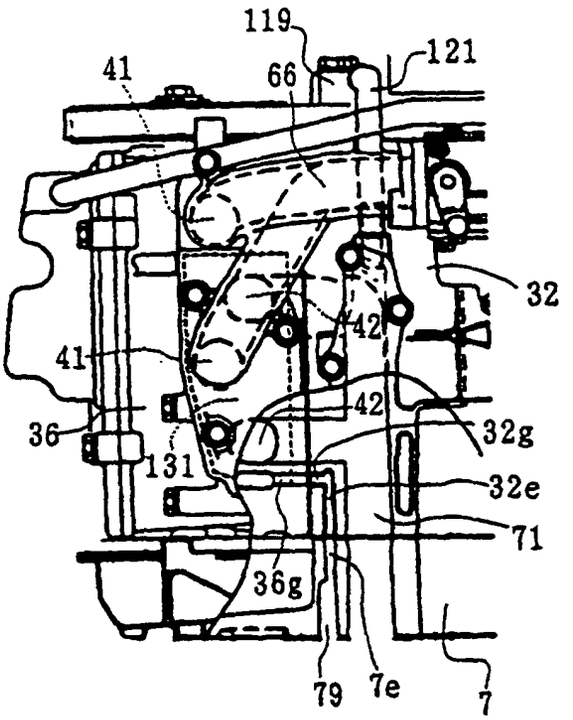

FIGURE 19

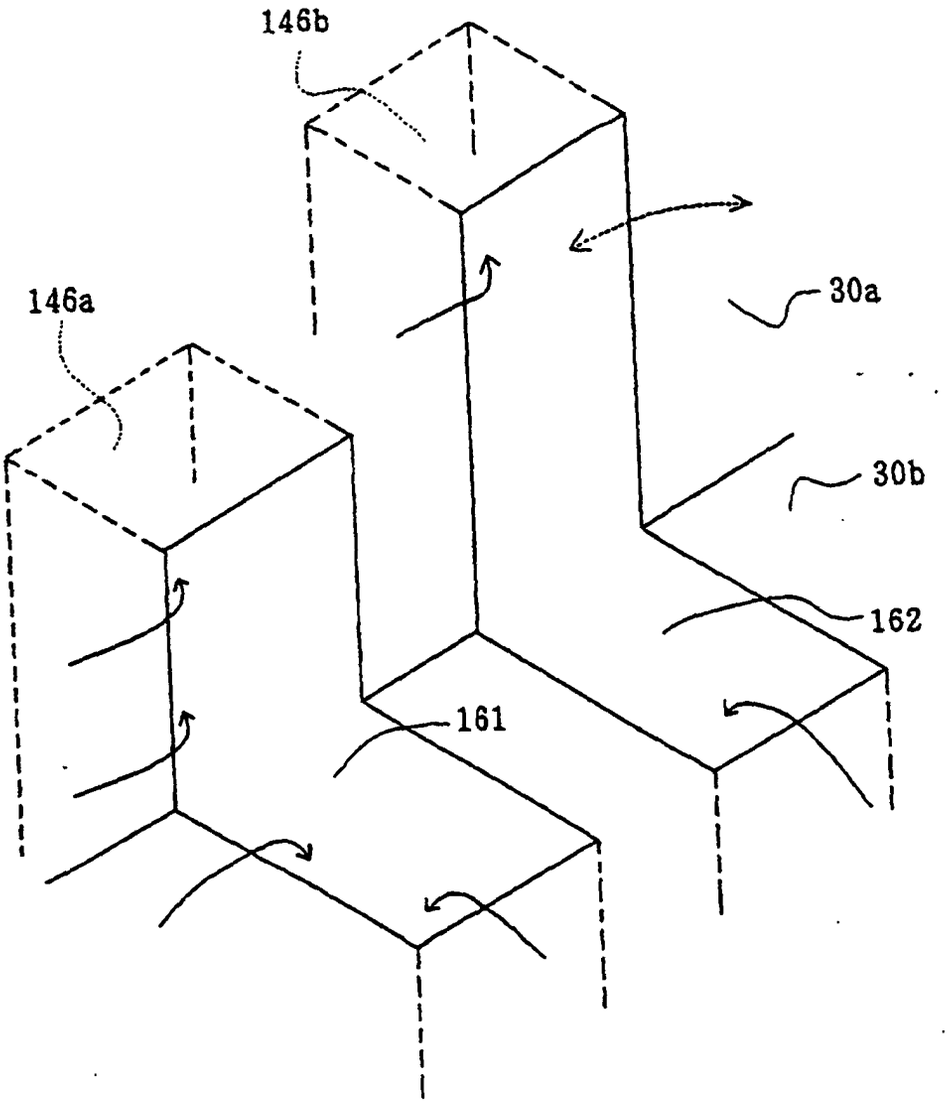

FIGURE 20

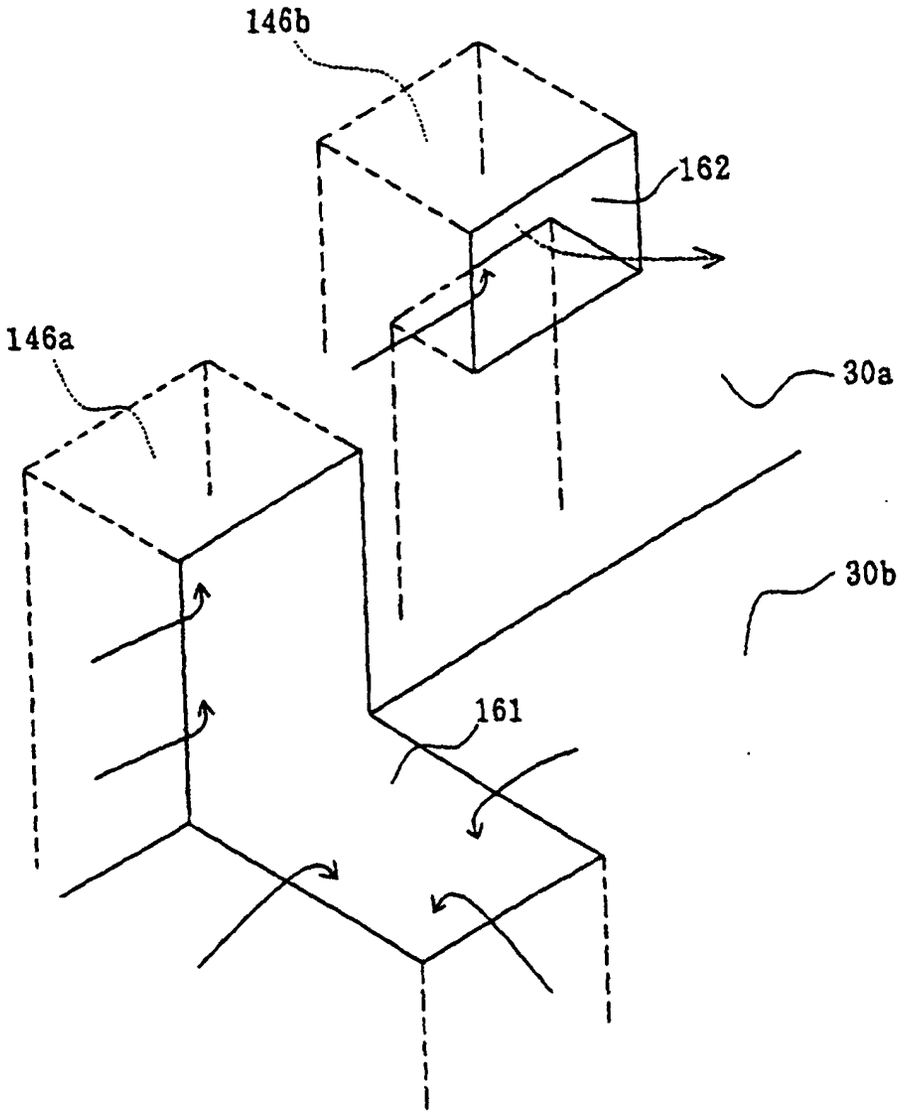

FIGURE 21