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(54) **COVER MEMBER ATTACHMENT STRUCTURE FOR INTERNAL COMBUSTION ENGINE**

(57) [Problem to be Solved]

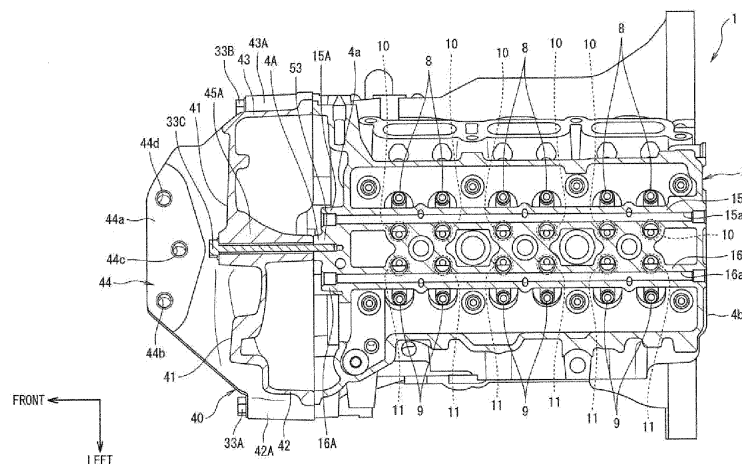
To provide a cover member attachment structure for an internal combustion engine (1), in which the rigidity of a portion of an internal combustion engine main body (2) to which a cover member (40) is fastened can be increased, thereby making it possible to prevent the cover member (40) from vibrating.

[Solution]

In a chain cover (40) attachment structure for an engine (1) including a chain cover (40) attached to a front wall (4a) to cover a timing chain (14) that transmits power to an intake cam shaft (21) and an exhaust cam shaft

(22) from a crankshaft (7), a central boss (45A) extending toward a front wall (4a) from a central portion in a width direction of the chain cover (40), and a central boss (4A) provided in the front wall (4a) and to be connected to the central boss (45A) with a bolt (33C), an intake-side oil supply pipe portion (15) includes a boss (15A) protruding toward the chain cover (40) from the front wall (4a), an exhaust-side oil supply pipe portion (16) includes a boss (16A) protruding toward the chain cover (40) from the front wall (4a), and the central boss (4A) is installed in a region (53) sandwiched between the boss (15A) and the boss (16A).

FIG. 3



Description

[Technical Field]

[0001] The present invention relates to a cover member attachment structure for an internal combustion engine.

[Background Art]

[0002] A chain cover structure for an engine has been known in which a chain cover of the engine is connected to a cylinder head and a cylinder block (see JP2021-63490A).

[0003] In the chain cover structure for the engine, the chain cover is provided with a first fastening part having a boss shape (cylindrical shape), and the first fastening part is provided in an upper portion of the chain cover and a central portion in its width direction.

[0004] The chain cover is fixed to the cylinder head by fastening the first fastening part to the cylinder head with a bolt.

[Citation List]

[Patent Literature]

[0005] [Patent Literature 1] JP2021-63490A

[Summary of Invention]

[Technical Problem]

[0006] In the chain cover structure for the engine described in JP2021-63490A, the first fastening part is fastened to the cylinder head with the bolt. However, unless a fastening part on the cylinder head side is structured not to easily vibrate, vibration of a cover member may increase, still leaving room for improvement.

[0007] The present invention has been made in view of the above-described problems, and is directed to providing a cover member attachment structure for an internal combustion engine, in which the rigidity of a portion of an internal combustion engine main body to which a cover member is fastened can be increased, thereby making it possible to prevent the cover member from vibrating.

[Solution to Problem]

[0008] The present invention provides a cover member attachment structure for an internal combustion engine including an internal combustion engine main body that has one side wall and another side wall positioned on the opposite side to the one side wall in an axial direction of a crankshaft and rotatably supports the crankshaft and a cam shaft, a first oil supply pipe portion and a second oil supply pipe portion that are provided in the internal

combustion engine main body and extend parallel to each other from the one side wall to the other side wall, a cover member attached to the one side wall to cover a transmission member that transmits power to the cam shaft from the crankshaft, a cover-side boss extending toward the one side wall from a central portion in a width direction of the cover member, and an internal combustion engine main body-side boss provided in the one side wall and to be connected to the cover-side boss with a fastener, characterized in that the first oil supply pipe portion includes a first boss protruding toward the cover member from the one side wall, the second oil supply pipe portion includes a second boss protruding toward the cover member from the one side wall, and the internal combustion engine main body-side boss is installed in a region sandwiched between the first boss and the second boss.

[Advantageous Effect of Invention]

[0009] Thus, according to the present invention, described above, the rigidity of a portion of the internal combustion engine main body to which the cover member is fastened can be increased, thereby making it possible to prevent the cover member from vibrating.

[Brief Description of Drawings]

[0010]

[Figure 1] Figure 1 is a front view of an internal combustion engine according to an embodiment of the present invention.

[Figure 2] Figure 2 is a cross-sectional view taken along a line II-II illustrated in Figure 1.

[Figure 3] Figure 3 is a cross-sectional view taken along a line III-III illustrated in Figure 2.

[Figure 4] Figure 4 is an inner side view of an upper portion of a chain cover in an internal combustion engine according to the embodiment of the present invention.

[Figure 5] Figure 5 is a front view of the internal combustion engine according to the embodiment of the present invention, illustrating a front wall of a cylinder head with the chain cover removed.

[Description of Embodiment]

[0011] A cover member attachment structure for an internal combustion engine according to an embodiment of the present invention is a cover member attachment structure for an internal combustion engine including an internal combustion engine main body that has one side wall and another side wall positioned on the opposite side to the one side wall in an axial direction of a crankshaft and rotatably supports the crankshaft and a cam shaft, a first oil supply pipe portion and a second oil supply pipe portion that are provided in the internal combustion

engine main body and extend parallel to each other from the one side wall to the other side wall, a cover member attached to the one side wall to cover a transmission member that transmits power to the cam shaft from the crankshaft, cover-side boss extending toward the one side wall from a central portion in a width direction of the cover member, and an internal combustion engine main body-side boss provided in the one side wall and to be connected to the cover-side boss with a fastener, in which the first oil supply pipe portion includes a first boss protruding toward the cover member from the one side wall, the second oil supply pipe portion includes a second boss protruding toward the cover member from the one side wall, and the internal combustion engine main body-side boss is installed in a region sandwiched between the first boss and the second boss.

[0012] As a result, in the cover member attachment structure for the internal combustion engine according to the embodiment of the present invention, the rigidity of a portion of the internal combustion engine main body to which the cover member is fastened can be increased, thereby making it possible to prevent the cover member from vibrating.

[Embodiment]

[0013] An embodiment of a cover member attachment structure for an internal combustion engine according to the present invention will be described below with reference to the drawings.

[0014] Figure 1 to Figure 5 are diagrams each illustrating a cover member attachment structure for an internal combustion engine according to an embodiment of the present invention. In Figure 1 to Figure 5, up-down, front-rear, and left-right directions are defined as follows.

[0015] A direction along a crankshaft is set as a front-rear direction of an engine, and the side on which a timing chain is arranged is set as the front side and the opposite side thereof is set as the rear side. A direction along a center axis of a cylinder is set as an up-down direction of the engine, and the side of a cylinder head is set as the upper side and the opposite side thereof is set as the lower side. A direction intersecting the crankshaft and the center axis of the cylinder is set as a left-right direction of the engine, and the left side of the center axis of the cylinder and the right side of the center axis of the cylinder with the crankshaft viewed from the rear side are respectively set as the left side and the right side.

[0016] First, a configuration will be described.

[0017] In Figure 1 and Figure 2, an engine 1 includes an engine main body 2 and a chain cover 40. The engine main body 2 includes a cylinder block 3, a cylinder head 4, a cylinder head cover 5, and an oil pan 6. In the present embodiment, the engine 1 constitutes an internal combustion engine, and the engine main body 2 constitutes an internal combustion engine main body. A virtual line 55 illustrated in Figure 1 and Figure 4 is a boundary between the cylinder block 3 and the cylinder head 4.

[0018] As illustrated in Figure 2, the cylinder block 3 is provided with cylinders 3A, 3B, and 3C, and the cylinders 3A, 3B, and 3C are installed side by side in a front-rear direction of the engine 1. The engine 1 is installed such that a center axis 1C of each of the cylinders 3A, 3B, and 3C extends in its up-down direction.

[0019] Although the engine 1 in the present embodiment is composed of a three-cylinder engine, the number of cylinders is not limited to three.

[0020] A piston not illustrated is accommodated in each of the cylinders 3A, 3B, and 3C. The piston is connected to a crankshaft 7 with a connecting rod not illustrated interposed therebetween. The crankshaft 7 has a rotational center axis 7a (see Figure 2) extending in its front-rear direction, and rotates around the rotational center axis 7a.

[0021] The piston reciprocates in each of the cylinders 3A, 3B, and 3C, to rotate the crankshaft 7 via the connecting rod. A plurality of intake ports 4P (see Figure 2) and a plurality of exhaust ports not illustrated are formed in the cylinder head 4.

[0022] The intake ports 4P respectively communicate with the cylinders 3A, 3B, and 3C, to introduce incoming air into the cylinders 3A, 3B, and 3C. An exhaust manifold communicates with the cylinders 3A, 3B, and 3C, respectively, through the exhaust ports, and collects exhaust gases respectively released from the cylinders 3A, 3B, and 3C and releases the exhaust gases to a catalyst converter not illustrated from an exhaust opening.

[0023] As illustrated in Figure 3, the cylinder head 4 is provided with intake valves 8 and exhaust valves 9. Two intake valves 8 and two exhaust valves 9 are installed for each of the cylinders.

[0024] An intake-side cam shaft 21 having an intake cam not illustrated and an exhaust cam shaft 22 having an exhaust cam not illustrated are rotatably supported on the cylinder head 4 (see Figure 1). The intake cam shaft 21 and the exhaust cam shaft 22 in the present embodiment constitute a cam shaft.

[0025] The intake valves 8 are operated by the intake cam, to open and close the intake ports 4P and to allow each of the cylinders 3A, 3B, and 3C and the intake ports 4P provided for the cylinder to communicate with or discommunicate with each other. The exhaust valves 9 are operated by the exhaust cam, to open and close the exhaust ports and to allow each of the cylinders 3A, 3B, and 3C and the exhaust ports provided for the cylinder to communicate with or discommunicate with each other.

[0026] An intake-side locker arm not illustrated that swings upon being pressed by the intake cam and a hydraulic intake-side lash adjuster 10 that supports one end of the intake-side locker arm and adjusts a valve clearance (a clearance between the intake-side locker arm and each of the intake valves 8) by a hydraulic pressure are installed in the cylinder head 4.

[0027] An exhaust-side locker arm not illustrated that swings upon being pressed by the exhaust cam and a hydraulic exhaust-side lash adjuster 11 that supports one

end of the exhaust-side locker arm and adjusts a valve clearance (a clearance between the exhaust-side locker arm and each of the exhaust valves 9) by a hydraulic pressure are installed in the cylinder head 4.

[0028] As illustrated in Figure 1, a front end portion of the intake cam shaft 21 is provided with an intake sprocket 21S, and a front end portion of the exhaust cam shaft 22 is provided with an exhaust sprocket 22S.

[0029] A front end portion of the crankshaft 7 is provided with a crank sprocket 7S. A timing chain 14 is wound around the crank sprocket 7S, the intake sprocket 21S, and the exhaust sprocket 22S.

[0030] Power of the crankshaft 7 is transmitted to the intake cam shaft 21 and the exhaust cam shaft 22 via the timing chain 14. The timing chain 14 in the present embodiment constitutes a transmission member.

[0031] As illustrated in Figure 2 and Figure 3, the cylinder head 4 includes a front wall 4a and a rear wall 4b. The front wall 4a is provided on a front surface of the cylinder head 4, and the rear wall 4b is provided on a rear surface of the cylinder head 4 positioned on the opposite side to the front wall 4a in an axial direction of the crankshaft 7. In the present embodiment, the front wall 4a constitutes one side wall, and the rear wall 4b constitutes the other side wall.

[0032] As illustrated in Figure 1, the cylinder block 3 is provided with an oil pump 35. The oil pump 35 supplies oil to be stored in the oil pan 6 to each of portions in the engine 1 upon being driven by the crankshaft 7.

[0033] As illustrated in Figure 2, a chain cover 40 is attached to a front wall 3a of the cylinder block 3 and the front wall 4a of the cylinder head 4, and covers the timing chain 14 (the timing chain 14 is not illustrated in Figure 2).

[0034] As illustrated in Figure 3 to Figure 4, the chain cover 40 includes a vertical wall 41, a left side wall portion 42, and a right side wall portion 43. The vertical wall 41 opposes a front wall 4a of the cylinder head 4 in its front-rear direction.

[0035] The left side wall portion 42 and the right side wall portion 43 respectively protrude toward the engine main body 2 from a right end portion and a left end portion in a width direction (in a vehicle width direction and a left-right direction) of the chain cover 40.

[0036] As illustrated in Figure 1 and Figure 4, the left side wall portion 42 and the right side wall portion 43 are respectively provided with a left-side boss 42A and a right-side boss 43A.

[0037] The chain cover 40 is fixed to the engine main body 2 by respectively fastening bolts 33A and 33B to the front wall 3a of the cylinder block 3 and the front wall 4a of the cylinder head 4 through the left-side boss 42A and the right-side boss 43A. The chain cover 40 in the present embodiment constitutes a cover member.

[0038] A front end portion of the intake cam shaft 21 is provided with an intake-side valve timing adjustment device not illustrated, and the intake-side valve timing adjustment device adjusts a rotational phase of the intake cam shaft 21 relative to the crankshaft 7 and adjusts an

opening/closing timing (valve timing) of the intake valve 8.

[0039] A front end portion of the exhaust cam shaft 22 is provided with an exhaust-side valve timing adjustment device not illustrated, and the exhaust-side valve timing adjustment device adjusts a rotational phase of the exhaust cam shaft 22 relative to the crankshaft 7 and adjusts an opening/closing timing (valve timing) of the exhaust valve 9.

[0040] As illustrated in Figure 1, an upper portion of the vertical wall 41 is provided with an intake-side solenoid 32A, and the intake-side solenoid 32A controls oil to be supplied to an advanced angle chamber and a retarded angle chamber of the intake-side valve timing adjustment device and adjusts a rotational phase of the intake cam shaft 21 relative to the crankshaft 7.

[0041] An upper portion of the vertical wall 41 is provided with an exhaust-side solenoid 32B, and the exhaust-side solenoid 32B controls oil to be supplied to an advanced angle chamber and a retarded angle chamber of the exhaust-side valve timing adjustment device and adjusts a rotational phase of the exhaust cam shaft 22 relative to the crankshaft 7.

[0042] As illustrated in Figure 3, the cylinder head 4 is provided with an intake-side oil supply pipe portion 15 and an exhaust-side oil supply pipe portion 16.

[0043] The intake-side oil supply pipe portion 15 and the exhaust-side oil supply pipe portion 16 linearly extend parallel to each other from the front wall 4a to the rear wall 4b of the cylinder head 4, and respectively have oil passages 15s and 16a therein.

[0044] Oil fed from the oil pump 35 is introduced into the oil passages 15a and 16a. The oil introduced into the oil passage 15a is supplied to the intake-side lash adjuster 10, and the oil introduced into the oil passage 16a is supplied to the exhaust-side lash adjuster 11.

[0045] In the present embodiment, the intake-side oil supply pipe portion 15 constitutes a first oil supply pipe portion, and the exhaust-side oil supply pipe portion 16 constitutes a second oil supply pipe portion.

[0046] As illustrated in Figure 2 and Figure 3, an upper portion of the vertical wall 41 of the chain cover 40 is provided with a mount attachment part 44.

[0047] The mount attachment part 44 protrudes from the vertical wall 41 of the chain cover 40 in a direction away from the engine main body 2, i.e., forward. The vertical wall 41 in the present embodiment constitutes an outer wall of a cover member.

[0048] As illustrated in Figure 2, a side member 31 is provided in front of the engine 1, and the side member 31 extends in its front-rear direction. As illustrated in Figure 3, a distal end portion of the mount attachment part 44 is provided with an attachment seat 44a, and the attachment seat 44a is provided with bolt holes 44b, 44c, and 44d into which bolts not illustrated are to be respectively inserted.

[0049] As illustrated in Figure 2, a mount member 51 is attached to the attachment seat 44a. The mount mem-

ber 51 includes a mount bracket 51A, and bolts are inserted into a rear end portion of the mount bracket 51A.

[0050] The bolts inserted into the rear end portion of the mount bracket 51A are respectively inserted into the bolt holes 44b, 44c, and 44d, and are respectively fastened to screw portions on the inner peripheries of the bolt holes 44b and 44c. As a result, the rear end portion of the mount bracket 51A is fixed to the attachment seat 44a.

[0051] The mount member 51 includes a vibration absorbing member 51B, and the vibration absorbing member 51B is attached to the side member 31. A front end portion of the mount bracket 51A is attached to the vibration absorbing member 51B, and the engine main body 2 is elastically supported on the side member 31 via the mount member 51. The side member 31 in the present embodiment constitutes a vehicle body.

[0052] As illustrated in Figure 1 and Figure 4, the vertical wall 41 of the chain cover 40 is provided with central bosses 45A, 45B, and 45C. The central boss 45A is provided in a central portion in a width direction of the vertical wall 41, and extends toward the front wall 4a of the cylinder head 4 from the vertical wall 41.

[0053] The central boss 45B is provided in the central portion in the width direction of the vertical wall 41, and extends toward the front wall 4a of the cylinder head 4 from the vertical wall 41.

[0054] The central boss 45C is provided in the central portion in the width direction of the vertical wall 41, and extends toward the front wall 4a of the cylinder head 4 from the vertical wall 41.

[0055] As illustrated in Figure 2 and Figure 3, the front wall 4a of the cylinder head 4 is provided with a central boss 4A having a screw portion, and the central boss 4A extends toward the vertical wall 41 from the front wall 4a.

[0056] As illustrated in Figure 1 and Figure 2, a bolt 33C is inserted into the central boss 45A in the vertical wall 41, and the bolt 33C is screwed into the central boss 4A.

[0057] As illustrated in Figure 2, the central boss 4A and the central boss 45A are installed above the mount attachment part 44, and the central boss 45A is connected to the mount attachment part 44.

[0058] The front wall 4a of the cylinder head 4 is provided with a boss not illustrated having a screw portion. A bolt 33D (see Figure 1) is inserted into the central boss 45B in the vertical wall 41, and the bolt 33D is screwed into the boss.

[0059] The front wall 3a of the cylinder block 3 is provided with a boss not illustrated having a screw portion. A bolt 33E (see Figure 1) is inserted into the central boss 45C in the vertical wall 41, and the bolt 33E is screwed into the boss.

[0060] That is, the chain cover 40 is fixed to the engine main body 2 by fastening the left-side boss 42A, the right-side boss 43A, the central boss 45A, the central boss 45B, and the central boss 45C to the front wall 3a of the cylinder block 3 and the front wall 4a of the cylinder head

4, respectively, with the bolts 33A, 33B, 33C, 33D, and 33E.

[0061] In the present embodiment, the central boss 45A constitutes a cover-side boss, and the central boss 4A constitutes an internal combustion engine main body-side boss. The bolt 33C constitutes a fastener.

[0062] As illustrated in Figure 3 and Figure 5, a front end portion of the intake-side oil supply pipe portion 15 is provided with a boss 15A, and the boss 15A protrudes toward the chain cover 40 from the front wall 4a. The boss 15A has an opening formed to process the oil passage 15a with a drill or the like, and a plug not illustrated is attached to the opening of the boss 15A.

[0063] A front end portion of the exhaust-side oil supply pipe portion 16 is provided with a boss 16A, and the boss 16A protrudes toward the chain cover 40 from the front wall 4a. The boss 16A has an opening formed to process the oil passage 16a with a drill or the like, and a plug not illustrated is attached to the opening of the boss 16A.

[0064] As illustrated in Figure 3 and Figure 5, the central boss 4A is installed in a region 53 sandwiched between the boss 15A and the boss 16A. That is, the central boss 4A is positioned between the boss 15A and the boss 16A in its left-right direction.

[0065] A clearance in the left-right direction between the central boss 4A and the boss 15A is formed to be smaller than the width of the central boss 4A, and a clearance in the left-right direction between the central boss 4A and the boss 16A is formed to be smaller than the width of the central boss 4A.

[0066] As a result, the central boss 4A and the boss 15A are installed in close proximity to each other in the left-right direction, and the central boss 4A and the boss 16A are installed in close proximity to each other in the left-right direction. Accordingly, the rigidity of the front wall 4a in a region around the central boss 4A, the boss 15A, and the boss 16A is high. In the present embodiment, the boss 15A constitutes a first boss, and the boss 16A constitute a second boss.

[0067] As illustrated in Figure 5, the front wall 4a of the cylinder head 4 is provided with a main oil supply pipe portion 46 and a sub-oil supply pipe portion 47.

[0068] The main oil supply pipe portion 46 extends in an up-down direction of the front wall 4a. A main oil passage 46a is provided in the main oil supply pipe portion 46, and oil is supplied to the main oil passage 46a from the oil pump 35.

[0069] The main oil passage 46a supplies operating oil to the exhaust-side valve timing adjustment device, for example.

[0070] The sub-oil supply pipe portion 47 extends rightward in a width direction of the front wall 4a from the main oil supply pipe portion 46, and extends upward.

[0071] A sub-oil passage 47a is provided in the sub-oil supply pipe portion 47, and oil is supplied to the sub-oil passage 47a from the main oil passage 46a. The sub-oil passage 47a supplies operating oil to the intake-side valve timing adjustment device, for example.

[0072] The central boss 4A is installed in a region 54 adjacent to the main oil supply pipe portion 46 and the sub-oil supply pipe portion 47. Specifically, the central boss 4A is positioned on the opposite side (the right side) to the boss 16A with respect to the main oil supply pipe portion 46, and is installed above the sub-oil supply pipe portion 47. The main oil supply pipe portion 46 is sandwiched between the boss 15A and the boss 16A in its left-right direction.

[0073] As illustrated in Figure 4, the vertical wall 41 of the chain cover 40 is provided with a first rib 48A, a second rib 48B, a third rib 48C, a fourth rib 48D, a fifth rib 48E, a sixth rib 48F, a seventh rib 48G, an eighth rib 48H, a ninth rib 48I, and a tenth rib 48J.

[0074] The first rib 48A protrudes toward the cylinder head 4 from the vertical wall 41, and linearly extends in its up-down direction in the central portion in the width direction of the chain cover 40. The first rib 48A extends from the central boss 45A to the central boss 45B, and connects the central boss 45A and the central boss 45B to each other.

[0075] The second rib 48B protrudes toward the cylinder head 4 from the vertical wall 41. The second rib 48B linearly extends diagonally downward to the left toward the left side wall portion 42 from the central boss 45A, and connects the central boss 45A and the left side wall portion 42 to each other.

[0076] The third rib 48C protrudes toward the cylinder head 4 from the vertical wall 41. The third rib 48C linearly extends diagonally downward to the right toward the right side wall portion 43 from the central boss 45A, and connects the central boss 45A and the right side wall portion 43 to each other.

[0077] The fourth rib 48D protrudes toward the cylinder head 4 from the vertical wall 41. The fourth rib 48D linearly extends diagonally upward to the left toward the second rib 48B from the central boss 45B, and connects the central boss 45B and the second rib 48B to each other.

[0078] The fifth rib 48E protrudes toward the cylinder head 4 from the vertical wall 41. The fifth rib 48E linearly extends diagonally upward to the right toward the third rib 48C from the central boss 45B, and connects the central boss 45B and the third rib 48C to each other.

[0079] The sixth rib 48F protrudes toward the cylinder head 4 from the vertical wall 41, and extends in its up-down direction in the central portion in the width direction of the chain cover 40.

[0080] The sixth rib 48F extends downward to the central boss 45C from the central boss 45B, and connects the central boss 45B and the central boss 45C to each other.

[0081] The seventh rib 48G protrudes toward the cylinder head 4 from the vertical wall 41. The seventh rib 48G linearly extends diagonally downward to the left toward the left side wall portion 42 from the central boss 45B, and connects the central boss 45B and the left side wall portion 42 to each other.

[0082] The eighth rib 48H protrudes toward the cylinder

head 4 from the vertical wall 41. The eighth rib 48H linearly extends diagonally downward to the right toward the right side wall portion 43 from the central boss 45B, and connects the central boss 45B and the right side wall portion 43 to each other.

[0083] The ninth rib 48I protrudes toward the cylinder head 4 from the vertical wall 41. The ninth rib 48I linearly extends toward the right side wall portion 43 from the central boss 45B, and connects the central boss 45B and the right side wall portion 43 to each other.

[0084] The tenth rib 48J protrudes toward the cylinder head 4 from the vertical wall 41. The tenth rib 48J linearly extends toward the right side wall portion 43 from the central boss 45C, and connects the central boss 45C and the right side wall portion 43 to each other.

[0085] Then, an effect of a chain cover 40 attachment structure for the engine 1 according to the present embodiment will be described.

[0086] In the chain cover 40 attachment structure for the engine 1 according to the present embodiment, the engine 1 includes the cylinder head 4 that has the front wall 4a and the rear wall 4b positioned on the opposite side to the front wall 4a in the axial direction of the crankshaft 7 and rotatably supports the crankshaft 7, the intake cam shaft 21, and the exhaust cam shaft 22, and the intake-side oil supply pipe portion 15 and the exhaust-side oil supply pipe portion 16 that are provided in the cylinder head 4 and extend parallel to each other from the front wall 4a to the rear wall 4b.

[0087] In the chain cover 40 attachment structure for the engine 1, the engine 1 includes the chain cover 40 attached to the front wall 4a to cover the timing chain 14 that transmits power to the intake cam shaft 21 and the exhaust cam shaft 22 from the crankshaft 7, the central boss 45A extending toward the front wall 4a from the central portion in the width direction of the chain cover 40, and the central boss 4A provided in the front wall 4a and to be connected to the central boss 45A with the bolt 33C.

[0088] The intake-side oil supply pipe portion 15 includes the boss 15A protruding toward the chain cover 40 from the front wall 4a, and the exhaust-side oil supply pipe portion 16 includes the boss 16A protruding toward the chain cover 40 from the front wall 4a.

[0089] The cylinder head 4 in the present embodiment does not easily vibrate because the rigidity of the region 53 adjacent to the intake-side oil supply pipe portion 15 and the exhaust-side oil supply pipe portion 16 in the front wall 4a of the cylinder head 4 is high.

[0090] In the chain cover 40 attachment structure for the engine 1 according to the present embodiment, the central boss 4A is installed in the region 53 sandwiched between the boss 15A and the boss 16A, whereby the central boss 4A can be reinforced with the boss 15A and the boss 16A each having a high rigidity, and the central boss 4A can be prevented from vibrating.

[0091] This makes it possible to prevent the chain cover 40 from vibrating by fastening the central boss 45A in

the chain cover 40 to the central boss 4A having a high rigidity with the bolt 33C.

[0092] Thus, in the chain cover 40 attachment structure for the engine 1, the rigidity of a portion of the front wall 4a of the cylinder head 4 to which the chain cover 40 is fastened can be increased, thereby making it possible to prevent the chain cover 40 from vibrating.

[0093] In the chain cover 40 attachment structure for the engine 1 according to the present embodiment, the engine 1 includes the intake-side lash adjuster 10 that is provided in the cylinder head 4 and adjusts the valve clearance of the intake valve 8 and the exhaust-side lash adjuster 11 that is provided in the cylinder head 4 and adjusts the valve clearance of the exhaust valve 9.

[0094] The intake-side oil supply pipe portion 15 supplies oil to the intake-side lash adjuster 10, and the exhaust-side oil supply pipe portion 16 supplies oil to the exhaust-side lash adjuster 11.

[0095] As a result, the central boss 4A can be prevented from vibrating by only installing the existing intake-side oil supply pipe portion 15 for the intake-side lash adjuster 10 and the existing exhaust-side oil supply pipe portion 16 for the exhaust-side lash adjuster 11 in the cylinder head 4 in the vicinity of the central boss 4A.

[0096] As a result, the structure of the cylinder head 4 can be more simplified than a structure in which a dedicated rib that reinforces the central boss 4A is added to the front wall 4a of the cylinder head 4, which can result in a structure of the engine 1 being simplified.

[0097] In the chain cover 40 attachment structure for the engine 1 according to the present embodiment, the chain cover 40 includes the mount attachment part 44 to which the mount bracket 51A that supports the engine main body 2 on the side member 31 is attached, and the mount attachment part 44 protrudes from the vertical wall 41 of the chain cover 40 in a direction away from the engine main body 2.

[0098] A portion above the mount attachment part 44 easily vibrates by a swing of the engine 1 because an outward protrusion length of the mount attachment part 44 in the chain cover 40 is large.

[0099] In the chain cover 40 attachment structure for the engine 1 according to the present embodiment, the central boss 4A on the front wall 4a side having a high rigidity is connected to the central boss 45A on the chain cover 40 side installed above the mount attachment part 44, thereby making it possible to effectively prevent the chain cover 40 from vibrating.

[0100] In the chain cover 40 attachment structure for the engine 1 according to the present embodiment, the front wall 4a includes the main oil supply pipe portion 46 and the sub-oil supply pipe portion 47.

[0101] The main oil supply pipe portion 46 extends in the up-down direction of the front wall 4a, and the sub-oil supply pipe portion 47 extends in the width direction of the front wall 4a from the main oil supply pipe portion 46 and then extends upward.

[0102] In addition thereto, the central boss 4A is in-

stalled in the region 54 adjacent to the main oil supply pipe portion 46 and the sub-oil supply pipe portion 47.

[0103] As a result, the front wall 4a can be reinforced by the main oil supply pipe portion 46 and the sub-oil supply pipe portion 47 each having a high rigidity. Accordingly, the central boss 4A is arranged in the region 54 having a high rigidity adjacent to the main oil supply pipe portion 46 and the sub-oil supply pipe portion 47, whereby the central boss 4A can be more effectively prevented from vibrating, thereby making it possible to more effectively prevent the chain cover 40 from vibrating.

[0104] In the chain cover 40 attachment structure for the engine 1 according to the present embodiment, the central boss 45A and the central boss 45B are connected to each other with the first rib 48A, the central boss 45B and the left side wall portion 42 are connected to each other with the second rib 48B, and the central boss 45B and the right side wall portion 43 are connected to each other with the third rib 48C.

[0105] As a result, the central boss 45A can be more firmly reinforced by the ribs 48A, 48B, and 48C in addition to the boss 15A and the boss 16A, whereby the central boss 4A can be more effectively prevented from vibrating. This makes it possible to more effectively prevent the chain cover 40 from vibrating.

[0106] Although the embodiment of the present invention has been disclosed, it will be apparent that adjustments can be made by those skilled in the art without departing from the scope of the present invention. All such modifications and equivalents are intended to be included in the following claims.

[Reference Signs List]

[0107] 1...engine (internal combustion engine), 2...engine main body (internal combustion engine main body), 4...cylinder head, 4A...central boss (internal combustion engine main body-side boss), 4a...front wall (one side wall), 4b...rear wall (the other side wall), 7...crankshaft, 8...intake valve, 9...exhaust valve, 10...intake-side lash adjuster, 11...exhaust-side lash adjuster, 14...timing chain, 15...intake-side oil supply pipe portion (first oil supply pipe portion), 15A...boss (first boss), 16...exhaust-side oil supply pipe portion (second oil supply pipe portion), 16A...boss (second boss), 31...side member (vehicle body), 33C...bolt (fastener), 40...chain cover (cover member), 41...vertical wall (outer wall of cover member), 44...mount attachment part, 45A...central boss (cover-side boss), 46...main oil supply pipe portion, 47...sub-oil supply pipe portion, 51A...mount bracket, 53...region (region sandwiched between first boss and second boss), 54...region (region adjacent to main oil supply pipe portion and sub-oil supply pipe portion)

Claims

1. A cover member attachment structure for an internal

combustion engine (1) comprising:

an internal combustion engine main body (2) that has one side wall (4a) and another side wall (4b) positioned on the opposite side to the one side wall (4a) in an axial direction of a crankshaft (7) and rotatably supports the crankshaft (7) and a cam shaft (21);
 a first oil supply pipe portion (15) and a second oil supply pipe portion (16) that are provided in the internal combustion engine main body (2) and extend parallel to each other from the one side wall (4a) to the other side wall (4b);
 a cover member (40) attached to the one side wall (4a) to cover a transmission member (14) that transmits power to the cam shaft (21) from the crankshaft (7);
 a cover-side boss (45A) extending toward the one side wall (4a) from a central portion in a width direction of the cover member (40); and
 an internal combustion engine main body-side boss (4A) provided in the one side wall (4a) and to be connected to the cover-side boss (45A) with a fastener (33C), **characterized in that** the first oil supply pipe portion (15) includes a first boss (15A) protruding toward the cover member (40) from the one side wall (4a), the second oil supply pipe portion (16) includes a second boss (16A) protruding toward the cover member (40) from the one side wall (4a), and the internal combustion engine main body-side boss (4A) is installed in a region (53) sandwiched between the first boss (15A) and the second boss (16A).

2. The cover member attachment structure for the internal combustion engine (1) according to claim 1, **characterized in that**

the internal combustion engine main body (2) comprises a cylinder head (4) having the one side wall (4a) and the other side wall (4b), an intake-side lash adjuster (10) that is provided in the cylinder head (4) and adjusts a valve clearance of an intake valve (8), and an exhaust-side lash adjuster (11) that is provided in the cylinder head (4) and adjusts a valve clearance of an exhaust valve (9),
 the first oil supply pipe portion (15) is provided in the cylinder head (4) and supplies oil to the intake-side lash adjuster (10), and
 the second oil supply pipe portion (16) is provided in the cylinder head (4) and supplies oil to the exhaust-side lash adjuster (11).

3. The cover member attachment structure for the internal combustion engine (1) according to claim 1 or 2, **characterized in that**

the cover member (40) includes a mount attachment part (44) to which a mount bracket (51A) that supports the internal combustion engine main body (2) on a vehicle body (31) is installed, the mount attachment part (44) protrudes from an outer wall (41) of the cover member (40) in a direction away from the internal combustion engine main body (2), and the cover-side boss (45A) and the internal combustion engine main body-side boss (4A) are installed above the mount attachment part (44).

4. The cover member attachment structure for the internal combustion engine (1) according to any one of claims 1 to 3, **characterized in that**

the one side wall (4a) includes a main oil supply pipe portion (46) and a sub-oil supply pipe portion (47),
 the main oil supply pipe portion (46) extends in an up-down direction of the one side wall (4a), the sub-oil supply pipe portion (47) extends in a width direction of the one side wall (4a) from the main oil supply pipe portion (46), and extends upward, and
 the internal combustion engine main body-side boss (4A) is installed in a region (54) adjacent to the main oil supply pipe portion (46) and the sub-oil supply pipe portion (47).

FIG. 1

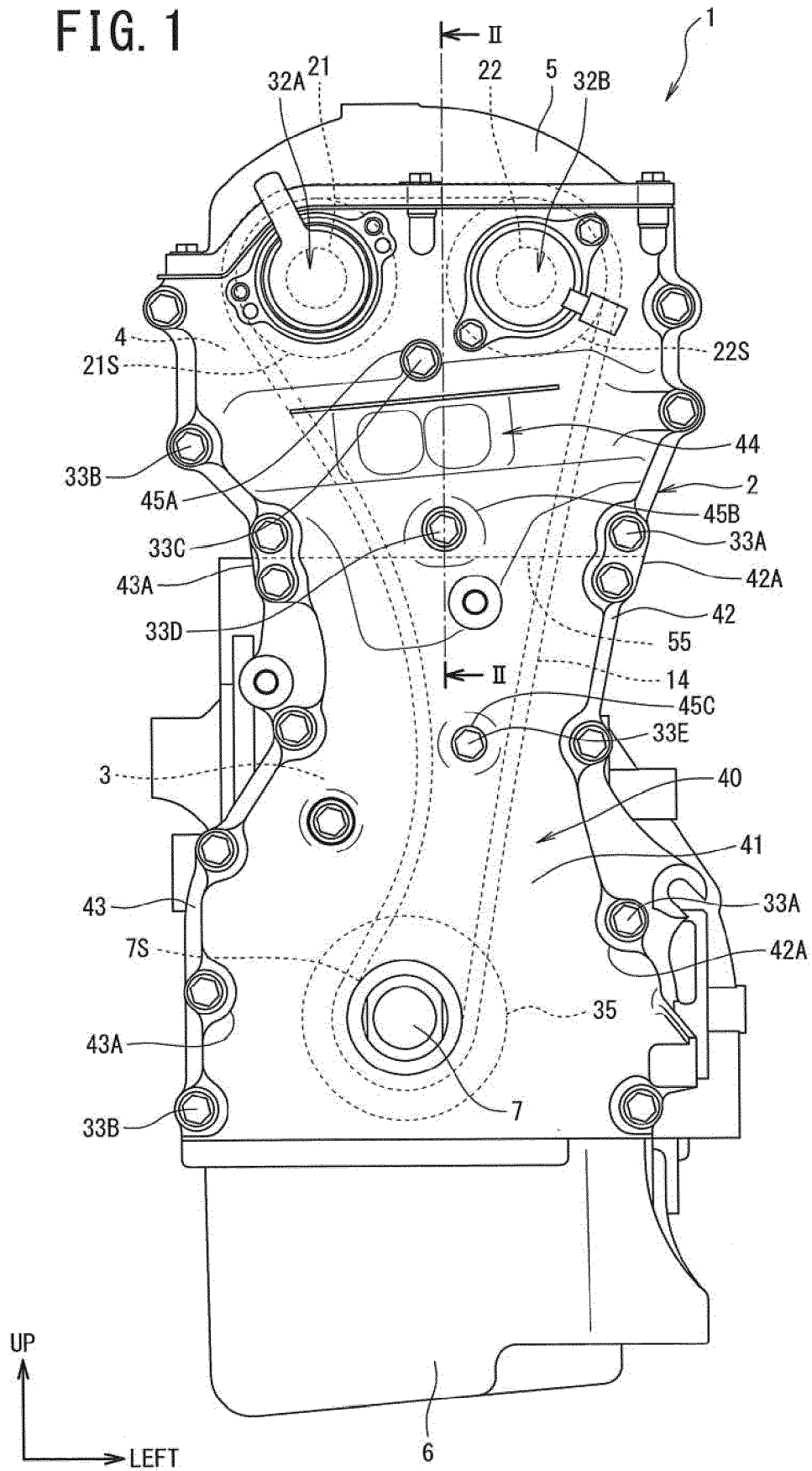


FIG. 2

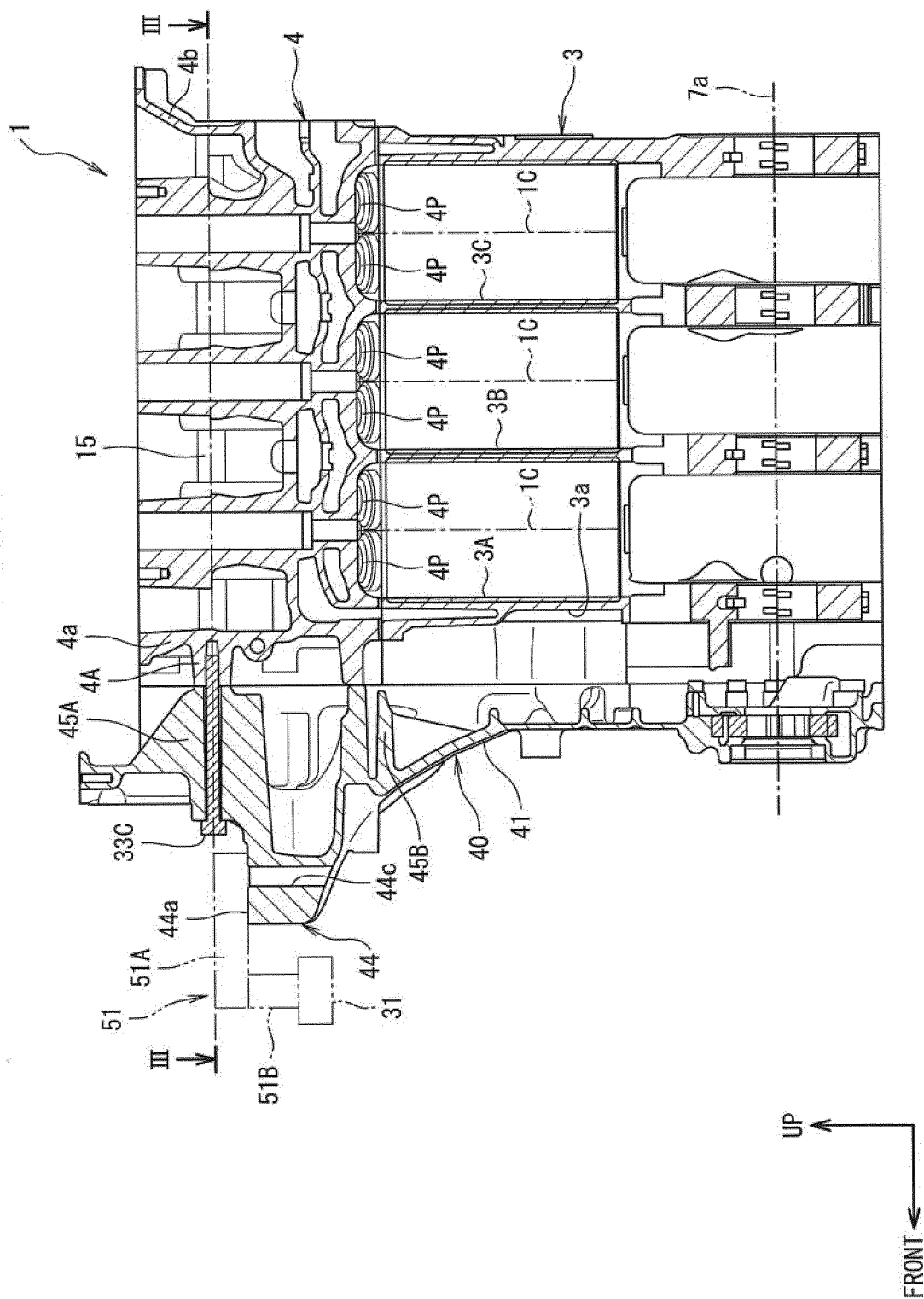


FIG. 3

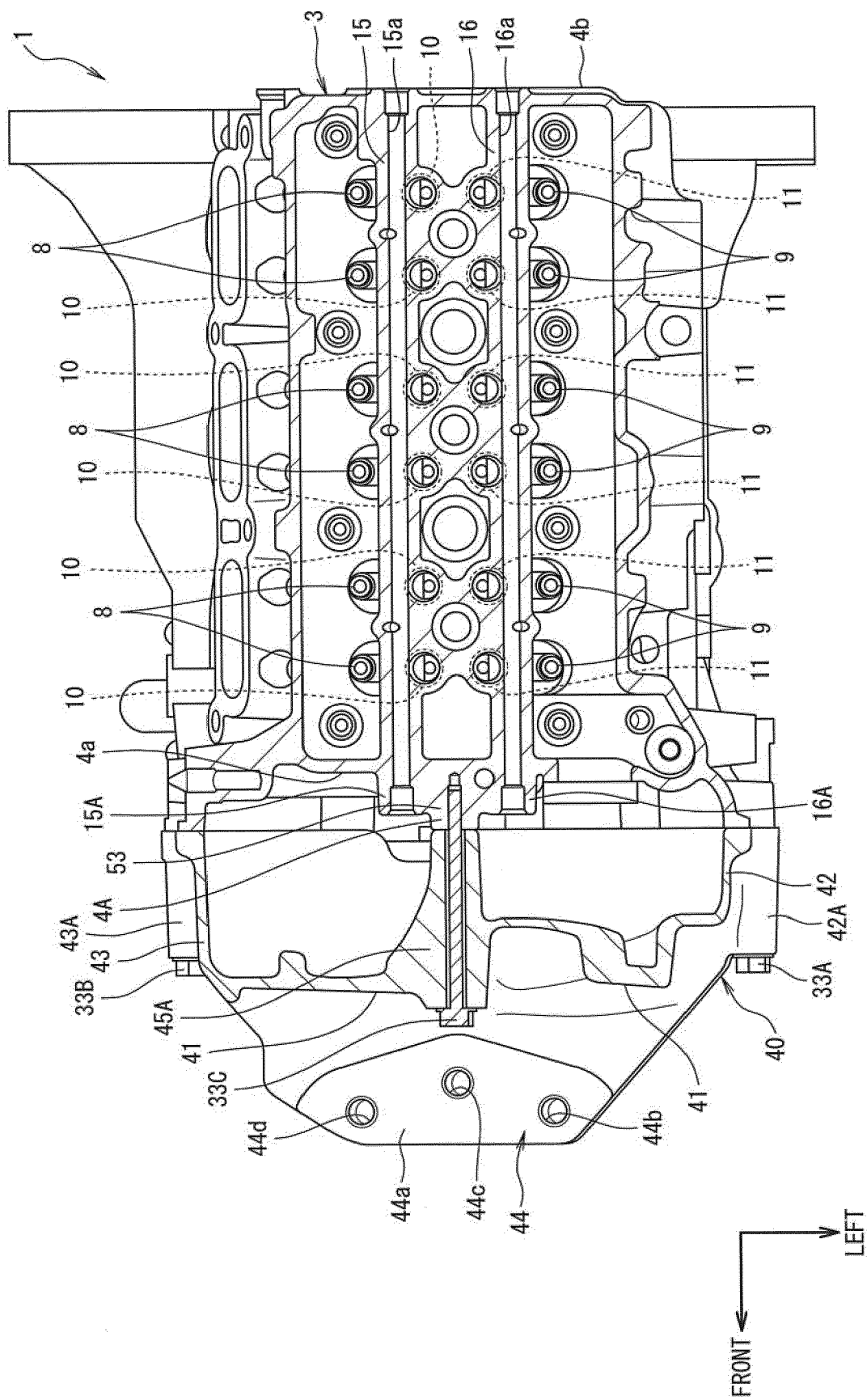


FIG. 4

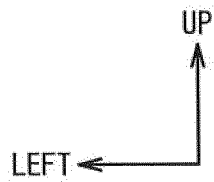
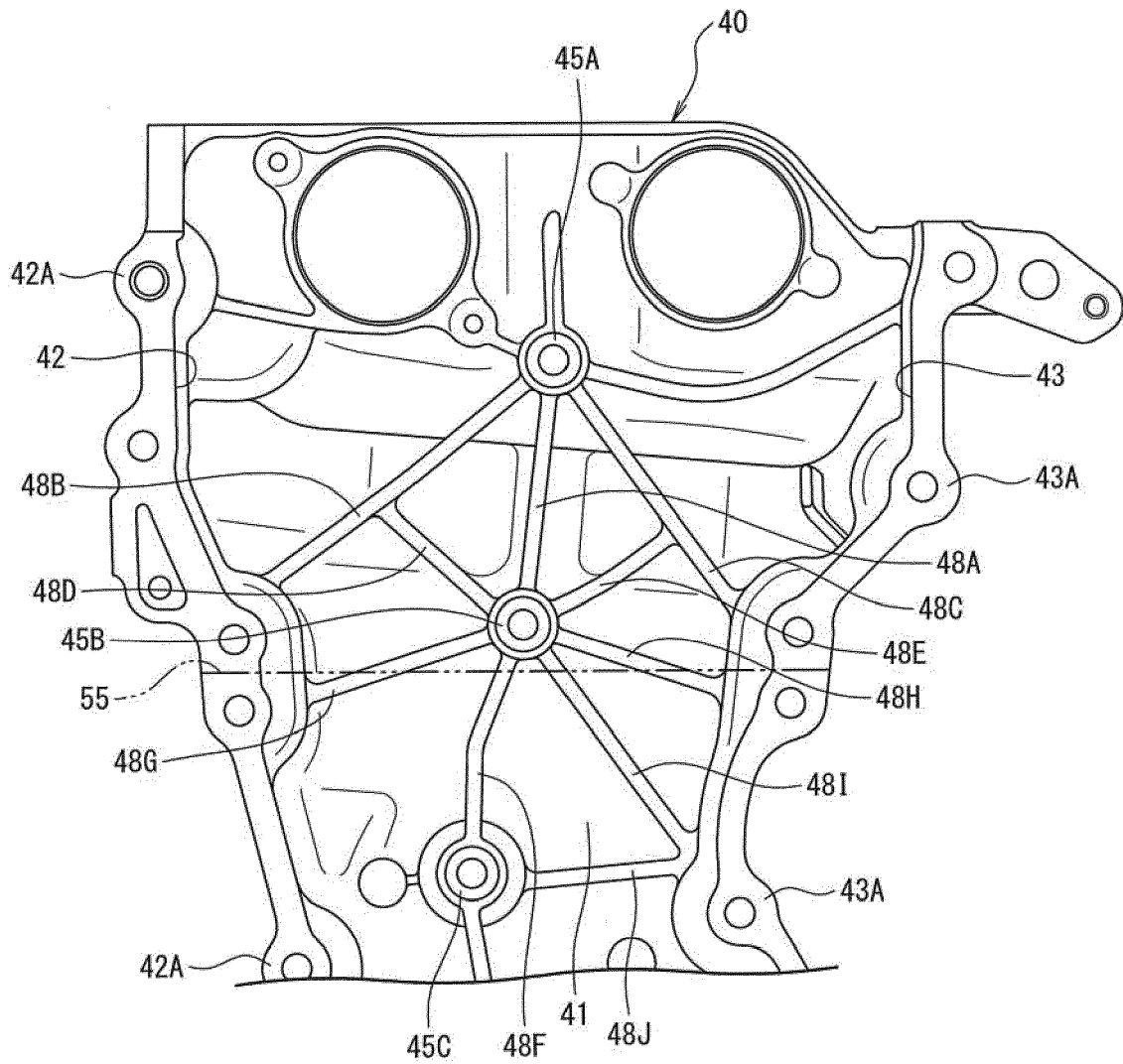
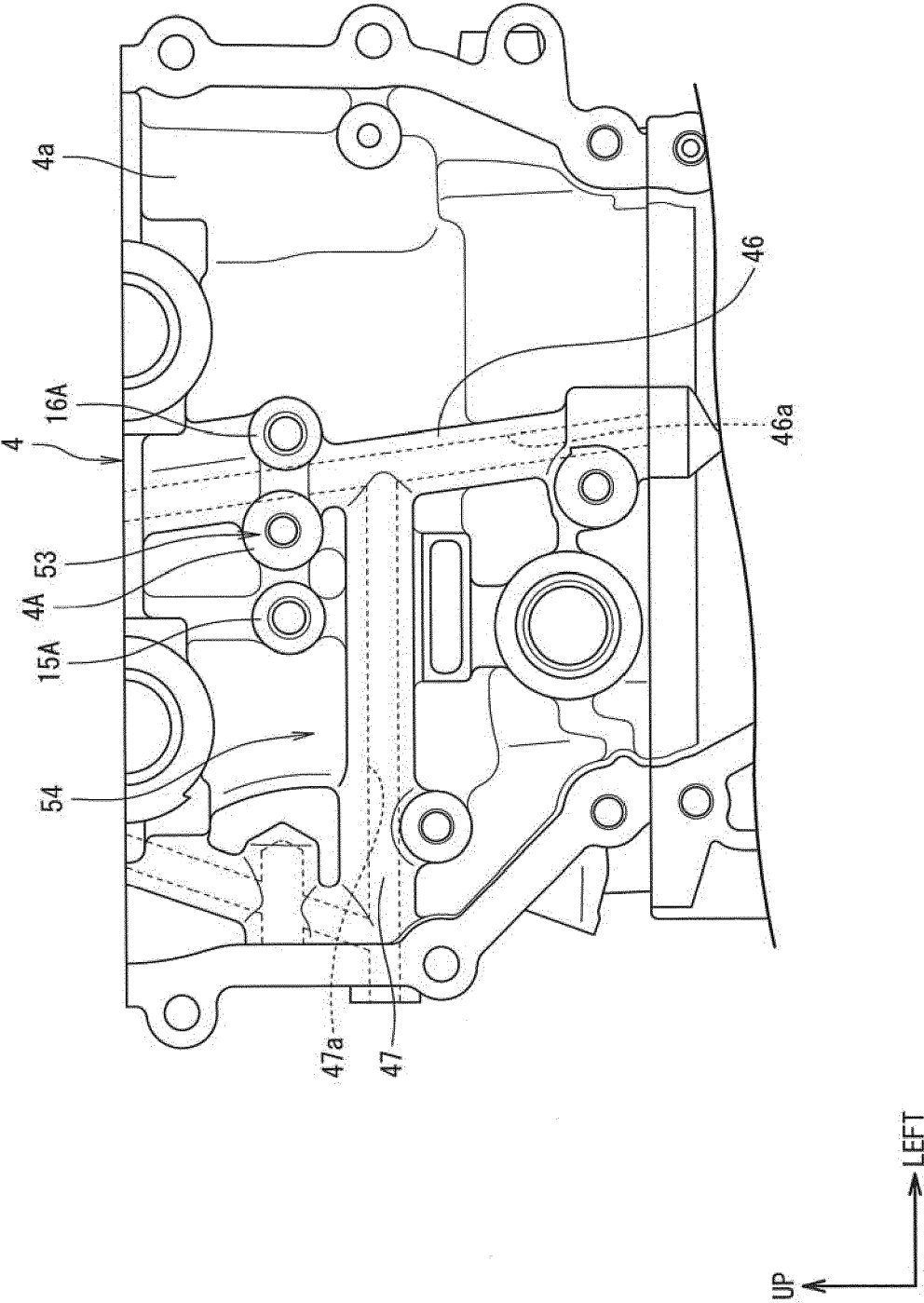


FIG. 5





EUROPEAN SEARCH REPORT

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EPO FORM 1503 03.82 (P04C01)

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			F02F F01L
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 23 November 2022	Examiner Kämper, Fabian
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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