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(54) **Oil Passage Structure**

Öldurchgangsstruktur

Structure de passage d'huile

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(56) References cited:
US-A- 5 857 442
US-A- 5 950 763
US-A- 5 975 041
US-B1- 6 536 400
US-B1- 6 755 173

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Description

[0001] The present invention relates to oil passage structure of an engine of a motorcycle and others.

[Background Art]

[0002] In conventional type oil passage structure, when each oil passage divided on a division plane of a crankcase is mutually connected, the oil passages are connected with them sealed using a collar and a sealing member (for example, refer to a patent document 1).

[0003] [Patent document 1] JP-A No. 2001-342816

[0004] When two oil passages divided on a division plane of a crankcase exist, a communicating passage is required to be separately provided to make the two oil passages communicate , and a problem that an engine is made intricate because another oil passage is secured, is easily large-sized and a manhour for working the communicating passage also increases is caused. Besides, a problem that two sealing members for sealing divided faces are required and as a result, a manhour and a cost for assembly increase is also caused.

Then, the invention provides oil passage structure where a manhour and a cost for assembly is reduced, securing the sealing performance of each oil passage on a division plane of a crankcase and each oil passage can be easily made to communicate, avoiding the large sizing of an engine.

[0005] Moreover, oil passage structure where an oil passage is formed from both ends of a main oil gallery extended in an axial direction of a crankshaft in a crankcase to each crank bearing is disclosed (for example, refer to patent documents 2). Engine oil supplied to each crank bearing is supplied to the circumference of a camshaft via a cylinder and a cylinder head or is supplied to the circumference of a connecting rod via a crankshaft.

[0006] [Patent document 2] JP-A No. 2001-280111 and US 6 536 400

[0007] In the above-mentioned oil passage structure, engine oil that passes an oil filter enters a lubricating oil supply passage extended in parallel with the crankshaft and is supplied to the crank bearing via an oil passage extended substantially at a right angle from the lubricating oil supply passage.

However, engine oil is required to be supplied to each part such as not only the crank bearing but a generator arranged inside a crankcase cover and the camshaft driven via a cam chain arranged on one side of the cylinder and the cylinder head in balance and sufficiently. A simple and compact layout where the machining of plural oil passages laid to each part such as the generator and the camshaft can be also simplified possibly is desired.

Then, the invention provides oil passage structure where engine oil can be supplied to each part of an engine in balance and sufficiently and plural oil passages can be laid out simply and compactly.

[0008] To address the problem, the invention according to Claim 1 is based upon oil passage structure of an engine (for example, an engine E in an embodiment) where a crankcase (for example, a crankcase 21 in the embodiment) that supports a crankshaft (for example, a crankshaft 31 in the embodiment) is divided in a crank axial direction, is provided with: first and second oil passages (for example, an oil outflow passage 72 and a main oil gallery 76 in the embodiment) extended substantially in parallel with the crankshaft across a division plane (for example, a division plane B1 in the embodiment) of the crankcase; a communicating groove (for example, a communicating groove 75 in the embodiment) that connects each oil passage is formed on the division plane of at least one divided body (for example, a left case half 21a in the embodiment) of the crankcase; and an endless sealing member (for example, a sealing member 78 in the embodiment) that integrally surrounds the peripheries of the oil passages and the endless sealing member being provided to the oil passages and the communicating groove each half of which is mutually opposite on the division plane.

[0009] In the invention according to Claim 2, a cartridge type oil filter (for example, an oil filter 68 in the embodiment) is attached to the side of the crankcase, the first oil passage communicates with an oil outlet (for example, an oil outlet 68d in the embodiment) of the oil filter, and the second oil passage communicates with a crank bearing (for example, each crank bearing 36a, 36b in the embodiment) of the crankcase.

[0010] In the invention according to Claim 3, the oil passage structure of an engine (for example, an engine E in an embodiment) is further provided with: a cylinder (for example, a cylinder 32 in the embodiment) protruded from the crankcase; a cylinder head (for example, a cylinder head 33 in the embodiment) attached to an end of the cylinder; a crankcase cover (for example, a right case cover 21c in the embodiment) that covers one side of the crankcase; and a generator (for example, a generator 37 in the embodiment) arranged inside the crankcase. Besides, the invention according to Claim 3 is provided with: a camshaft lubricating oil supply passage (for example, a camshaft lubricating oil supply passage 120 in the embodiment) that supplies engine oil to the circumference of a camshaft (for example, a camshaft 52 in the embodiment) from one crank bearing (for example, a left crank bearing 36a in the embodiment) via the cylinder and the cylinder head; a connecting rod lubricating oil supply passage (for example, a connecting rod lubricating oil supply passage 48 in the embodiment) that supplies engine oil to the circumference of a connecting rod (for example, a connecting rod 35 in the embodiment) from the other crank bearing (for example, a right crank bearing 36b in the embodiment) via the crankshaft; a generator lubricating oil supply passage (for example, a generator lubricating oil supply passage 46 in the embodiment) that supplies engine oil to the generator via the crankcase cover; and a main oil gallery (for example, a main oil gallery 76 in the embodiment) extended further to the

outside of each crank bearing in an axial direction of the crankshaft. The main oil gallery is branched into: a first oil passage (for example, a lubricating oil supply passage 42a in a left bearing in the embodiment) that communicates with the camshaft lubricating oil supply passage; a second oil passage (for example, a lubricating oil supply passage 42b in a right bearing in the embodiment) that communicates with the connecting rod lubricating oil supply passage; and a third oil passage (for example, a generator side oil passage 44 in the embodiment) that communicates with the generator lubricating oil supply passage.

[0011] In the invention according to Claim 4, the cylinder is provided with bolt insertion holes (for example, a bolt insertion hole 114 in the embodiment) for a stud bolt for fastening the cylinder and the cylinder head to the crankcase, the camshaft lubricating oil supply passage communicates with the cylinder head from the crank bearing on the reverse side to a cam chain (for example, a cam chain 54 in the embodiment) via the bolt insertion hole, and engine oil is supplied to the circumference of the camshaft via an oil passage in the head (for example, a longitudinal oil passage 117 in the head and an inclined oil passage 118 in the head in the embodiment) provided to a side wall (for example, a left side wall 33b in the embodiment) on the reverse side of the cam chain in the cylinder head.

[0012] In the invention according to Claim 5, an oil passage (for example, an oil outflow passage 72 in the embodiment) that communicates with the upstream side of the main oil gallery is arranged close to a water jacket (for example, a cooling water communicating passage 74 in the embodiment).

[0013] In the invention according to Claim 6, the cam chain and an oil pump driving chain (for example, a chain 85 in the embodiment) are provided between a crank bearing on the side of the generator (for example, a right crank bearing 36b in the embodiment) and the generator.

[0014] According to the invention disclosed in Claim 1, a manhour and a cost for assembly can be reduced, securing the sealing performance on the division plane of each oil passage by integrally sealing divided parts on the division plane of each oil passage together with the communicating groove with one endless sealing member when the divided parts on the division plane of each oil passage are sealed. As each oil passage can be easily made to communicate only by forming the communicating groove on the division plane of the crankcase, the oil passage structure is simplified, a degree of the freedom of the layout of each oil passage can be enhanced, the large-sizing of the engine is avoided, and a manhour for working a communicating passage can be reduced.

[0015] According to the invention disclosed in Claim 2, when an oil inflow port of an oil filter is arranged opposite to a discharge port of an oil pump, a first oil passage that communicates with the oil outlet of the oil filter and a second oil passage as a main oil gallery that communicates with a crank bearing may be arranged off, however, as each oil passage can be also easily made to communicate in such a case, the efficient oil passage structure can be formed and a degree of the freedom of the layout of each oil passage can be enhanced.

[0016] According to the invention disclosed in Claim 3, as the first oil passage that supplies oil to the circumference of the camshaft, the second oil passage that supplies oil to the circumference of the connecting rod and the third oil passage that supplies oil to the generator are directly branched from the main oil gallery, the winding of the oil passage is reduced, the flow resistance can be reduced, the circulated quantity of oil is increased, engine oil can be supplied to each part of the engine in balance, and plural oil passages can be simply and compactly laid out. Machining for forming the plural oil passages can be simplified.

[0017] According to the invention disclosed in Claim 4, a part of the camshaft lubricating oil supply passage can be easily formed utilizing the bolt insertion hole of the cylinder. Besides, the lubrication of the end of the camshaft can be facilitated by providing the oil passage in the head of the camshaft lubricating oil supply passage in the side wall of the cylinder head and the oil passage in the head can be simply and compactly laid out. Further, the interference with the cam chain and others is avoided by providing the oil passage in the head of the camshaft lubricating oil supply passage in the side wall on the reverse side to the cam chain in the cylinder head and the oil passage in the head can be easily formed.

[0018] According to the invention disclosed in Claim 5, as engine oil is cooled by the water jacket on the upstream side of the main oil gallery, engine oil of relatively low temperature can be supplied to each part of the engine and the engine cooling performance can be enhanced.

[0019] According to the invention disclosed in Claim 6, as each chain wound on the crankshaft is collected on one side, the workability of the assembly of each chain can be enhanced and as each chain is provided on the side of the generator, oil chamber space can be made intensive.

[Fig. 1] is a left side view showing a motorcycle equivalent to an embodiment of the invention.

[Fig. 2] is a development sectional view showing an engine of the motorcycle.

[Fig. 3] is a development sectional view showing another section of the engine.

[Fig. 4] is a left side view showing a right crankcase half of the engine.

[Fig. 5] is a right side view showing a left crankcase half of the engine.

[Fig. 6] is an enlarged view showing a main part in Fig. 5.

[Fig. 7] is a sectional view viewed along a line A-A in Fig. 6.

[Figs. 8] are sectional views viewed along a line B-B in Fig. 6, Fig. 8(a) shows a state in which a reed

valve is right attached, and Fig. 8(b) shows a state in which the reed valve is attached by mistake.

[Fig. 9] is a view viewed from a direction shown by an arrow A in Fig. 5.

[Fig. 10] is a sectional view viewed along a line A-A in Fig. 9.

[Fig. 11] shows a cylinder of the engine viewed along a cylinder axis.

[Fig. 12] shows a cylinder head of the engine viewed along the cylinder axis.

[Fig. 13] is a sectional view viewed along a line A-A in Fig. 12.

[0020] Referring to the drawings, an embodiment of the invention will be described below. A direction such as the front, the rear, the right and the left in the following description is similar to a direction in a vehicle if unspecified. An arrow FR in the drawings points to the front side of the vehicle, an arrow LH points to the left side of the vehicle, and an arrow UP points to the upside of the vehicle.

[0021] In a scooter type motorcycle 1 which is a low deck vehicle shown in Fig. 1, a body frame F is provided with a head pipe 13 at a front end, and a front fork 11 that journals a front wheel WF and a steering handlebar 12 are steerably supported by the head pipe 13. On the downside of the rear of the body frame F, an integrated swing type power unit (hereinafter called a swing unit) U in the front of which an engine E as a power plant of the motorcycle 1 is arranged and in the rear of which an axle S of a rear wheel WR as a driving wheel is arranged is arranged.

[0022] The downside of the front of the swing unit U is vertically swingably supported by the rear of the body frame F via a link member 61. In the meantime, a rear end of the swing unit U is supported by a rear end of the body frame F via a rear cushion 7 which is a shock absorber. The swing unit U can be vertically swung together with the rear wheel WR because the link member 61 functions as a pivot and so-called unit swing type rear suspension is configured.

[0023] The body frame F is provided with a pair of right and left upper down frames 14 extended backward and diagonally downward from the head pipe 13 and a pair of right and left lower down frames 15 bent and extended backward after they are extended backward and diagonally downward from the head pipe 13 on the downside of the upper down frames 14. The rears of the lower down frames 15 are rear inclined parts 15a bent and extended backward and diagonally upward and a rear end of each upper down frame 14 is bonded to the downside of each rear inclined part 15a.

[0024] A front end of each of a pair of right and left seat rails 16 inclined backward and diagonally upward is bonded to the rear of each upper down frame 14 and an upper end of each rear inclined part 15a is bonded to an intermediate part of each seat rail 16. A support frame 10 that functions as a diagonal brace is laid between the rear of each seat rail 16 and an intermediate part of each rear inclined part 15a. The body frame F is mainly configured by the head pipe 13, the upper down frames 14, the lower down frames 15, the seat rails 16 and the support frames 10.

[0025] The circumference of the body frame F is covered with a body cover 19. A tandem seat for occupants 20 is arranged on the upside of the rear of the body cover 19 so that the seat can be lifted. An article housing 18 that can house a helmet and others is arranged on the downside of the seat for occupants 20 and on the upside of the power unit U.

[0026] The swing unit U integrates the engine E in the front and a power transmission mechanism M on the rear left side.

The engine E is a water-cooled 4-stroke OHC single-cylinder engine in which a rotational axis C1 of its crankshaft 31 is laid laterally (in a direction of the width of the body) and a cylinder part 22 is protruded substantially horizontally (in detail, in a state inclined forward and slightly upward) in front from a front end of a crankcase 21. A reference code C2 denotes an axis of the cylinder part 22 (a cylinder axis).

[0027] As also shown in Fig. 2, the crankcase 21 is divided into left and right case halves 21a, 21b. The body 23a of a left case extended backward after the body is overhung leftward from the left side of the rear is integrated with the left case half 21a of the crankcase 21. The body 23a of the left case configures a transmission case 23 in the power transmission mechanism M together with a left case cover 23b attached to the left side of the body of the left case. A right case cover 21c is attached to the right side of the right case half 21b of the crankcase 21 and a generator 37 is provided coaxially with the crankshaft 31 inside the right case cover 21c. A reference code B1 denotes a division plane perpendicular to a lateral direction in the center (a position of the cylinder axis C2) in the lateral direction of the crankcase 21.

[0028] The power transmission mechanism M is provided with a belt continuously variable transmission 24 that continuously shifts the driving force of the engine E and a speed reducing gear train not shown that decelerates the output of the belt continuously variable transmission 24 and outputs it to the axle S. The belt continuously variable transmission 24 is housed in a longitudinal direction of the transmission case 23 and the speed reducing gear train is housed on the right side of the rear of the transmission case 23 (inside in the direction of the width of the body). The axle S is protruded rightward from the speed reducing gear train and the rear wheel WR is attached to the axle S.

[0029] The cylinder part 22 is mainly configured by a cylinder 32 attached to a front end of the crankcase 21, a cylinder head 33 attached to a front end of the cylinder 32 and a head cover 33a attached to a front end of the cylinder head 33.

A piston 34 is reciprocatably fitted into the cylinder 32. A

small-diameter end 35b of a connecting rod 35 is coupled to the piston 34 via a piston pin and a large-diameter end 35a of the connecting rod 35 is coupled to a crankpin 31e of the crankshaft 31. Left and right journals 31a, 31b of the crankshaft 31 are rotatably supported by left and right crank bearings 36a, 36b formed by left and right inside walls 41a, 41b of the left and right case halves 21a, 21b via metal bearings (plane bearings) 39a, 39b.

[0030] The rotational power of the crankshaft 31 is transmitted to the axle S via the power transmission mechanism M.

In the belt continuously variable transmission 24 of the power transmission mechanism M, a V-belt 103 is wound on a drive pulley 101 and on a driven pulley 102 and speed reducing ratio for the rotational power is continuously varied in a predetermined range according to the variation of the revolution speed of the crankshaft 31. The drive pulley 101 is arranged coaxially with the crankshaft 31 in the front of the transmission case 23 and the driven pulley 102 is arranged at the back of the drive pulley, that is, in the rear of the transmission case 23.

[0031] A generator shaft 31c is extended further rightward from the right journal 31b on the right side of the crankshaft 31 and supports an outer rotor 37a of the generator 37 housed in the right case cover 21c. The outer rotor 37a is a cup type open rightward and a stator coil 37b supported by the right case cover 21c is arranged in the outer rotor 37a.

[0032] A drive sprocket 51 for driving a camshaft 52 in the cylinder head 33 is coaxially provided on the base side of the generator shaft 31c. A drive sprocket 82 for driving an oil pump 81 (see Fig. 3) is provided close on the left side of the drive sprocket 51. Further, a starter driven gear 37c linked with a starter not shown is attached on the right side of the outer rotor 37a of the generator 37 via a one-way clutch 37d.

[0033] The camshaft 52 is arranged in parallel with the crankshaft 31 (that is, in lateral direction) in the cylinder head 33 and both sides are rotatably supported by the cylinder head 33. A driven sprocket 53 is coaxially provided at a left end of the camshaft 52 and the camshaft 52 is rotated in synchronization with the crankshaft 31 because a cam chain 54 is wound on the driven sprocket 53 and on the drive sprocket 51 of the crankshaft 31. A cam chain chamber 55 that houses the cam chain 54 is provided on the right side of the cylinder head 33 and the cylinder 32.

[0034] Inlet and exhaust cams 52a, 52b are arranged alongside in an intermediate part in a lateral direction of the camshaft 52, and input ends of rocker arms 56a, 56b on the intake side and on the exhaust side abut on the inlet and exhaust cams 52a, 52b. When the camshaft 52 is rotated as described above, each rocker arm 56a, 56b is rocked according to cam patterns of the inlet and exhaust cams 52a, 52b, intake and exhaust valves not shown are operated, and intake and exhaust ports in the cylinder head 33 are opened and closed. A reference numeral 38 denotes an ignition plug.

[0035] The left side of the crankshaft 31 is extended further leftward from the left journal 31a, forms a drive pulley shaft 31d, and the drive pulley shaft 31d supports the drive pulley 101 of the belt continuously variable transmission 24 so that the drive pulley can be integrally rotated. The drive pulley 101 is provided with a fixed pulley half 101a located outside in an axial direction of the drive pulley shaft and fixed to the drive pulley shaft 31d and a moving pulley half 101b located inside in the axial direction and movable on the drive pulley shaft 31d in the axial direction. The V-belt 103 is wound in a V-type groove 101c formed between both pulley halves 101a, 101b. The moving pulley half 101b is pressed on the side on which the moving pulley half separates from the fixed pulley half 101a. Plural weight rollers 104 are arranged inside the moving pulley half 101b.

[0036] When the rotation of the drive pulley 101 is stopped (when the rotation of the crankshaft 31 is stopped), the moving pulley half 101b separates from the fixed pulley half 101a, the width of the V-type groove 101c is extended, and a position in which the V-belt 103 is wound is moved inside. When the drive pulley 101 is rotated (when the crankshaft 31 is rotated), each weight roller 104 is moved outside by its centrifugal force, the moving pulley half 101b is brought close to the fixed pulley half 101a, the width of the V-type groove 101c is narrowed, and a position in which the V-belt 103 is wound is moved outside. According to the variation of the wound position, a position in which the V-belt 103 is wound on the driven pulley 102 also varies and speed reducing ratio between both pulleys 101, 102 automatically and continuously varies.

[0037] A cooling fan 107 is formed on the left side of the drive pulley 101 and is rotated together with the drive pulley 101 when the engine is driven. Hereby, outside air is taken in the transmission case 23 from an inlet port 23e of an intake duct 23c attached on the right side of the front of the transmission case 23 and the belt continuously variable transmission 24 and others are forcedly cooled. In the intake duct 23c, an engine air intake passage is provided separately from a transmission cooling wind passage.

[0038] A cartridge type oil filter 68 is attached to the left side of a lower part of the crankcase 21 (the left case half 21a)(see Fig. 1).

As shown in Fig. 3, the oil filter 68 houses an element in a bottomed cylindrical case 68a, an opening of the case 68a is closed by a disclike set plate 68b, and the case is attached so that a central axis of the case 68a is laid in the lateral direction (in the axial direction of the crankshaft) and the side of the opening of the case 68a is opposite to a holder 71 of a left side wall 21d of the crankcase 21 (the left case half 21a).

[0039] An oil outlet 68d is formed in the center of the set plate 68b and around it, plural oil inflow ports 68c are arranged in a circumferential direction. After the oil filter 68 receives engine oil flowing into the case 68a from each oil inflow port 68c, the oil is passed from the outside

to the inside of the element and is filtered, the oil is made to flow out of the case 68a from the oil outlet 68d. A reference numeral 69 denotes an oil sensor for sensing oil temperature or oil pressure in the vicinity of the oil filter 68 on the left side wall 21d of the crankcase 21 and 69a denotes a breather pipe for adjusting internal pressure in the crankcase 21.

[0040] An oil outflow passage 72 extended in the lateral direction substantially in parallel with the crankshaft 31 (substantially in parallel with the crank axis C1) rightward (toward inside in the lateral direction) from the center (a part opposite to the oil outlet 68d of the oil filter 68) of the holder 71 is formed in the crankcase 21. The oil filter 68 is detachably attached to the holder 71 by protruding a nozzle 72a that communicates with the oil outflow passage 72 leftward from the center of the holder 71, screwing a thread outside the nozzle 72a and a thread inside the oil outlet 68d and fastening the oil filter 68 itself rotating it around its axis, and the oil outflow passage 72 and the oil outlet 68d communicate.

[0041] An annular oil groove 71a is formed opposite to each oil inflow port 68c of the oil filter 68 on the holder 71. A part of the oil groove 71a is opposite to a discharge port of the oil pump 81 in the lateral direction and an oil passage 73 on the discharge side is formed in the lateral direction in the crankcase 21 so that the oil groove 71a and the discharge port are connected via the shortest distance.

[0042] The oil pump 81 for circulating engine oil is arranged with its driving shaft 83 in the lateral direction inside a lower part of the right case half 21b. A driven sprocket 84 is coaxially provided to the driving shaft 83 of the oil pump 81 and the oil pump 81 is rotated in a link with the crankshaft 31 by winding an endless chain 85 on the driven sprocket 84 and on the drive sprocket 82.

[0043] A water pump 86 for circulating engine cooling water is arranged with its driving shaft 87 coaxial with the driving shaft 83 of the oil pump 81 on the right side of the lower part of the right case half 21b. A left end of the driving shaft 87 of the water pump 86 is fitted to a right end of the driving shaft 83 of the oil pump 81 so that relative rotation is impossible and when the oil pump 81 is driven, the water pump 86 is also similarly driven. Cooling water from the water pump 86 is taken into the cylinder part 22 from the left side of the crankcase 21 through a cooling water communicating passage 74 across the left and right case halves 21a, 21b. The cooling water communicating passage 74 is arranged close to the oil outflow passage 72. A reference numeral 58 denotes a coupling part on the unit side for coupling the link member 61 on the downside of the front of the swing unit U.

[0044] An oil passage 73a on the suction side that communicates with an oil pan in the lower part of the crankcase 21 is connected to a suction opening of the oil pump 81 and the oil passage 73 on the discharge side that communicates with the oil inflow port 68c of the oil filter 68 is connected to the discharge port of the oil pump 81. When oil pump 81 is driven, engine oil stored in the oil pan is sucked into the oil pump 81 via the oil passage 73a on the suction side formed in the right case half 21b, oil discharged from the oil pump 81 flows into the oil groove 71a of the holder 71 via the oil passage 73 on the discharge side across the left and right case halves 21a, 21b, and directly flows into the oil filter 68 from each oil inflow port 68c via the oil groove 71a.

[0045] The oil passing in the oil filter 68 and filtered directly flows into the oil outflow passage 72 from the oil outlet 68d via the nozzle 72a. The oil outflow passage 72 is provided across the left and right case halves 21a, 21b (in detail, so that its right end reaches the right case half 21b). The right end of the oil outflow passage 72 communicates with an intermediate part in the lateral direction of a main oil gallery 76 extended substantially in parallel with the crankshaft 31 across the left and right case halves 21a, 21b in the crankcase 21 via a communicating groove 75 concave on the division plane B1 in the right case half 21b. That is, oil that flows into the oil outflow passage 72 flows into the intermediate part in the lateral direction of the main oil gallery 76 via the communicating groove 75. The communicating groove 75 may be also formed in the left case half 21a and may be also formed in both left and right case halves 21a, 21b.

[0046] As shown in Fig. 6, a single endless sealing member 78 that integrally surrounds the peripheries is provided to parts in which the main oil gallery 76, the oil outflow passage 72 and the communicating groove 75 are opposite on the division plane B1 of the left and right case halves 21a, 21b. That is, the sealing member 78 surrounds the periphery of a communicating part including the main oil gallery 76, the oil outflow passage 72 and the communicating groove 75 on the division plane B1 along the periphery and when the left and right case halves 21a, 21b are integrally assembled, the communicating part can be easily and securely sealed.

[0047] As also shown in Fig. 7, divided parts on the division plane B1 of the main oil gallery 76 and the oil outflow passage 72 are connected via each collar 76c, 72c. A part along the periphery of the above-mentioned communicating part in the left case half 21a is a counter bored concave portion, the sealing member 78 is fitted into a groove formed by the concave portion and the periphery of each collar, and the communicating part is positioned. A wall 75a along a longitudinal direction of the communicating groove is protruded on both sides in a direction of the width of the communicating groove 75, the sealing member 78 is fitted into a groove formed by each wall 75a and the concave portion, and the communicating part is positioned. In the meantime, the periphery of the communicating part in the right case half 21b has a flat sealed plane without irregularities. Divided parts on the division plane B1 of the oil passage on the discharge side 73, the cooling water communicating passage 74 and a relief passage 77 are connected via each collar 73c, 74c1, 77c and are sealed by an individual sealing member (O ring) 73d, 74d1, 77d provided on the periphery of each collar (see Figs. 3, 5, 6).

[0048] As shown in Fig. 3, lubricating oil supply passages in the left and right bearings 42a, 42b formed in left and right inside walls 41a, 41b that form the left and right crank bearings 36a, 36b in the left and right case halves 21a, 21b are connected to both left and right ends of the main oil gallery 76. The lubricating oil supply passages 42a, 42b in the left and right bearings are extended substantially perpendicularly to the crankshaft 31 (the crank axis C1) and communicate with lubricating oil supply grooves 43a, 43b inside the left and right crank bearings 36a, 36b. Hereby, engine oil that flows into the main oil gallery 76 is supplied to sliding surfaces of left and right metal bearings 39a, 39b.

[0049] The left end of the main gallery 76 is extended on the left side of the left inside wall 41a (the left crank bearing 36a) and a sensing element of the oil sensor 69 is opposite to the left end. In the meantime, an oil passage 44 on the side of the generator extended substantially in parallel with the crankshaft 31 is connected to a right end of the main oil gallery 76 on the right side of the right inside wall 41b (the right crank bearing 36b). The oil passage 44 on the side of the generator communicates with an oil passage in the cover 45 formed in the right case cover 21c.

[0050] An oil injection port 45a opposite to the generator 37 inside the right case cover 21c is suitably formed in the oil passage in the cover 45. Hereby, a part of oil in the main oil gallery 76 is supplied to the generator 37 via the oil passage 44 on the side of the generator and the oil passage in the cover 45. Hereinafter, the oil passage 45 in the cover may be called a generator lubricating oil supply passage 46.

Divided parts of the oil passage 44 on the side of the generator and the oil passage in the cover 45 on a division plane (a fitting plane) perpendicular to a lateral direction between the right case half 21b and the right case cover 21c are connected via a collar 44c and are sealed by a sealing member (O ring) 44d provided on the periphery of the collar. Divided parts of the cooling water communicating passage 74 on the division plane are connected via a collar 74c2 and are sealed by a sealing member (O ring) 74d2 provided on the periphery of the collar.

[0051] A part of the oil supplied to the left crank bearing 36a is supplied to a valve train in the cylinder head 33 (in a valve chamber) via an oil passage 79 on the cylinder side (see Fig. 5) formed in the left case half 21a and others. The oil in the cylinder head 33 is returned to the oil pan in the lower part of the crankcase 21 via the cam chain chamber 55 on the right side of the cylinder part 22. The inside of the crankcase 21 and the inside of the transmission case 23 are partitioned oiltightly and no oil is supplied to the belt continuously variable transmission 24. A reference numeral 39c denotes an oil seal that is arranged next to the outside in an axial direction of the left crank bearing 36a and seals the left crank bearing 36a and the left journal 31a oiltightly.

[0052] In the meantime, a part of the oil supplied to the right crank bearing 36b is supplied to a sliding surface of a metal bearing inside the large-diameter end 35a of the connecting rod 35 via an oil hole 47a piercing the right journal 31b of the crankshaft 31 in a radial direction, an oil hole 47b piercing the crankpin 31e in a radial direction and an oil hole 47c diagonally connecting each oil hole 47a, 47b.

[0053] That is, a connecting rod lubricating oil supply passage 48 mainly configured by each oil hole 47a, 47b, 47c for supplying engine oil around the connecting rod 35 from the right crank bearing 36b is formed. An annular groove for making oil flow is respectively formed on the periphery of the right journal 31b and on an inside face of the right metal bearing 39b. A part of the oil supplied to the large-diameter end 35a of the connecting rod 35 is supplied to a sliding surface of a metal bush inside the small-diameter end 35b and others through the inside of the connecting rod 35.

[0054] As shown in Fig. 4, the oil pump 81 is arranged in front of the diagonal downside of the crankshaft 31 (the crank axis C1) in the right case half 21b. A relief passage 77 extended substantially in parallel with the crankshaft 31 across the left and right case halves 21a, 21b is arranged on the left side of a relief port of the oil pump 81.

As shown in Fig. 5, the holder 71 (the oil filter 68) is arranged in front of the diagonal downside of the crankshaft 31 on the left side wall 21d of the left case half 21a. The oil outflow passage 72 that communicates with the oil groove 71a of the holder 71 is arranged on the left side of the discharge port of the oil pump 81.

[0055] The oil passage 73 on the discharge side, the oil outflow passage 72, the relief passage 77, the main oil gallery 76 and the cooling water communicating passage 74 across the left and right case halves 21a, 21b are arranged in front of the diagonal downside of the crankshaft 31 in the crankcase 21 intensively. An endless sealing member 78 integrally surrounding the peripheries of the followings is provided to the main oil gallery 76, the oil outflow passage 72 and the communicating groove 75 each half of which is opposite on the division plane B1 of the left and right case halves 21a, 21b (see Fig. 5).

[0056] As shown in Figs. 6 and 8(a), a reed valve 91 that partitions space in which the crankshaft 31 is arranged (crank arrangement space) K in the crankcase 21 and the oil pan P in the lower part of the crankcase 21 is provided at the back of the diagonal downside of the crankshaft 31 in the left case half 21a. The reed valve 91 is a substantially horizontal plate, and a frame plate 92 having a square communicating hole 92a in the center, an elastic plate 93 one side of which is fixed to a lower surface of the frame plate 92 and a sealing member 94 that covers the periphery of the frame plate 92 are integrated.

[0057] The rectangular elastic plate 93 is larger than the communicating hole 92a and a short-side part on its front side is fixed to the frame plate 92 by a pair of screws 95. The elastic plate 93 closes the communicating hole 92a when no load is applied and when a load is applied

from the downside and opens the communicating hole 92a by deflecting downward when a load is applied from the upside. Hereby, the reed valve 91 is suitably opened and closed according to the variation of the internal pressure of the crank arrangement space K by the reciprocation of the piston 34, the friction is reduced, and engine oil in the crank arrangement space K can be circulated into the oil pan P. That is, when pressure varies in the sealed crank arrangement space K by the operation of the engine E, the lead valve 91 is intermittently opened and closed so that oil in the crank arrangement space K is made to flow downward, that is, into the oil pan P.

[0058] A cutout 97 U-shaped in a top view open on the side of the division plane B1 is provided to a left partition wall 96a that partitions the crank arrangement space K and the oil pan P in the left case half 21a. The cross section open inside the cutout 97 of an inner circumference of the cutout 97 is U-shaped and the reed valve 91 with the sealing member 94 on the periphery of it is held inside the cutout in a sealed condition. One side of the reed valve 91 is opposite to the division plane B1 and one side of a right partition wall 96b of the right case half 21b abuts on the one side in a sealed condition.

[0059] The reed valve 91 is substantially rectangular in the top view and a pair of corners on the side of the depth of the cutout 97 opposite to a pair of corners on the side of the division plane B1 are chamfered in a circular arc having a relatively large radius. As for each corner on the side of the depth of the cutout 97 of the reed valve 91, the rear corner opposite to the front corner is chamfered in a circular arc having a further large radius. Hereby, when the flat reed valve 91 is attached to the crankcase 21, wrong assembly such as the attachment in a wrong direction of the reed valve 91 is prevented.

[0060] The vertical width (the height of each screw 95) of a part fixed to the elastic plate 93 on the rear side of the reed valve 91 is set to be larger than the vertical width inside the U-shaped section of the inner circumference of the cutout 97 and the depth of the U-shaped section on the rear side of the cutout 97 is set to be longer than the depth of the U-shaped section on the front side of the cutout 97. Hereby, even if a direction in assembling the reed valve 91 in the cutout 97 is wrong as shown in Fig. 8(b), each screw 95 interferes with the inner circumference on the rear side of the cutout 97, the reed valve cannot be fitted into the cutout, and the wrong assembly of the reed valve 91 is prevented.

[0061] As described above, the oil passage structure equivalent to the above-mentioned embodiment is based upon oil passage structure of the engine E where the crankcase 21 that supports the crankshaft 31 is divided in the crank axial direction, is provided with the oil outflow passage 72 and the main oil gallery 76 respectively extended across the division plane B1 of the crankcase 21 substantially in parallel with the crankshaft 31, the communicating groove 75 that connects the oil outflow passage 72 and the main oil gallery 76 is formed on the division plane B1 of at least one divided body (the left case half 21a) of the crankcase 21, and the endless sealing member 78 that integrally surrounds the peripheries of the oil outflow passage 72, the main oil gallery 76 and the communicating groove 75 is provided to the oil outflow passage, the main oil gallery and the communicating groove each half of which is mutually opposite on the division plane B1.

[0062] According to this configuration, when the divided parts on the division plane B1 of the oil outflow passage 72 and the main oil gallery 76 are sealed, a manhour and a cost for assembly can be reduced, securing the sealing performance on the division plane B1 of the oil outflow passage 72 and the main oil gallery 76 by integrally sealing these together with the communicating groove 75 with one endless sealing member 78. Besides, as the oil outflow passage 72 and the main oil gallery 76 can be easily made to communicate only by forming the communicating groove 75 on the division plane B1 of the crankcase 21, the oil passage structure is simplified, a degree of the freedom of the layout of each oil passage can be enhanced, the large-sizing of the engine is avoided, and a manhour for working a communicating passage can be reduced.

[0063] In addition, in the oil passage structure, the cartridge type oil filter 68 is attached to the side of the crankcase 21, the oil outflow passage 72 communicates with the oil outlet 68d of the oil filter 68, and the main oil gallery 76 communicates with each crank bearing 36a, 36b of the crankcase 21.

[0064] According to this configuration, when an oil inflow port 68c of the oil filter 68 is arranged opposite to the discharge port of the oil pump 81, the oil outlet 72 that communicates with the oil outlet 68d of the oil filter 68 and the main oil gallery 76 that communicates with each crank bearing 36a, 36b may be arranged off, however, in such a case, as the oil outflow passage 72 and the main oil gallery 76 can be also easily made to communicate, the efficient oil passage structure can be formed and a degree of the freedom of the layout of each oil passage can be enhanced.

[0065] As shown in Figs. 9 and 10, a cooling water intake 112 as a part of a water jacket 111 (see Fig. 11) in the cylinder 32 is provided on the downside of a front end of the left case half 21a. A left end of the cooling water communicating passage 74 is connected to the cooling water intake 112 and the cooling water intake is open to a cylinder fitting plane (a plane for fitting a base of the cylinder 32) T1 in the left case half 21a. Cooling water is taken in the water jacket 111 surrounding the periphery of a cylinder bore in the open deck type cylinder 32 via the cooling water intake 112.

[0066] As the cooling water intake 112 is extended backward so that the cooling water intake approaches the oil passage 73 on the discharge side and the oil outflow passage 72 respectively located at the back of the cooling water intake and an extended part 112a further extended between the oil passage 73 on the discharge side and the oil outflow passage 72 is provided, the cool-

ing performance of engine oil circulated in the crankcase 21 is enhanced. After cooling water in the water jacket 111 of the cylinder 32 is taken into a water jacket of the cylinder head 33 from an end plane of the cylinder 32 (a plane for fitting a base of the cylinder head 33) T2, the cooling water is returned to the water pump 86 from a cooling water outlet 113 (see Fig. 12) on the right side of an upper part of the cylinder head 33 via a radiator not shown.

[0067] As shown in Figs. 11 and 12, a bolt insertion hole 114 for inserting a stud bolt not shown extended forward along the cylinder axis C2 from the crankcase 21 is respectively provided to both right and left sides on the upside and on the downside of the cylinder 32. Similarly, a bolt insertion hole 115 corresponding to each bolt insertion hole 114 is respectively provided to both right and left sides on the upside and on the downside of the cylinder head 33. The cylinder 32 and the cylinder head 33 are integrally fixed to the crankcase 21 by inserting the stud bolt into each bolt insertion hole 114, 115, screwing and tightening a nut on each bolt from the side of the valve chamber.

[0068] As also shown in Fig. 13, the oil passage 79 on the cylinder side in the left case half 21a is open on the left upside of the cylinder fitting plane T1. In the meantime, on the base plane of the cylinder 32, a communicating groove 116 on the base side that makes the bolt insertion hole 114 on the left upside and the oil passage 79 on the cylinder side communicate is formed.

[0069] In the cylinder head 33, a longitudinal oil passage 117 in the head extended along the cylinder axis C2 from the base of the cylinder head 33 to the height of the axis C3 of the camshaft 52 is formed in the vicinity of the bolt insertion hole 115 on the left upside in a left side wall 33b, and an inclined oil passage 118 in the head which is inclined in relation to the axis C3 in a view in a cylinder axial direction and is linearly extended is formed from an end of the longitudinal oil passage 117 in the head to a left cam bearing 121 that supports the left end of the camshaft 52. As the longitudinal oil passage 117 in the head and the inclined oil passage 118 in the head are located on the left side of the cylinder head 33, that is, on the reverse side to the cam chain 54, their layout is not influenced by the cam chain 54 and the driven sprocket 53.

[0070] On the end plane T2 of the cylinder 32, a communicating groove 119 on the side of the end that makes the bolt insertion hole 114 on the left upside and the longitudinal oil passage 117 on the side of the head communicate is formed. Therefore, a part of oil supplied to the left crank bearing 36a is taken into the left cam bearing 121 through the oil passage 79 on the cylinder side, the communicating groove 116 on the base side, the bolt insertion hole 114, the communicating groove 119 on the end side, the longitudinal oil passage 117 in the head and the inclined oil passage 118 in the head, and after the part of the oil is taken into its internal space from the left end of the camshaft 52, it is suitably supplied to each sliding part and others of the valve train via the internal space.

[0071] That is, the bolt insertion hole 114 on the left upside in the cylinder 32 functions as a longitudinal oil passage 114a in the cylinder that supplies engine oil to the valve train. The camshaft lubricating oil supply passage 120 for supplying engine oil to the circumference (the valve train) of the camshaft 52 from the left crank bearing 36a is configured mainly by the oil passage 79 on the cylinder side, the longitudinal oil passage 114a in the cylinder (the bolt insertion hole 114), the longitudinal oil passage 117 in the head and the inclined oil passage 118 in the head (see Fig. 2).

[0072] As thus described above, the oil passage structure equivalent to the embodiment is based upon the oil passage structure of the engine E provided with the crankcase 21 that supports the crankshaft 31, the cylinder 32 protruded from the crankcase 21, the cylinder head 33 attached to the end of the cylinder 32, the right case cover 21c that covers one side of the crankcase 21 and the generator 37 arranged inside the crankcase 21. Besides, the oil passage structure equivalent to the embodiment is provided with the camshaft lubricating oil supply passage 120 that supplies engine oil to the circumference of the camshaft 52 from the left crank bearing 36a via the cylinder 32 and the cylinder head 33, the connecting rod lubricating oil supply passage 48 that supplies engine oil to the circumference of the connecting rod 35 from the right crank bearing 36b via the crankshaft 31, the generator lubricating oil supply passage 46 that supplies engine oil to the generator 37 via the right case cover 21c and the main oil gallery 76 extended further on the outside of each crank bearing 36a, 36b in the axial direction of the crankshaft, and the main oil gallery 76 is branched into the lubricating oil supply passage 42a in the left bearing that communicates with the camshaft lubricating oil supply passage 120, the lubricating oil supply passage 42b in the right bearing that communicates with the connecting rod lubricating oil supply passage 48 and the oil passage 44 on the generator side that communicates with the generator lubricating oil supply passage 46.

[0073] According to the above-mentioned configuration, as the lubricating oil supply passage 42a in the left bearing that supplies oil to the circumference of the camshaft 52, the lubricating oil supply passage 42b in the right bearing that supplies oil to the circumference of the connecting rod 35 and the oil passage 44 on the generator side that supplies oil to the generator are directly branched from the main oil gallery 76, the winding of the oil passage is reduced, the flow resistance can be reduced, the circulated quantity of oil is increased, engine oil can be supplied to each part of the engine in balance, and plural oil passages can be simply and compactly laid out. Besides, machining for forming plural oil passages can be simplified.

[0074] Besides, as for the oil passage structure, the cylinder 32 is provided with the bolt insertion holes 114

for a stud bolt for fastening the cylinder 32 and the cylinder head 33 to the crankcase 21, the camshaft lubricating oil supply passages 120 communicates with the cylinder head 33 from the left crank bearing 36a on the reverse side to the cam chain 54 via the bolt insertion hole 114, and engine oil is supplied to the circumference of the camshaft 52 via the longitudinal oil passage 117 in the head provided to the left side wall 33b on the reverse side to the cam chain 54 and the inclined oil passage 118 in the head respectively in the cylinder head 33.

[0075] According to the above-mentioned configuration, a part of the camshaft lubricating oil supply passage 120 can be easily formed utilizing the bolt insertion holes 114 of the cylinder 32. Besides, the lubrication of the end of the camshaft 52 can be facilitated by providing the longitudinal oil passage 117 in the head and the inclined oil passage 118 in the head respectively in the camshaft lubricating oil supply passage 120 in the left side wall 33b of the cylinder head 33, and the longitudinal oil passage 117 in the head and the inclined oil passage 118 in the head can be simply and compactly laid out. Further, the interference with the cam chain 54 and others is avoided by providing the longitudinal oil passage 117 in the head and the inclined oil passage 118 in the head respectively in the camshaft lubricating oil supply passage 120 in the left side wall 33b on the reverse side to the cam chain 54 in the cylinder head 33, and the longitudinal oil passage 117 in the head and the inclined oil passage 118 in the head can be easily formed.

[0076] Further, in the above-mentioned oil passage structure, as engine oil is cooled by the cooling water communicating passage 74 on the upstream side of the main oil galley 76 because the oil outflow passage 72 that communicates with the upstream side of the main oil gallery 76 is arranged close to the cooling water communicating passage 74, engine oil of relatively low temperature can be supplied to each part of the engine and the engine cooling performance can be enhanced.

[0077] In addition, in the oil passage structure, as the cam chain 54 and the oil pump driving chain 85 are provided between the right crank bearing 36b on the side of the generator 37 and the generator 37, each chain 54, 85 wound on the crankshaft 31 is collected on one side, the workability of the assembly of each chain 54, 85 can be enhanced, and the oil chamber space can be made intensive by providing each chain 54, 85 on the side of the generator 37.

1..... Motorcycle (Saddle-ride type vehicle)
21.... Crankcase
21a... Left case half (One divided body)
21b... Right case half
21c... Right case cover (Crankcase cover)
31.... Crankshaft
32.... Cylinder
33.... Cylinder head
33b... Left side wall (Side wall)
35.... Connecting rod
36a... Left crank bearing (One crank bearing)
36b... Right crank bearing (Other crank bearing, Crank bearing on generator side)
37.... Generator
42a... Lubricating oil supply passage in left bearing (First oil passage)
42b... Lubricating oil supply passage in right bearing (Second oil passage)
44.... Oil passage on generator side (Third oil passage)
46.... Generator lubricating oil supply passage
48.... Connecting rod lubricating oil supply passage
52.... Camshaft
54.... Cam chain
68.... Oil filter
72.... Oil outflow passage (First oil passage)
74.... Cooling water communicating passage (Water jacket)
75.... Communicating groove
76.... Main oil gallery (Second oil passage)
78.... Sealing member
85.... Chain (Oil pump driving chain)
114... Bolt insertion hole
117... Longitudinal oil passage in head (Oil passage in head)
118... Inclined oil passage in head (Oil passage in head)
120... Camshaft lubricating oil supply passage
E..... Engine
B1.... Division plane

Claims

1. Oil passage structure of an engine (E) where a crankcase (21) that supports a crankshaft (31) is divided in a crank axial direction, the oil passage structure comprising:

first and second oil passages (72, 76) extended substantially in parallel with the crankshaft (31) across a division plane (B1) of the crankcase (21),

a communicating groove (75) that connects each oil passage, the communicating groove (75) being formed on the division plane (B1) of at least one divided body (21a) of the crankcase (21); and

an endless sealing member (78) that integrally surrounds the peripheries of the oil passages and the communicating groove (75), the endless sealing member (78) being provided to the oil passages and the communicating groove (75) each half of which is mutually opposite on the division plane (B1).

2. The oil passage structure according to Claim 1,

wherein: a cartridge type oil filter (68) is attached to the side of the crankcase (21);
the first oil passage (72) communicates with an oil outlet (68d) of the oil filter (68); and
the second oil passage (76) communicates with a crank bearing (36a, 36b) of the crankcase (21).

3. The oil passage structure according to Claim 1 or Claim 2, further including: a cylinder (32) protruded from the crankcase (21); a cylinder head (33) attached to an end of the cylinder (32); a crankcase cover (21c) that covers one side of the crankcase (21); and a generator (37) arranged inside the crankcase (21), the oil passage structure further comprising:

a camshaft lubricating oil supply passage (120) that supplies engine oil to the circumference of a camshaft (52) from one crank bearing (36a) via the cylinder (32) and the cylinder head (33);
a connecting rod lubricating oil supply passage (48) that supplies engine oil to the circumference of a connecting rod (35) from the other crank bearing (36b) via the crankshaft (31);
a generator lubricating oil supply passage (46) that supplies engine oil to the generator (37) via the crankcase cover (2.1c) ; and
a main oil gallery (76) extended further on the outside of each crank bearing (36a, 36b) in an axial direction of the crankshaft (31),

wherein: the main oil gallery (76) is branched into a first oil passage (42a) that communicates with the camshaft lubricating oil supply passage (120), a second oil passage (42b) that communicates with the connecting rod lubricating oil supply passage (48) and a third oil passage (44) that communicates with the generator lubricating oil supply passage (46).

4. The oil passage structure according to Claim 3,

wherein: the cylinder (32) is provided with bolt insertion holes (114) for a stud bolt for fastening the cylinder (32) and the cylinder head (33) to the crankcase (21);
the camshaft lubricating oil supply passage (120) communicates with the cylinder head (33) from the crank bearing on the reverse side to a cam chain (54) via the bolt insertion hole (114); and
engine oil is supplied to the circumference of the camshaft (52) via an oil passage in the head (117, 118) provided to a side wall (33b) on the reverse side to the cam chain (54) in the cylinder head (33).

5. The oil passage structure according to Claim 3 or 4,

wherein the oil passage (72) that communicates with the upstream side of the main oil gallery (76) is arranged close to a water jacket (74).

6. The oil passage structure according to any of Claims 4 or 5,

wherein the cam chain (54) and an oil pump driving chain (85) are provided between the crank bearing (36b) on the side of the generator (37) and the generator (37).

Patentansprüche

1. Öldurchgangskonstruktion eines Motors (E), wobei ein Kurbelgehäuse (21), welches eine Kurbelwelle (31) lagert, in einer axialen Kurbelrichtung unterteilt ist, wobei die Öldurchgangskonstruktion umfasst:

erste und zweite Öldurchgänge (72, 76), welche sich im Wesentlichen parallel zu der Kurbelwelle (31) über eine Unterteilungsebene (B1) des Kurbelgehäuses (21) erstrecken,
eine Verbindungsnut (75), welche jeden Öldurchgang verbindet, wobei die Verbindungsnut (75) auf der Unterteilungsebene (B1) von zumindest einem unterteilten Körper (21a) des Kurbelgehäuses (21) gebildet ist; und
ein Endlosdichtelement (78), welches die Peripherien der Öldurchgänge und der Verbindungsnut (75) integral umgibt, wobei das Endlosdichtelement (78) zu den Öldurchgängen und der Verbindungsnut (75) vorgesehen ist, wovon jede Hälfte wechselseitig gegenüberliegend auf der Unterteilungsebene (B1) ist.

2. Öldurchgangskonstruktion gemäß Anspruch 1,

wobei: ein Filter (68) des Kerzentyps an der Seite des Kurbelgehäuses (21) angebracht ist;
der erste Öldurchgang (72) mit einem Ölauslass (68d) des Ölfilters (68) verbunden ist; und
der zweite Öldurchgang (76) mit einem Kurbellager (36a, 36b) des Kurbelgehäuses (21) verbunden ist.

3. Öldurchgangskonstruktion gemäß Anspruch 1 oder Anspruch 2, weiterhin enthaltend: einen Zylinder (32), welcher von dem Kurbelgehäuse (21) hervorragt; einen Zylinderkopf (33), welcher an ein Ende des Zylinders (32) angebracht ist; eine Kurbelgehäuseabdeckung (21c), welche eine Seite des Kurbelgehäuses (21) abdeckt; und einen Generator (37), welcher im Inneren des Kurbelgehäuses (21) angeordnet ist, wobei die Öldurchgangskonstruktion weiterhin umfasst:

einen Nockenwellen-Schmieröl-Zuführdurchgang (120), welcher Motoröl zu dem Umfang einer Nockenwelle (52) von einem Kurbellager (36a) über den Zylinder (32) und den Zylinderkopf (33) zuführt;
einen Verbindungsstangen-Schmieröl-Zuführdurchgang (48), welcher Motoröl zu dem Umfang einer Verbindungsstange (35) von dem anderen Kurbellager (36b) über die Kurbelwelle (31) zuführt;
einen Generator-Schmieröl-Zufiihrdurchgang (46), welcher Motoröl zu dem Generator (37) über die Kurbelgehäuseabdeckung (21c) zuführt; und
eine Hauptölbohrung (76), welche sich weiter von der Außenseite von jedem Kurbellager (36a, 36b) in einer axialen Richtung der Kurbelwelle (31) erstreckt,

wobei: die Hauptölbohrung (76) in einen ersten Öldurchgang (42a), welcher mit dem Nockenwellen-Schmieröl-Zuführdurchgang (120) verbunden ist, einen zweiten Öldurchgang (42b), welcher mit dem Verbindungsstangen- Schmieröl- Zuführdurchgang (48) verbunden ist, und einen dritten Öldurchgang (44) verzweigt ist, welcher mit dem Generator-Schmieröl-Zuführdurchgang (46) verbunden ist.

4. Öldurchgangskonstruktion gemäß Anspruch 3,

wobei: der Zylinder (32) mit Bolzeneinführlöchem (114) für einen Gewindebolzen zum Befestigen des Zylinders (32) und des Zylinderkopfes (33) an dem Kurbelgehäuse (21) versehen ist;
der Nockenwellen-Schmieröl-Zuführdurchgang (120) mit dem Zylinderkopf (33) von dem Kurbellager auf der entgegengesetzten Seite zu einer Nockenkette (54) über das Bolzeneinführloch (114) verbunden ist; und
Motoröl zu dem Umfang der Nockenwelle (552) über einen Öldurchgang in dem Kopf (117, 118) zugeführt wird, welcher an einer Seitenwand (33b) auf der entgegengesetzten Seite zu der Nockenkette (54) in dem Zylinderkopf (33) vorgesehen ist.

5. Öldurchgangskonstruktion gemäß Anspruch 3 oder 4,

wobei der Öldurchgang (72), welcher mit der stromaufwärtigen Seite der Hauptölbohrung (76) verbunden ist, dicht an einem Wassermantel (74) angeordnet ist.

6. Öldurchgangskonstruktion gemäß irgendeinem der Ansprüche 4 oder 5,

wobei die Nockenkette (54) und eine Ölpumpenantriebskette (85) zwischen dem Kurbellager (36b) auf der Seite des Generators (37) und dem Generator (37) vorgesehen sind.

Revendications

1. Structure de passage d'huile d'un moteur (E) dans lequel un carter de moteur (21) qui supporte un vilebrequin (31) est divisé dans une direction axiale de manivelle, la structure de passage d'huile, comprenant :

des premier et second passages d'huile (72, 76) qui s'étendent sensiblement parallèlement au vilebrequin (31) sur un plan de division (B1) du carter de moteur (21),
une rainure de communication (75) qui raccorde chaque passage d'huile, la rainure de communication (75) étant formée sur le plan de division (B1) d'au moins un corps divisé (21a) du carter de moteur (21) ; et
un élément d'étanchéité sans fin (78) qui entoure de manière intégrale les périphéries des passages d'huile et de la rainure de communication (75), l'élément d'étanchéité sans fin (78) étant prévu sur les passages d'huile et la rainure de communication (75) dont chaque moitié est mutuellement opposée sur le plan de division (B1) .

2. Structure de passage d'huile selon la revendication 1, dans laquelle : un filtre à huile de type cartouche (68) est fixé sur le côté du carter de moteur (21) ;

le premier passage d'huile (72) communique avec une sortie d'huile (68d) du filtre à huile (68) ; et
le second passage d'huile (76) communique avec un palier de manivelle (36a, 36b) du carter de moteur (21).

3. Structure de passage d'huile selon la revendication 1 ou la revendication 2, comprenant en outre : un cylindre (32) faisant saillie du carter de moteur (21) ; une culasse (33) fixée à une extrémité du cylindre (32) ; un couvercle (21c) de carter de moteur qui recouvre un côté du carter de moteur (21) ; et un générateur (37) agencé à l'intérieur du carter de moteur (21), la structure de passage d'huile comprenant en outré :

un passage d'alimentation d'huile de lubrification d'arbre à cames (120) qui alimente de l'huile moteur à la circonférence d'un arbre à cames (52) à partir d'un palier de manivelle (36a) via le cylindre (32) et la culasse (33) ;
un passage d'alimentation d'huile de lubrifica-

tion de tige de raccordement (48) qui alimente de l'huile moteur à la circonférence d'une tige de raccordement (35) à partir de l'autre palier de manivelle (36b) via le vilebrequin (31) ;
un passage d'alimentation d'huile de lubrification de générateur (46) qui alimente de l'huile moteur au générateur (37) via le couvercle de carter (21c) ; et
une canalisation principale d'huile (76) étendue davantage sur l'extérieur de chaque palier de manivelle (36a, 36b) dans une direction axiale du vilebrequin (31),

dans laquelle : la canalisation principale d'huile (76) se ramifie dans un premier passage d'huile (42a) qui communique avec le passage d'alimentation d'huile de lubrification d'arbre à cames (120), un deuxième passage d'huile (42b) qui communique avec le passage d'alimentation d'huile de lubrification de tige de raccordement (48) et un troisième passage d'huile (44) qui communique avec le passage d'alimentation d'huile de lubrification de générateur (46).

4. Structure de passage d'huile selon la revendication 3, dans laquelle : le cylindre (32) est prévu avec des trous d'insertion de boulon (114) pour un goujon afin de fixer le cylindre (32) et la culasse (33) au carter de moteur (21) ;

le passage d'alimentation d'huile de lubrification d'arbre à cames (120) communique avec la culasse (33) à partir du palier de manivelle sur le côté inverse à une chaîne de cames (54) via le trou d'insertion de boulon (114) ; et
l'huile de moteur est alimentée à la circonférence de l'arbre à cames (52) via un passage d'huile dans la tête (117, 118) prévue sur une paroi latérale (33b) sur le côté inverse à la chaîne de cames (54) dans la culasse (33).

5. Structure de passage d'huile selon la revendication 3 ou 4, dans laquelle le passage d'huile (72) qui communique avec le côté en amont de la canalisation principale d'huile (76) est agencé à proximité d'une chemise d'eau (74).

6. Structure de passage d'huile selon l'une quelconque des revendications 4 ou 5, dans laquelle la chaîne de cames (54) et une chaîne d'entraînement de pompe à huile (85) sont prévues entre le palier de manivelle (36b) du côté du générateur (37) et le générateur (37).

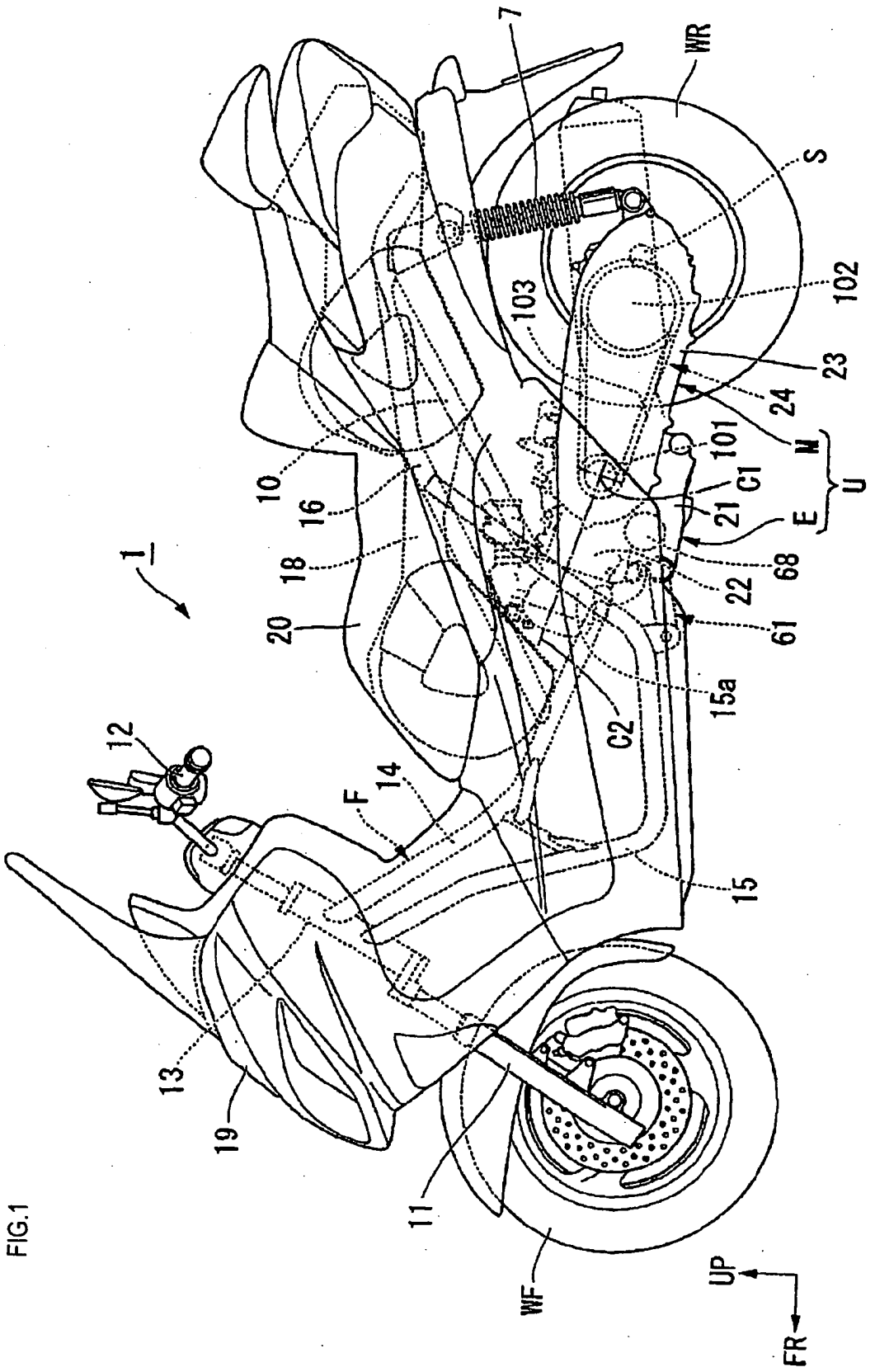

1
7
WR
S
102
103
23
24
101
C1
21
E
M
U
10
16
18
20
68
22
61
15a
C2
12
F
14
15
13
19
11
WF
UP
FR

FIG.1

FIG.2

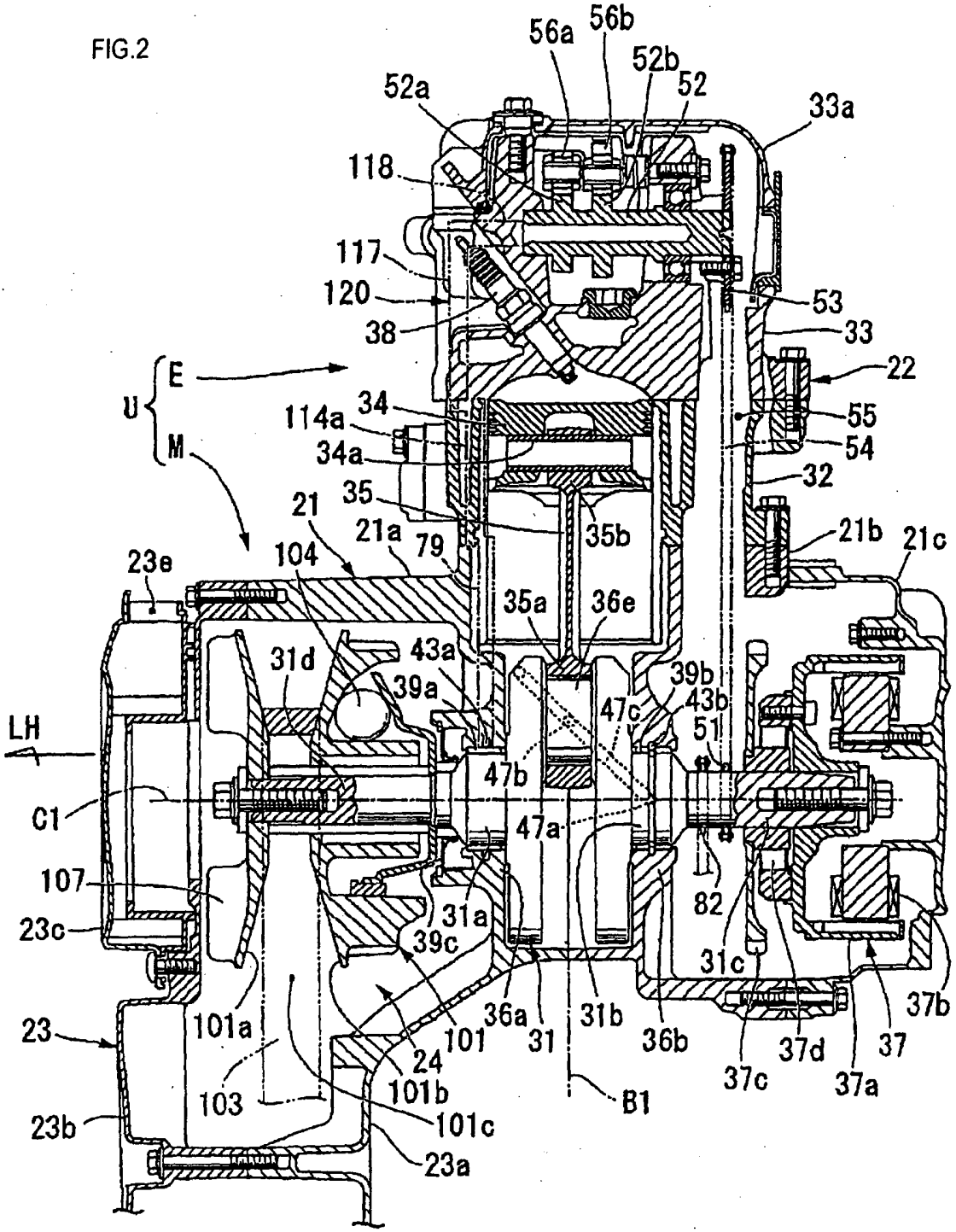

56a
56b
52b
52
52a
33a
118
117
120
38
53
33
22
U
E
M
114a
34
34a
55
54
32
35
21
21a
79
35b
21b
21c
23e
104
35a
36e
31d
43a
39a
39b
43b
47c
51
LH
47b
C1
47a
107
82
31a
23c
39c
31c
37b
23
101a
36a
31
31b
36b
37d
37
101
24
37c
37a
103
101b
B1
23b
101c
23a

FIG.3

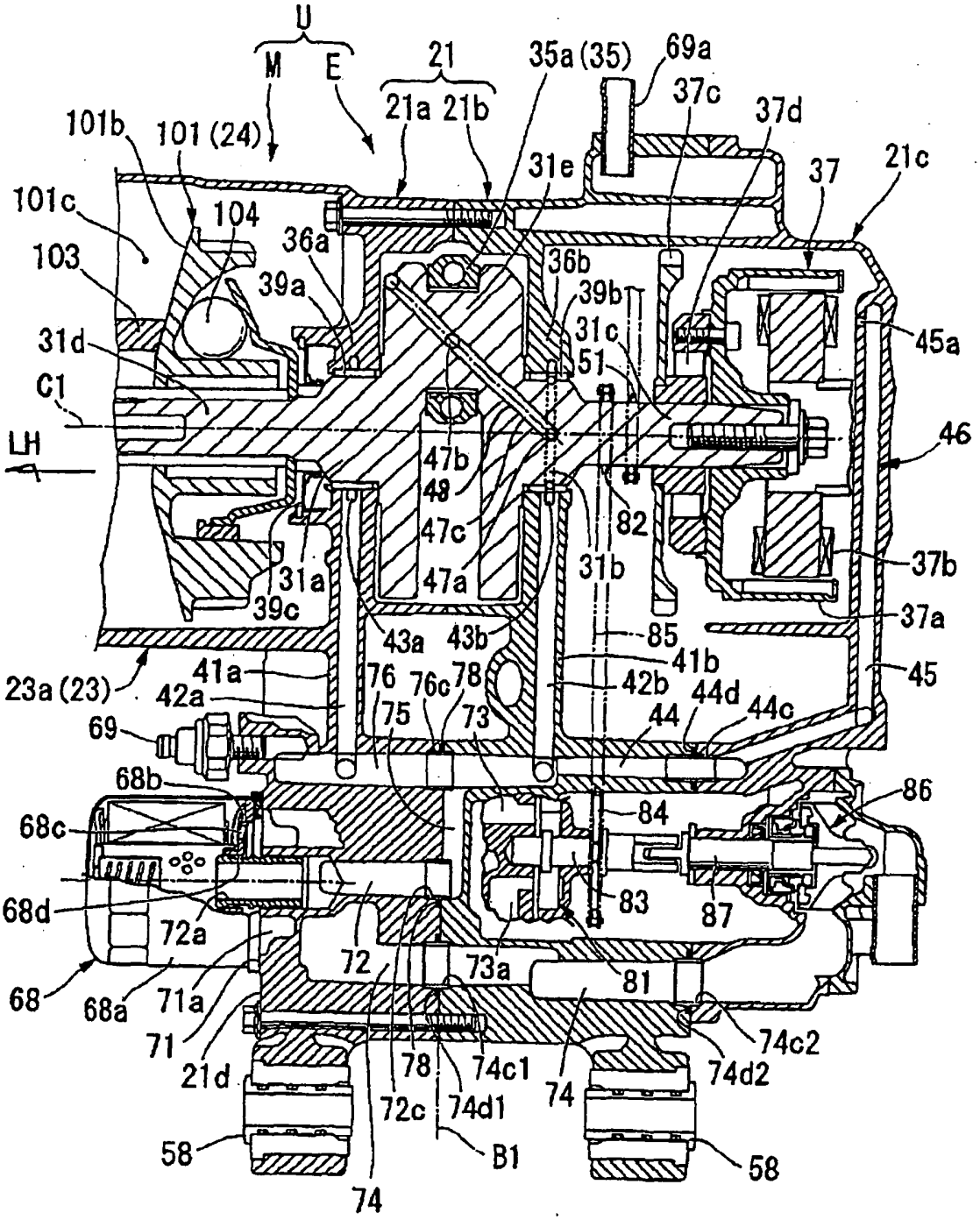

U
M
E
21
21a
21b
35a (35)
69a
37c
37d
37
21c
101b
101 (24)
101c
104
103
36a
39a
36b
39b
31c
51
31e
45a
31d
C1
LH
46
47b
49
47c
47a
82
31b
37b
31a
39c
43a
43b
85
37a
41b
41a
42a
76
76c
78
42b
44d
44c
45
23a (23)
75
73
44
69
68b
86
84
68c
68d
83
87
72a
72
73a
81
68
68a
71a
71
74c2
21d
78
74c1
74d2
74
72c
74d1
58
B1
58
74

FIG.4

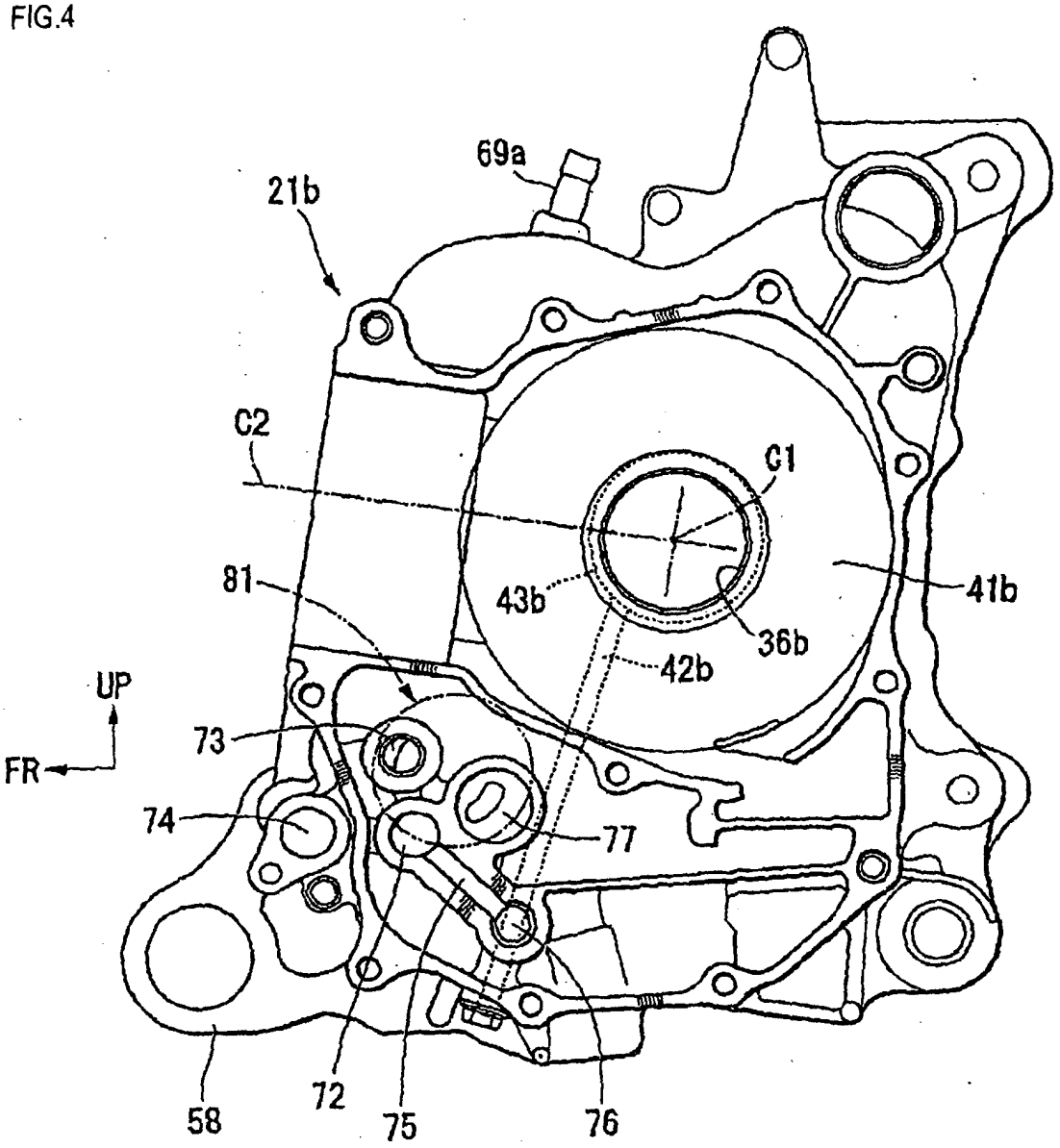


FIG.5

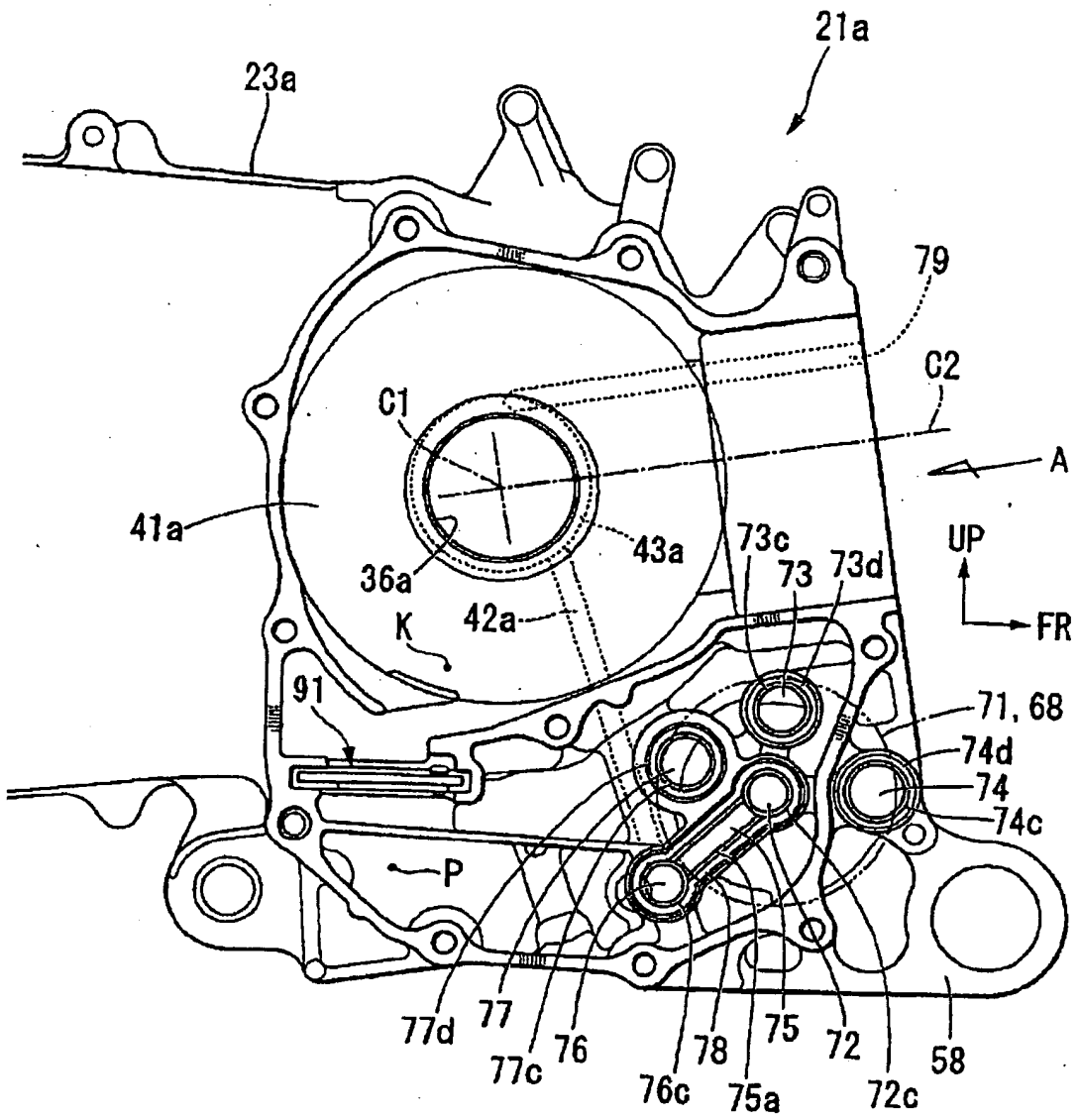

21a
23a
79
C2
C1
A
41a
43a
73c
73
73d
UP
36a
42a
K
FR
91
71, 68
74d
74
74c
P
77d
77
77c
76
76c
78
75a
75
72
72c
58

FIG.6

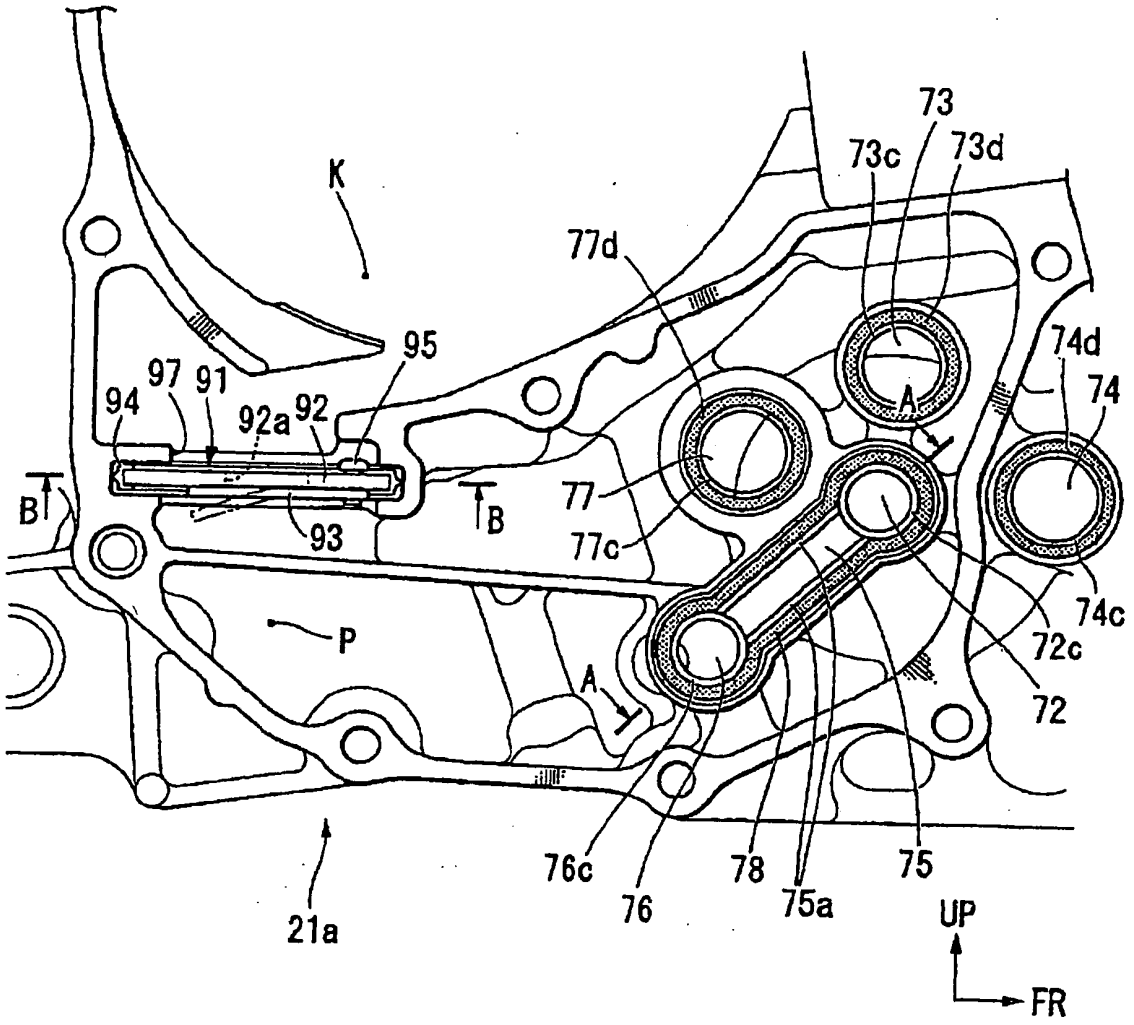

K
95
97
91
94
92a
92
93
B
B
P
A
A
73
73c
73d
77d
74d
74
77
77c
74c
72c
72
76c
76
78
75a
75
21a
UP
FR

FIG.7

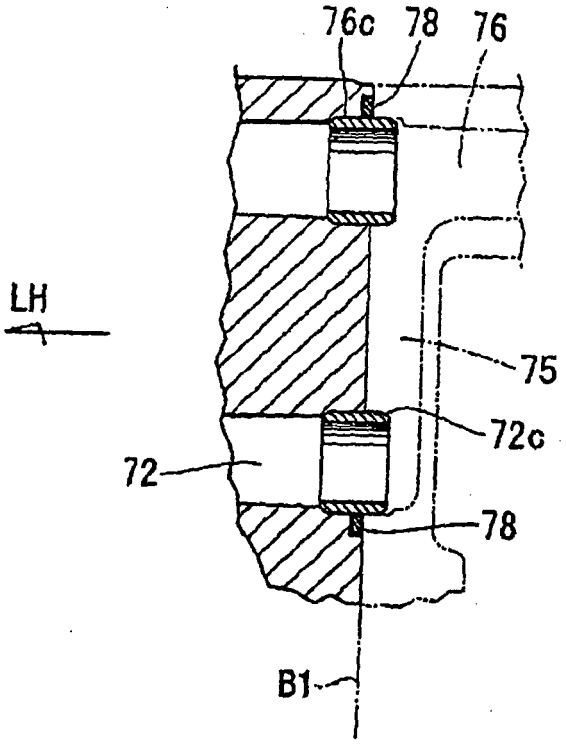


FIG.8

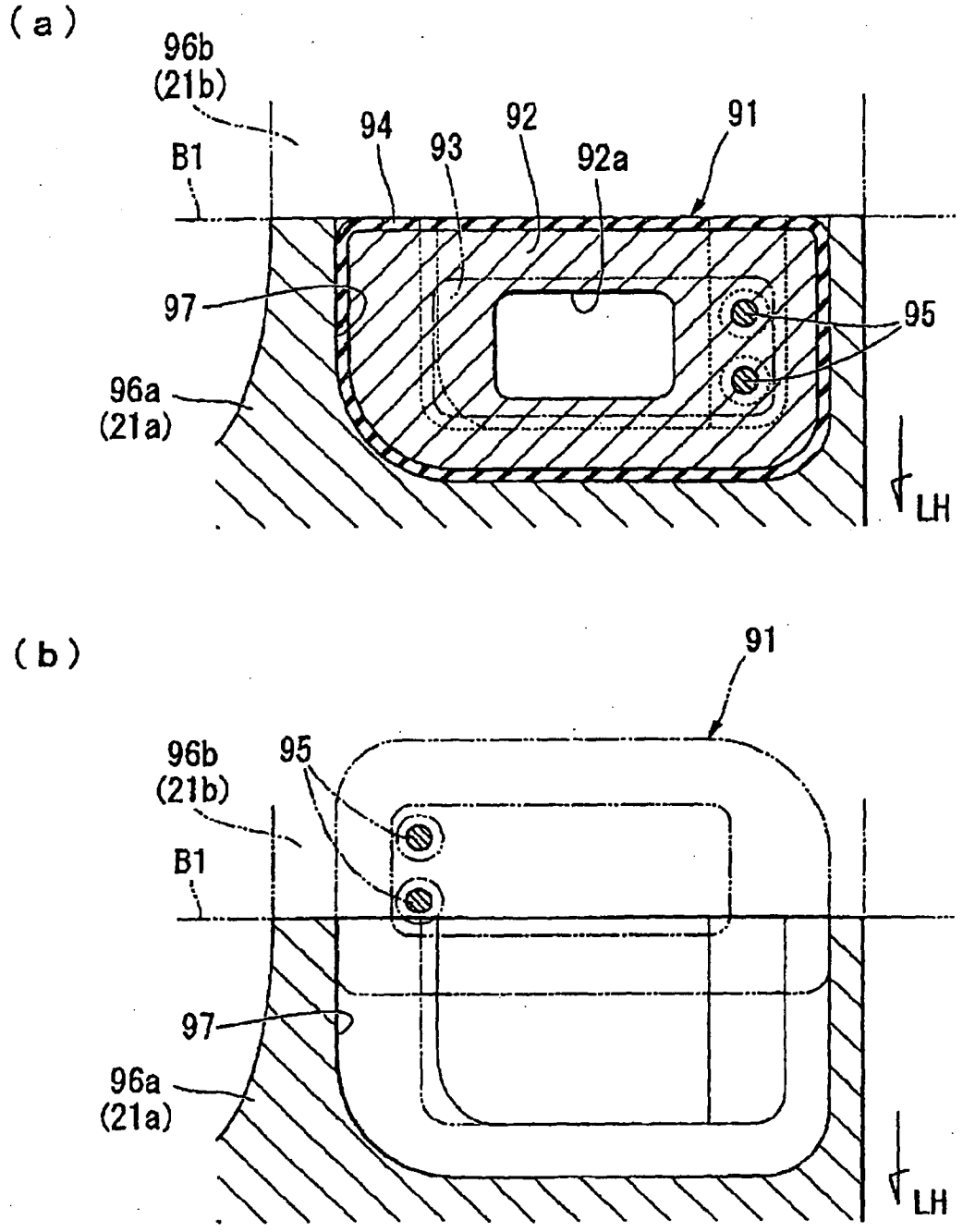

(a)
96b
(21b)
94
93
92
91
92a
B1
97
95
96a
(21a)
LH
(b)
91
96b
(21b)
95
B1
97
96a
(21a)
LH

FIG. 3

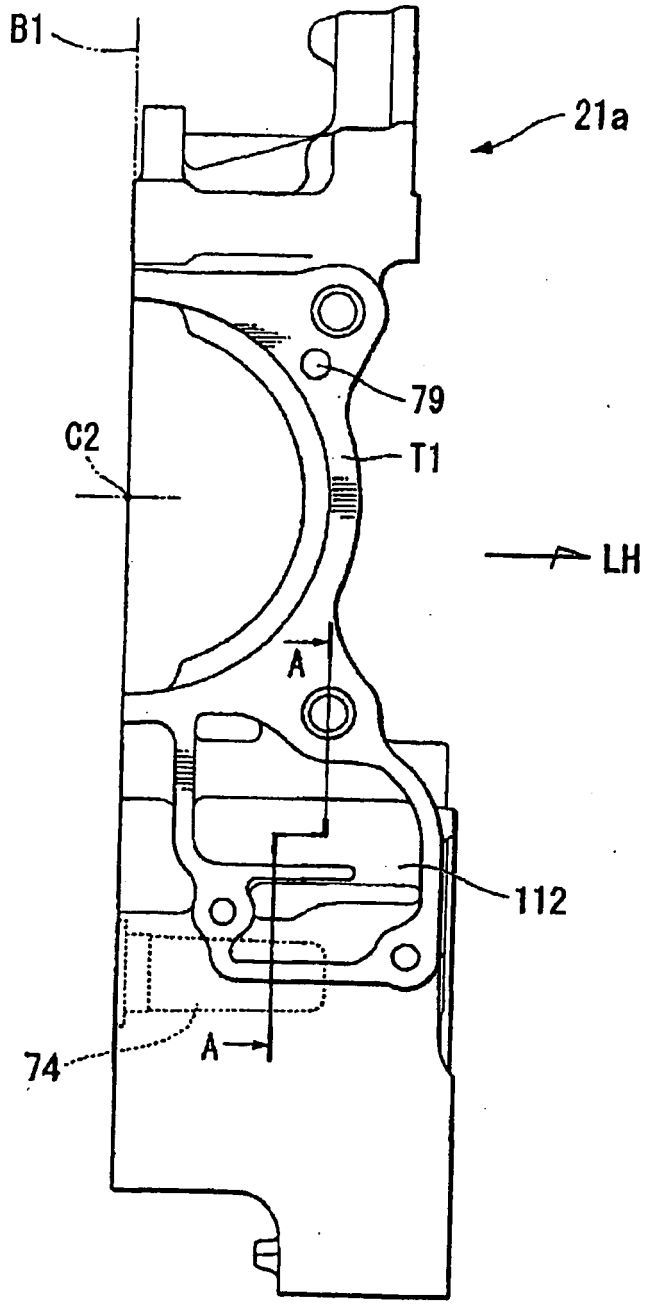


FIG.10

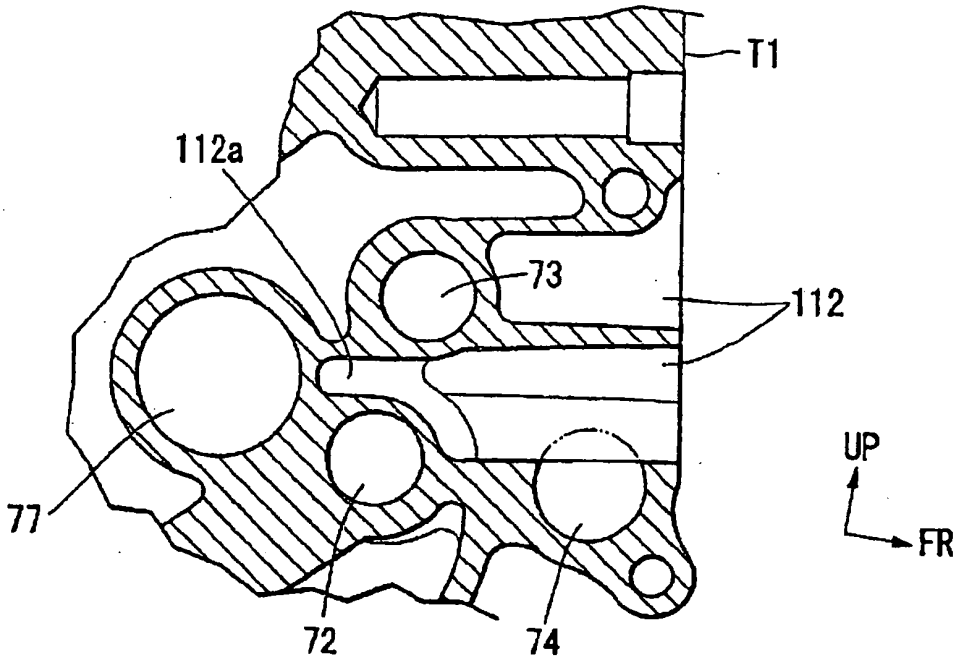

T1
112a
73
112
UP
FR
77
72
74

FIG.11

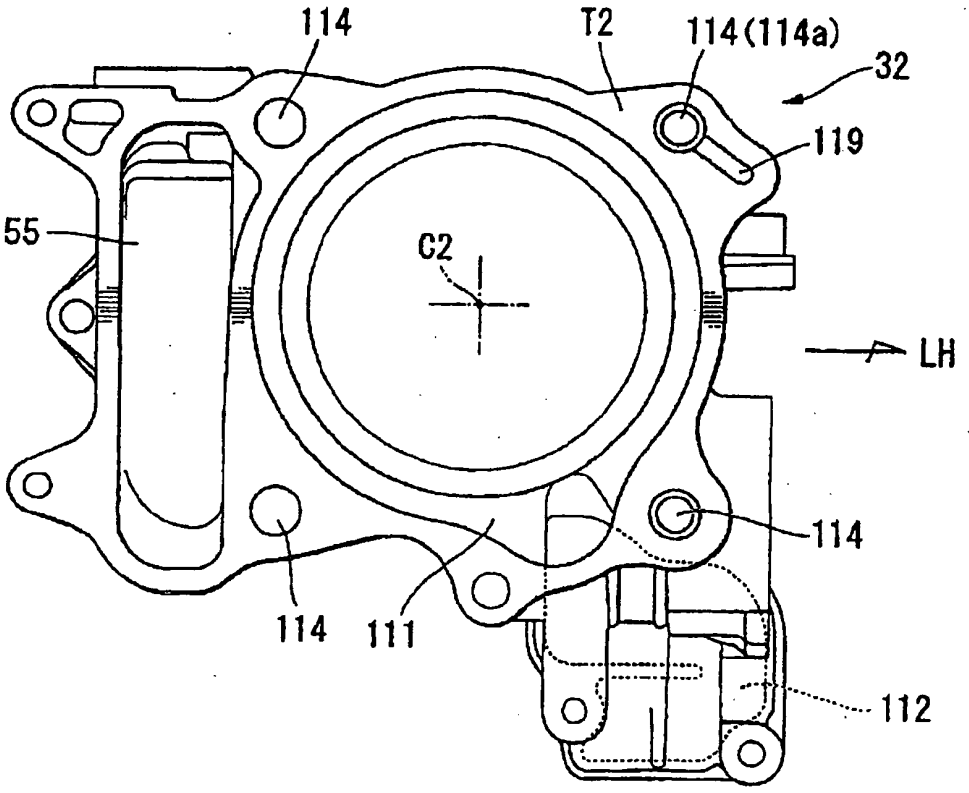

114
T2
114(114a)
32
119
55
C2
LH
114
114
111
112

FIG.12

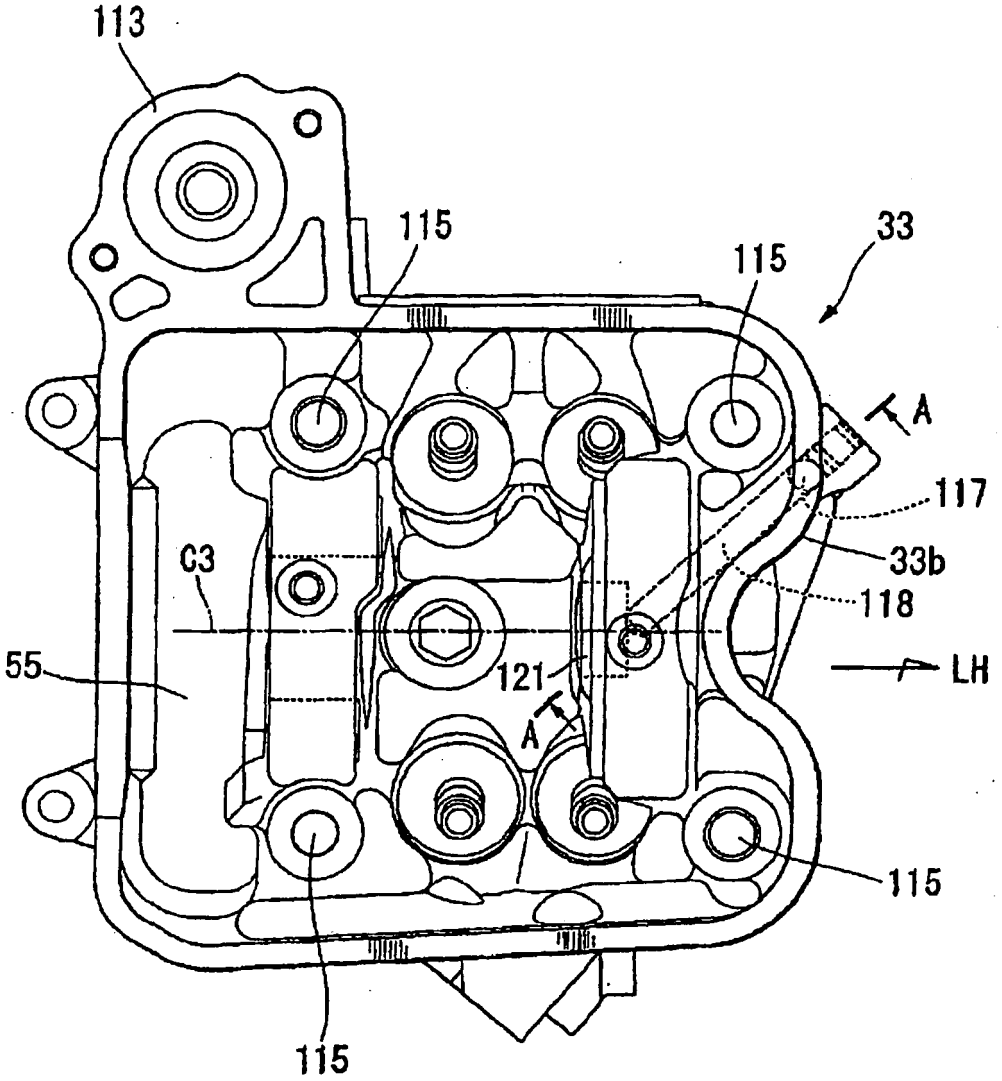
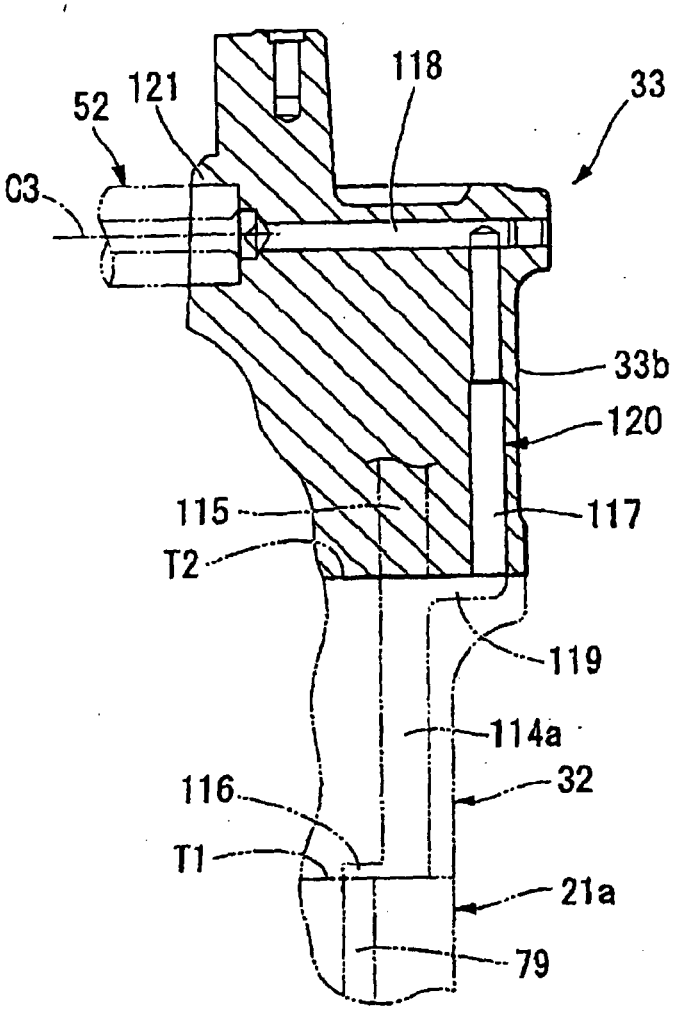


FIG.13



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2001342816 A **[0003]**
- JP 2001280111 A **[0006]**
- US 6536400 B **[0006]**