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(54) Variable valve gear of internal combustion engine for saddle-ride type vehicle

Variabler Ventilantrieb für Verbrennungsmotoren von Sattelfahrzeugen

Commande de soupape variable de moteur à combustion interne pour véhicule de type à enfourcher

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Description

[0001] The present invention relates to a variable valve gear of an internal combustion engine for a saddle-ride type vehicle in which a valve chamber is formed between a cylinder head and a head cover joined to each other while constituting a part of an engine body mounted on a vehicle body frame, first and second rocker arms arrayed adjacent to each other inside the valve chamber with at least either one thereof being interlocked and joined to an engine valve are rockably journaled to the cylinder head through a rocker shaft so as to be rockable in rocking modes different from each other when the rocker arms are in a non-joined state, a joining pin having a center axis parallel to the rocker shaft is slidably fit to the first and second rocker arms so as to be movable between a joining position for straddling over between the first and second rocker arms and joining both the rocker arms to each other and a joining releasing position for being separated from the second rocker arm and releasing joining of both the rocker arms, and a press rod to which a press force is imparted from a solenoid attached to the engine body is made to abut upon one end of the joining pin on the opposite side of the second rocker arm.

[0002] A variable valve gear of an internal combustion engine for a saddle-ride type vehicle is known by Patent Literature 1 (JP 2012-077741 A) in which a joining pin is slidably fit to first and second rocker arms arrayed adjacent to each other so as to be capable of switching joining and joining releasing of the rocker arms, and a press rod transferring a press force from a solenoid attached to an engine body is made to abut upon the joining pin so as to be capable of pressing the joining pin to the joining position side.

[0003] However, in one disclosed in the Patent Literature 1, the solenoid is attached to the side wall of the cylinder head and the head cover of the engine body, and the ignition plug attached to the cylinder head is disposed on the same side of the solenoid. Therefore, thermal impact from the cylinder head is liable to be exerted on the solenoid, undesired temperature rise of the solenoid is liable to occur, and there is a possibility that the thermal resistance of the coil and the like increases due to the temperature rise of the solenoid, the electric current value drops, and the function of the solenoid deteriorates (the pressing force drops).

[0004] Also, in one disclosed in the Patent Literature 1, in disposing the solenoid and the ignition plug on side surface of the same side of the engine body, the solenoid and the ignition plug are disposed at a position overlapping with each other as viewed from a cylinder axis direction and a fastening boss for fastening the solenoid is arranged so as to project to the ignition plug side, and therefore there is also a problem that the solenoid becomes an obstacle in maintaining the ignition plug and the maintainability is liable to deteriorate. Particularly, in a vehicle such as a saddle-ride type vehicle in which a space is hardly secured, because the maintenance space around the ignition plug is liable to be hardly secured, it is desirable to secure a sufficient maintenance space around the ignition plug.

[0005] Also, in one disclosed in the Patent Literature 1, although projection of the actuator from the engine body in the cylinder axis direction can be suppressed by that the actuator is attached to the side wall of the cylinder head of the engine body, because the stud bolt bosses with which the stud bolts joining the cylinder head and the cylinder block to each other are fastened are arranged in the cylinder head between the first rocker arm on the actuator side out of the first and second rocker arms and the side wall of the cylinder, the side wall of the cylinder head comes to bulge out to the outside by a portion the stud bolt bosses are disposed. Accordingly, the attaching surface of the actuator also projects to the outside, and the projection amount of the actuator in the direction perpendicular to the cylinder axis comes to increase. Particularly, in a vehicle such as a saddle-ride type vehicle in which a space is hardly secured, it is desirable to suppress projection of the actuator and to dispose the actuator compactly around the engine body.

[0006] EP 2 821 601 A2 shows a first rocker arm being supported by a rocker shaft and being provided to be able to operate a valve. A second rocker arm is supported by the rocker shaft and is arranged to line up with the first rocker arm in the axial direction of a cam shaft. A switching pin member is able to be moved in the axial direction of the cam shaft, and links the first rocker arm and the second rocker arm at a first position and swings together with the first rocker arm and the second rocker arm. The switching pin member is positioned on an end section side of the valve with regard to the rocker shaft when viewed from the axial direction of the camshaft.

[0007] The present invention has been developed in view of such circumstances, and its object is to provide a variable valve gear of an internal combustion engine for a saddle-ride type vehicle that allows to suppress the thermal impact on the solenoid and facilitates to secure a maintenance space for the ignition plug when the solenoid and the ignition plug are disposed on a side surface of the same side of the engine body and preferably being capable of disposing an actuator compactly around an engine body.

[0008] In order to achieve the above object, the first feature of the present invention is a variable valve gear of an internal combustion engine for a saddle-ride type vehicle in which a valve chamber is formed between a cylinder head and a head cover joined to each other while constituting a part of an engine body mounted on a vehicle body frame, first and second rocker arms arrayed adjacent to each other inside the valve chamber with at least either one thereof being interlocked and joined to an engine valve are rockably journaled to the cylinder head through a rocker shaft so as to be rockable in rocking modes different from each other when the rocker arms are in a non-joined state, a joining pin having a center axis parallel to the rocker shaft is slidably fit to the first

and second rocker arms so as to be movable between a joining position for straddling over between the first and second rocker arms and joining both the rocker arms to each other and a joining releasing position for being separated from the second rocker arm and releasing joining of both the rocker arms, and a press rod to which a press force is imparted from a solenoid attached to the engine body is made to abut upon one end of the joining pin on the opposite side of the second rocker arm, in which the solenoid is attached only to a side wall of the head cover on the same side of an ignition plug that is attached to a side wall of the cylinder head by a plurality of fastening members so as to avoid that a housing of the solenoid and extension of the center axis of the ignition plug overlap with each other.

[0009] The solenoid and the ignition plug are disposed on a side facing one side in the vehicle width direction of the engine body that is rockably journaled to the vehicle body frame, and the housing of the solenoid is disposed higher than the center axis of the ignition plug in a side view.

[0010] Also, in addition to the configuration of the first feature, the second feature of the present invention is that distal ends of a plurality of fastened arm sections arranged in the housing of the solenoid and projecting radially from the housing are each fastened to the head cover by the fastening members, and a distal end of the first fastened arm section that is nearest to the ignition plug on a projected plan to a flat plane perpendicular to the working axis of the solenoid out of the plurality of fastened arm sections is disposed at a position far from the ignition plug than a distal end of the other fastened arm section that is farthest from the ignition plug out of the plurality of fastened arm sections in a direction along the center axis of the ignition plug.

[0011] In addition to the configuration of the second feature, the third feature of the present invention is that a fastening boss whose axis is disposed at a position apart from the cylinder head than a breather plate that is attached to the head cover so as to form a breather chamber between the head cover and the breather plate in a direction along the cylinder axis of the engine body is arranged in the head cover so as to fasten the distal end of the first fastened arm section.

[0012] In addition to the configuration of the third feature, the fourth feature of the present invention is that a cylinder head side recess is formed on the side wall of the cylinder head so that a plug attaching seat for attaching the ignition plug is arranged, a head cover side recess continuing to the cylinder head side recess is formed on the side wall of the head cover, and the fastening boss is arranged in the head cover so that the fastening member for fastening the first fastened arm section to the fastening boss out of the plurality of fastening members is fastened at a position avoiding overlapping of a bottom section of the head cover side recess and the center axis of the ignition plug with each other as viewed from a direction along the cylinder axis.

[0013] In addition to the configuration of the third feature, the fifth feature of the present invention is that an outlet section which communicates with the breather chamber and to which a breather hose is connected is arranged on an outer surface of the head cover so as to be oriented to a direction different from a direction to which the side wall of the head cover where the solenoid is attached faces.

[0014] In addition to any of the configurations of the first to fifth features, the sixth feature of the present invention is that a water pump is attached to the other side wall of the cylinder head and on the opposite side of the solenoid with the cylinder axis of the engine body in between.

[0015] In addition to any of the configurations of the first to sixth features, the seventh feature of the present invention is that a support wall that supports the rocker shaft and stud bolt bosses disposed between the side wall of the cylinder head and the support wall so that stud bolts joining the cylinder head and a cylinder block to a crankcase are inserted are arranged in the cylinder head, bolt fastening surfaces of the stud bolt bosses are formed so that top parts of the stud bolts are positioned on the cylinder block side of the working axis of the solenoid in a direction along the cylinder axis of the engine body, and the top parts of the stud bolts are disposed at positions overlapping with at least a part of the solenoid as viewed from a direction along the cylinder axis.

[0016] In addition to the configuration of the seventh feature, the eighth feature of the present invention is that a joining surface of the cylinder head and the head cover is disposed on the cylinder block side of the solenoid in a direction along the cylinder axis, a solenoid storing recess disposed at a position departing to the opposite side of the bolt fastening surface from the top part of the stud bolt in a direction along the cylinder axis is formed on the side wall of the head cover so as to be recessed to the stud bolt side, and the solenoid is attached to the head cover so that at least a part thereof is stored in the solenoid storing recess.

[0017] In addition to the configuration of the eighth feature, the ninth feature of the present invention is that an attaching surface of the solenoid in the head cover side recess is disposed at a position overlapping with the top part of the stud bolt as viewed from the direction along the cylinder axis.

[0018] In addition to the configuration of the ninth feature, the tenth feature of the present invention is that a housing is attached to the attaching surface while fitting a part of the housing included in the solenoid to an attaching hole arranged in the attaching surface, and a first seal member that seals the gap between an output shaft of the solenoid and the housing and a second seal member that seals the gap between the housing and the attaching hole are disposed on the same flat plane perpendicular to the axis of the output shaft.

[0019] In addition to any of the configurations of the eighth to tenth features, the eleventh feature of the

present invention is that knock members are arranged between the head cover and the cylinder head.

[0020] In addition to any of the configurations of the eighth to eleventh features, the twelfth feature of the present invention is that the solenoid storing recess is formed in the side wall that faces one side in the vehicle width direction of the head cover that constitutes a part of the engine body vertically rockably journaled to the vehicle body frame.

[0021] Also, in addition to the configuration of the twelfth feature, the thirteenth feature of the present invention is that the working axis of the solenoid is disposed lower than the center axis of the joining pin.

[0022] According to the first feature of the present invention, because the solenoid is attached only to the side wall of the head cover on the same side of the ignition plug that is attached to the side wall of the cylinder head, the thermal impact can be suppressed from being exerted from the cylinder head to the solenoid by that the solenoid is attached to the head cover that is apart from the combustion chamber, and undesired temperature rise of the solenoid can be prevented. Also, because the housing of the solenoid is disposed so as not to overlap with the extension of the center axis of the ignition plug, even when the ignition plug and the solenoid are disposed on a side surface of the same side of the engine body, the maintenance space of the ignition plug can be secured. Further, because the solenoid is attached to the head cover by a plurality of fastening members, it is also easy to position the fastening position of the solenoid by the fastening members at a position apart from the ignition plug attached to the cylinder head so as not to obstruct maintenance of the ignition plug. As a result, in a saddle-ride type vehicle in which the maintenance space is liable to become narrow, a space can be secured on the center axis of the ignition plug, and attaching/detaching of the ignition plug can be executed easily.

[0023] Furthermore, because the solenoid and the ignition plug are disposed on the side facing one side in the vehicle width direction of the engine body that is rockably journaled to the vehicle body frame, it is easy to access the solenoid and the ignition plug from one side in the vehicle width direction, and the maintainability can be improved. In addition, because the housing of the solenoid is disposed higher than the center axis of the ignition plug in a side view, the harness connected to the solenoid can be laid on the vehicle body frame side without straddling the center axis of the ignition plug, and the maintenance space of the ignition plug can be secured more widely.

[0024] Also, according to the second feature of the present invention, because the distal end of the first fastened arm section that is nearest to the ignition plug on a projected plan to a flat plane perpendicular to the working axis of the solenoid out of the plurality of fastened arm sections projecting radially from the housing of the solenoid is disposed at a position farther from the ignition plug than the distal end of the other fastened arm section that is farthest from the ignition plug in a direction along the center axis of the ignition plug, the distal end of the first fastened arm section can be made to hardly obstruct the attaching/detaching work of the ignition plug, and the maintainability of the ignition plug improves.

[0025] According to the third feature of the present invention, because the axis of the fastening boss for fastening the distal end of the first fastened arm section is disposed at a position apart from the cylinder head than the breather plate attached to the head cover in a direction along the cylinder axis, the first fastening boss hardly becomes an obstacle in attaching the breather plate to the head cover, and the breather plate is easily attached to the head cover.

[0026] According to the fourth feature of the present invention, because the head cover side recess continuing to the cylinder head side recess formed so that the plug attaching seat is arranged on the side wall of the cylinder head is formed on the side wall of the head cover and the fastening boss is arranged in the head cover so that the fastening member for fastening the first fastened arm section to the first fastening boss is fastened so as not to overlap with the bottom section of the head cover side recess and the center axis of the ignition plug as viewed from a direction along the cylinder axis, projection of the fastening boss to the inner surface side of the head cover can be suppressed, and the volume of the breather chamber inside the head cover can be secured sufficiently. In addition, the fastening member for fastening the first fastened arm section to the fastening boss can be prevented from becoming an obstacle in maintaining the ignition plug, and the maintenance space of the ignition plug can be secured widely.

[0027] According to the fifth feature of the present invention, because the outlet section which communicates with the breather chamber is arranged on the outer surface of the head cover so as to be oriented to the direction different from the direction to which the side wall of the head cover where the solenoid is attached faces, interference of the breather hose joined to the outlet section and the solenoid can be prevented easily.

[0028] According to the sixth feature of the present invention, because the water pump is attached to the other side wall of the cylinder head and on the opposite side of the solenoid with the cylinder axis in between, the solenoid and the water pump which are heavy articles come to be disposed separately so as to embrace the cylinder axis, the weight balance around the cylinder head improves, and interference of the solenoid and the water pump with each other can be easily avoided.

[0029] According to the seventh feature of the present invention, because the stud bolt bosses through which the stud bolts joining the cylinder head and the cylinder block to each other are inserted are disposed between the support wall arranged in the cylinder head so as to support the rocker shaft and the side wall of the cylinder head and the top parts of the stud bolt bosses are disposed on the cylinder block side of the working axis of

the solenoid in the direction along the cylinder axis, projection of the solenoid from the head cover in the cylinder axis direction can be suppressed, because the top parts of the stud bolt bosses overlap with at least a part of the solenoid as viewed from the direction along the cylinder axis, the projection amount of the solenoid from the head cover in the direction perpendicular to the cylinder axis can be suppressed also, the maintenance space of the ignition plug can be secured, and the solenoid can be disposed compactly around the engine body. effectively.

[0030] Also, according to the eighth feature of the present invention, because the joining surface of the cylinder head and the head cover is disposed on the cylinder block side of the solenoid in the cylinder axis direction, it is easy to form the solenoid storing recess recessed to the stud bolt side as viewed from the cylinder axis direction above the top part of the stud bolt and in the side wall of the head cover and the solenoid solenoid storing recess is disposed at a position departing to the opposite side of the bolt fastening surface from the top part of the stud bolt in the cylinder axis direction, and at least a part of the solenoid is stored in the solenoid storing recess, the configuration of the eighth feature that the top part of the stud bolt boss is made to overlap with at least a part of the solenoid as viewed from the direction along the cylinder axis can be secured easily.

[0031] According to the ninth feature of the present invention, because the attaching surface of the solenoid overlaps with the top part of the stud bolt as viewed from the cylinder axis direction, the attaching surface can be disposed closer to the cylinder axis side, and the projection amount of the solenoid from the engine body can be effectively suppressed.

[0032] According to the tenth feature of the present invention, because the first seal member that seals the gap between the output shaft of the solenoid and the housing and the second seal member that seals the gap between the attaching hole arranged in the attaching surface so as to make a part of the housing fit thereto and the housing are disposed on the same flat plane perpendicular to the axis of the output shaft, the projection amount of the solenoid from the engine body can be suppressed more effectively.

[0033] According to the eleventh feature of the present invention, because the knock members are arranged between the head cover and the cylinder head, a part of the load applied to the head cover side when the press rod is driven by the motion of the solenoid attached to the head cover is dispersed to the cylinder head side through the knock members, and the pressing movement accuracy of the joining pins which is the motion mode switching accuracy of the engine valve can be improved.

[0034] According to the twelfth feature of the present invention, because the engine body is vertically rockably journaled to the vehicle body frame and the solenoid storing recess is formed in the side wall that faces one side in the vehicle width direction of the head cover that is a part of the engine body, projection of the solenoid in the vehicle width direction can be effectively suppressed, interference of the solenoid with the vehicle body frame and other components such as the storage box and the like disposed around the engine body caused by rocking of the engine body can be prevented easily, the vehicle width can be made compact to improve straddling performance of the occupant, the solenoid can be easily got access from one side in the vehicle width direction, and the maintainability can be improved.

[0035] Also, according to the thirteenth feature of the present invention, because the working axis of the solenoid attached to the head cover that is a part of the vertically rockable engine body is lower than the center axis of the joining pin, upward projection of the solenoid from the engine body that vertically rocks can be also suppressed, and interference of the solenoid with the components such as the storage box and the like disposed above the engine body can be prevented effectively.

[0036]

Fig. 1 is a side view of a motorcycle.
Fig. 2 is a cross-sectional plan view of an essential part of a power unit.
Fig. 3 is a view taken along arrow 3 of Fig. 2.
Fig. 4 is a cross-sectional view taken along line 4-4 of Fig. 3.
Fig. 5 is a cross-sectional view taken along line 5-5 of Fig. 4.
Fig. 6 is an enlarged view of an essential part of Fig. 4.
Fig. 7 is a drawing showing the rear surface of the head cover.
Fig. 8 is a view taken along arrow 2 of Fig. 3.
Fig. 9 is a cross-sectional view taken along line 9-9 of Fig. 3.

[0037] Below, embodiments of the present invention will be described referring to attached Fig.1-Fig. 9. Also, in the description below, front/rear, right/left and up/down are to mean the directions as viewed by an occupant riding the motorcycle.

[0038] First, in Fig. 1, a vehicle body frame F of a scooter type motorcycle that is a saddle-ride type vehicle includes a head pipe 13 that steerably journals front forks 11 pivotally supporting a front wheel WF and a steering handlebar 12 joined to the front forks 11 at the front end thereof, and a power unit P that exerts the power for driving a rear wheel WR is vertically rockably supported at a middle section in the front/rear direction of the vehicle body frame F.

[0039] The power unit P includes an internal combustion engine E disposed in front of the rear wheel WR and a transmission gear M transmitting the power of the internal combustion engine E to the rear wheel WR, the transmission gear M is stored inside a transmission case 15 arranged so as to continue to an engine body 14 of the internal combustion engine E and extending to the left side part of the rear wheel WR, and a rear cushion

unit 16 is arranged between the rear part of the transmission case 15 and the rear part of the vehicle body frame F.

[0040] The vehicle body frame F and a part of the power unit P are covered by a vehicle body cover 17 that includes a left and right pair of footrests 18 on which the feet of the occupant are placed and a floor tunnel section 19 that rises upward between both the footrests 18, and the vehicle body cover 17 is attached to the vehicle body frame F. Also, a rider seat 20 disposed behind the floor tunnel section 19 and a passenger seat 21 disposed behind the rider seat 20 are disposed above the vehicle body cover 17.

[0041] Referring to both Fig. 2 and Fig. 3, the engine body 14 of the internal combustion engine E includes a crankcase 25 rotatably journaling a crankshaft 24 having the axis extending in the vehicle width direction, a cylinder block 26 including a cylinder bore 30 to which a piston 29 is slidably fit and being joined to the crankcase 25, a cylinder head 27 joined to the cylinder block 26, and a head cover 28 joined to the cylinder head 27. The cylinder axis C of the engine body 14 which is the axis of the cylinder bore 30 is inclined slightly to the upper front, and the piston 29 is continuously connected to the crankshaft 24.

[0042] An intake device 32 for supplying the air to a combustion chamber 31 formed between the cylinder block 26 and the cylinder head 27 with the top part of the piston 29 facing thereto includes an air cleaner 33 disposed in the left side part of the rear wheel WR and above the transmission case 15 and supported by the transmission case 15 and a throttle body 34 disposed between the air cleaner 33 and the cylinder head 27, and a fuel injection valve 35 is attached to the upper side wall of the cylinder head 27.

[0043] As shown in Fig. 1, to the lower side wall of the cylinder head 27, an exhaust device 36 for discharging the exhaust gas from the combustion chamber 31 is connected, and the exhaust device 36 includes an exhaust pipe 37 extended rearward below the engine body 14 from the lower side wall of the cylinder head 27, and an exhaust muffler (not illustrated) disposed in the right side part of the rear wheel WR so as to be connected to the downstream end of the exhaust pipe 37.

[0044] The crankcase 25 is formed by joining a first case half body 38 on the right side and a second case half body 39 on the left side to each other, an outer rotor 40 is fixed to the end on the right side of the crankshaft 24 that penetrates the first case half body 38 in a rotatable manner, and an inner stator 41 surrounded by the outer rotor 40 so as to form a generator 42 along with the outer rotor 40 is fixed to a support plate 43 that is fastened to the first case half body 38.

[0045] To the first case half body 38, a tubular generator cover 44 surrounding the generator 42 is joined, and a radiator 45 is disposed on the right side of the generator cover 44. A cooling fan 46 for circulating the cooling air to the radiator 45 is fixed to the crankshaft 24 so as to be disposed between the generator 42 and the radiator 45.

[0046] The transmission gear M stored in the transmission case 15 so as to transmit the rotational power of the crankshaft 24 to the rear wheel WR includes a V-belt type continuously variable transmission 48 that continuously converts the rotational power transmitted from the crankshaft 24, and a reduction gear mechanism (not illustrated) that decelerates the rotational power of the V-belt type continuously variable transmission 48 and transmits the same to an axle 50 (refer to Fig. 1) of the rear wheel 50.

[0047] A driving pulley 51 of the V-belt type continuously variable transmission 48 is arranged on the crankshaft 24 so as to be capable of changing the winding radius of a V-belt 52 and includes a fixed sheave 53 fixed to the crankshaft 24 and a movable sheave 54 supported by the crankshaft 24 so as to be capable of approaching to and departing from the fixed sheave 53 in the direction along the axis of the crankshaft 24, and the movable sheave 54 is disposed on the crankcase 25 side of the fixed sheave 53.

[0048] The movable sheave 54 is driven to the side of approaching the fixed sheave 53 responding to increase of the rotational speed of the crankshaft 24 by an action of a centrifugal shift mechanism 55, and the centrifugal shift mechanism 55 is formed with a weight 58 being held between a cam surface 56 formed in the movable sheave 54 and a weight holding plate 57 that is fixed to the crankshaft 24.

[0049] Referring to both Fig. 4 and Fig. 5, in the cylinder head 27, a pair of intake valves 61 for controlling the intake from the intake device 32 to the combustion chamber 31 and a pair of exhaust valves 62 for controlling the exhaust from the combustion chamber 31 to the exhaust device 36 are openably/closably disposed, both the intake valves 61 are energized to the valve closing direction by a valve spring 63, and both the exhaust valves 62 are energized to the valve closing direction by a valve spring 64. Also, to the left side wall of the cylinder head 27, an ignition plug 65 making the distal end thereof face the combustion chamber 31 is attached, and, in the outer surface of the left side wall of the cylinder head 27, a cylinder head side recess 66 is formed so that a plug attaching seat 66a for attaching the ignition plug 65 is arranged.

[0050] In a valve chamber 67 formed between the cylinder head 27 and the head cover 28 joined to the cylinder head 27 with a gasket 69 being interposed between the cylinder head 27 and the head cover 28, a valve gear 68 that drives opening/closing of the intake valves 61 and the exhaust valves 62 is stored. The valve chamber 67 is surrounded by a side wall of the cylinder head 27 that constitutes a part of the engine body 14 mounted on the vehicle body frame F and is formed inside the engine body 14.

[0051] The valve gear 68 includes a single camshaft 70 common to both the intake valves 61 and both the

exhaust valves 62 and disposed between both the intake valves 61 and both the exhaust valves 62, first and second intake side rocker arms 71, 72 interposingly arranged between both the intake valves 61 and the camshaft 70, and a single exhaust side rocker arm 73 interposingly arranged between both the exhaust valves 62 and the camshaft 70.

[0052] The middle section of the exhaust side rocker arm 73 is rockably journaled to an exhaust side rocker shaft 74 having the axis parallel to the camshaft 70, a roller 76 rollingly contacting an exhaust side cam 75 that is arranged on the camshaft 70 is pivotally supported by an end of the exhaust side rocker arm 73, a pair of joining arm sections 73a, 73b individually corresponding to both the exhaust valves 62 is integrally arranged at the other end of the exhaust side rocker arm 73, and tappet screws 77, 77 abutting upon stem ends 62a of both the exhaust valves 62 are screwed to the joining arm sections 73a, 73b so as to be capable of adjusting the advancing/retreating position.

[0053] The first and second intake side rocker arms 71, 72 are arranged in parallel in an adjoining state in the direction along the axis of the camshaft 70 so that at least either one thereof is interlocked and joined to the intake valve 61 that is an engine valve. In this embodiment, the first and second intake side rocker arms 71, 72 are individually interlocked and joined to the pair of intake valves 61, and are rockably journaled to an intake side rocker shaft 78 having the axis parallel to the camshaft 70. That is, to one ends of the first and second intake side rocker arms 71, 72, tappet screws 79, 79 abutting upon stem ends 61a of the intake valves 61 are screwed respectively so as to be capable of adjusting the advancing/retreating position.

[0054] Also, a roller 82 rollingly contacting a first intake side cam 80 arranged on the camshaft 70 is pivotally supported by the other end of the first intake side rocker arm 71, and a cam slipper 83 contacting a second intake side cam 81 arranged on the camshaft 70 is arranged at the other end of the second intake side rocker arm 72.

[0055] Although the second intake side cam 81 is formed so that the intake valve 61 interlocked and joined to the second intake side rocker arm 72 out of the pair of intake valves 61 is substantially suspended in a joining released state of the first and second intake side rocker arms 71, 72, the second intake side cam 81 is formed so as to have such an outer peripheral surface that the intake valve 61 is slightly opened in order to prevent generation of a fuel sump when the intake valve 61 is entirely made a valve closed and suspended state. That is, the first and second intake side rocker arms 71, 72 are rockably journaled to the cylinder head 27 through the intake side rocker shaft 78 so as to rock in a mutually different rocking mode in a non-joined state thereof.

[0056] The camshaft 70 is rotatably journaled to first and second support walls 85, 86 disposed at positions apart from each other in the direction along the axis of the camshaft 70 and are projectingly arranged so as to be integral with the cylinder head 27. The first and second support walls 85, 86 are formed so as to extend long in the direction perpendicular to the axes of the camshaft 70, the intake side rocker shaft 78, and the exhaust side rocker shaft 74.

[0057] A pair of stud bolts 87, 87 for joining the cylinder block 26 and the cylinder head 27 to the crankcase 25 are disposed between the first support wall 85 and the left side wall of the cylinder head 27 that embraces the first support wall 85 between the first intake side rocker arm 71, and a pair of stud bolts 88, 88 for joining the cylinder block 26 and the cylinder head 27 to the crankcase 25 are disposed at both ends in the longitudinal direction of the second support wall 86. Also, the top part 88a of the stud bolt 88 is disposed on the side departing from the cylinder block 26 in the direction along the cylinder axis C than the top part 87a of the stud bolt 87 that is disposed between the first support wall 85 and the left side wall of the cylinder head 27.

[0058] To an end projecting from the second support wall 86 disposed on the right side out of both ends of the camshaft 70, the rotational power of the crankshaft 24 is transmitted through a timing transmission mechanism 89 decelerated at the deceleration ratio of 1/2. The timing transmission mechanism 89 is formed by winding a cam chain 92 over a driving sprocket 90 (refer to Fig. 2) fixedly arranged on the crankshaft 24 and a driven sprocket 91 fixed to the right end of the camshaft 70 projecting from the second support wall 86, and a cam chain passage 93 disposed on the right side of the cylinder bore 30 so as to make the cam chain travel is formed in the cylinder block 26 and the cylinder head 27.

[0059] A water pump 94 is attached to the right side wall of the cylinder head 27, and a pump shaft 95 included in the water pump 94 crosses the cam chain passage 93 and is joined to the right end of the camshaft 70 so as to be coaxial and unable to rotate relatively.

[0060] Also, the intake side rocker shaft 78 and the exhaust side rocker shaft 74 are disposed on both sides of the camshaft 70, and both ends of the intake side rocker shaft 78 and the exhaust side rocker shaft 74 are fit to and supported by the first and second support walls 85, 86.

[0061] In the first and second intake side rocker arms 71,72, a valve motion characteristics changing means 96 is arranged which switches a state of substantially closing and suspending one intake valve 61 in low-speed operation of the internal combustion engine E by keeping the cam slipper 83 of the second intake side rocker arm 72 contact the second intake side cam 81 regardless of the first intake side rocker arm 71 that follows the first intake side cam 80 and rocks and opening/closing the other intake valve 61 in a motion mode corresponding to the cam profile of the first intake side cam 80, and a state of opening/closing both the intake valves 61 in a motion mode corresponding to the cam profile of the first intake side cam 80 in high-speed operation of the internal combustion engine E by joining the first and second intake

side rocker arms 71, 72 to each other.

[0062] Referring to Fig. 6 also, the valve motion characteristics changing means 96 is arranged in the upper part of the first and second intake side rocker arms 71, 72 between the intake side rocker shaft 78 and the camshaft 70, and includes a first joining pin 97 having the center axis parallel to the intake side rocker shaft 78 and slidably fit to the first and second intake side rocker arms 71, 72 while enabling movement between a joining position for straddling over between the first and second intake side rocker arms 71, 72 and joining the first and second intake side rocker arms 71, 72 to each other and a joining releasing position on the first intake side rocker arm 71 side for being detached from the second intake side rocker arm 72 and releasing joining of the first and second intake side rocker arms 71, 72, a second joining pin 98 slidably fit to the second intake side rocker arm 72 and connected to the first joining pin 97, and a return spring 99 arranged between the second joining pin 98 and the second intake side rocker arm 72 so as to exert a spring force that energizes the first joining pin 97 to the joining releasing side.

[0063] A first fitting hole 100 having the axis parallel to the intake side rocker shaft 78 is arranged in the first intake side rocker arm 71, and a bottomed second fitting hole 101 having the axis parallel to the intake side rocker shaft 78 and including an end wall 101a on the opposite side of the first intake side rocker arm 71 is arranged in the second intake side rocker arm 72. Also, the first and second fitting holes 100, 101 are formed into a circular cross-sectional shape having a same diameter so as to coaxially continue to each other at the timing when the intake valve 61 is in a closed state.

[0064] The first joining pin 97 can slidably fit the first and second fitting holes 100, 101, and is formed into a short cylindrical shape having a pressed section 97a at one end on the opposite side of the second intake side rocker arm 72. Also, the second joining pin 98 is formed into a bottomed cylindrical shape with the side of end wall 101a of the second fitting hole 101 being opened, and the return spring 99 energizing the first and second joining pins 97, 98 abutting upon each other to one side (the right side of Fig. 4 and Fig. 6) in the axial direction is shrinkingly arranged between the second joining pin 98 slidably fit to the second fitting hole 101 and the end wall 101a. Further, in the second intake side rocker arm 72, a communication hole 102 communicating a portion closer to the end wall 101a that is the closed end of the second fitting hole 101 with the outside is arranged so as to cross the second fitting hole 101.

[0065] The valve motion characteristics changing means 96 joins the first and second intake side rocker arms 71, 72 to each other by fitting a part of the first joining pin 97 to the second fitting hole 101 resisting the spring force of the return spring 99, and comes to release joining of the first and second intake side rocker arms 71, 72 by moving the first and second joining pins 97, 98 in the axial direction by the spring force of the return spring 99 until the abutment surface of the first and second joining pins 97, 98 is disposed between the first and second intake side rocker arms 71, 72.

[0066] A press rod 104 having a pressing section 104a abutting upon the pressed section 97a at one end of the first joining pin 97 at an end on the first joining pin 97 side is supported by the first support wall 85 that opposes the first intake side rocker arm 71 from the opposite side of the second intake side rocker arm 72 so as to be movable in the direction parallel to the intake side rocker shaft 78 while enabling pressing the first joining pin 97 to the joining position side, and, in the present embodiment, the press rod 104 is slidably fit to a press rod support hole 106 arranged in the first support wall 85 so as to extend in parallel with a rocker shaft support hole 105 that is arranged in the first support wall 85 so as to insert therethrough and to support one end of the intake side rocker shaft 78.

[0067] Also, the press rod 104 includes the pressing section 104a abutting upon the pressed section 97a of the first joining pin 97 at an end on the first joining pin 97 side, and is formed to have a diameter smaller than that of the first joining pin 97. In the inside of the first intake side rocker arm 71 in the direction along the axis of the intake side rocker shaft 78, a storage hole 113 storing the abutment section of the pressed section 97a of the first joining pin 97 and the pressing section 104a of the press rod 104 is formed so as to allow the relative movement of the press rod 104 with respect to rocking of the first intake side rocker arm 71. That is, the storage hole 113 is formed to have such a size that the press rod 104 does not interfere with the inner wall surface of the storage hole 113 in the maximum lift state and the minimum lift state of the first intake side rocker arm 71.

[0068] The first fitting hole 100 making the first joining pin 97 slidably fit thereto and the storage hole 113 continue to each other and are arranged in the first intake side rocker arm 71 while offsetting the center axis C_1 of the storage hole 113 to the intake side rocker shaft 78 side (downward) of the center axis C_2 of the first fitting hole 100, a step 114 facing the second intake side rocker arm 72 side is formed between the first fitting hole 100 and the storage hole 113, and the first joining pin 97 abuts upon the step 114 at the joining releasing position. Also, the center axis C_3 of the press rod 104 is disposed so as to be offset further to the intake side rocker shaft 78 side (downward) of the center axis C_1 of the storage hole 113.

[0069] In the head cover 28 of the engine body 14, a flat attaching surface 111 for attaching a solenoid 107 that is an actuator for imparting a pressing force to the press rod 104 is formed, and an attaching plate 109 is fixed to a housing 108 of the solenoid 107. In the attaching plate 109, a plurality of fastened arm sections or first and second fastened arm sections 109a, 109b in the present embodiment projecting radially from the housing 108 are arranged integrally, and distal ends of the fastened arm sections 109a, 109b are fastened to the head cover 28 by bolts 110, 110 which are fastening members. That is,

the solenoid 107 is fastened only to the head cover 28, and a harness 135 is extended from the solenoid 107.

[0070] Also, as shown in Fig. 2, the solenoid 107 is attached to the side wall that is the left side wall of the head cover 28 on the same side of the ignition plug 65 attached to the left side wall of the cylinder head 27 that is the opposite side of the water pump 94 with the cylinder axis C in between by the bolts 110, 110, and is disposed so as to avoid that the housing 108 overlaps with the extension of the center axis CP of the ignition plug 65.

[0071] That is, the ignition plug 65 and the solenoid 107 are disposed on the side facing one side in the vehicle width direction (the left side in the present embodiment) of the engine body 14 that is rockably journaled to the vehicle body frame F, and the housing 108 of the solenoid 107 is disposed upper than the center axis CP of the ignition plug 65 in a side view.

[0072] The distal end of the first fastened arm section 109a that is nearest to the ignition plug 65 on a projected plan (refer to Fig. 4) to a flat plane perpendicular to the working axis CS of the solenoid 107 out of the first and second fastened arm sections 109a, 109b is disposed at a position farther than the distal end of the second fastened arm section 109b that is farthest from the ignition plug 65 out of the first and second fastened arm sections 109a, 109b in the direction along the center axis CP of the ignition plug 65 as shown in Fig. 3.

[0073] As shown in Fig. 3 and Fig. 5, a breather plate 116 forming a breather chamber 115 between the head cover 28 and the breather plate 116 is attached to the head cover 28, and a fastening boss 117 whose axis is disposed at a position departing from the cylinder head 27 than the breather plate 116 in the direction along the cylinder axis C is arranged in the head cover 28 so as to fasten the distal end of the first fastened arm section 109a.

[0074] Referring to Fig. 7-Fig. 9 also, a head cover side recess 118 continuing to the cylinder head side recess 66 that is formed in the left side wall of the cylinder head 27 is formed in the left side wall of the head cover 28, and a solenoid storing recess 112 as an actuator storing recess storing a part of the solenoid 107 and forming the attaching surface 111 is formed so as to be recessed to the stud bolt 87 side at a position adjacent to the head cover side recess 118.

[0075] The fastening boss 117 for fastening the first fastened arm section 109a by the bolt 110 is arranged in the head cover 28 so as to be disposed within the head cover side recess 118. Also, the fastening boss 117 is disposed so as to avoid that the bolt 110 for fastening the first fastened arm section 109a overlaps with a bottom section 118a of the head cover side recess 118 and the center axis CP of the ignition plug 65 as viewed from the direction along the cylinder axis C. Further, the inner end of the fastening boss 117 is arranged integrally so as to continue to and to be integral with a wall section 28a that is projectingly arranged integrally with the inner surface of the head cover 28 so as to form the breather chamber 115 along with the breather plate 116.

[0076] Also, as shown in Fig. 3, the axis of the fastening boss 117 is disposed at a position apart from the cylinder head 27 than the breather plate 116 in the direction along the cylinder axis C.

[0077] An outlet section 119 which communicates with the breather chamber 115 and to which a breather hose 120 is joined is arranged on the outer surface of the head cover 28 so as to be directed to a direction different from the side wall side of the head cover 28 to which the solenoid 107 is attached. In the present embodiment, the solenoid 107 is attached to the left side wall of the head cover 28, whereas the outlet section 119 is arranged on the outer surface of the head cover 28 so as to be directed to the side part on the right side.

[0078] As shown in Fig. 5 and Fig. 9, between the first support wall 85 and the left side wall of the cylinder head 27, stud bolt bosses 121,121 having bolt fastening surfaces 121a, 121a for fastening the stud bolts 87, 87 at the top part and arranged integrally with the cylinder head 27 are arranged so that the stud bolts 87, 87 are inserted therethrough, and nuts 122,122 abutting upon and engaging with the bolt fastening surfaces 121a, 121a are screwed to the stud bolts 87, 87.

[0079] The bolt fastening surface 121a is formed so that the top part 87a of the stud bolt 87 is positioned on the cylinder block 26 side of the working axis CS of the solenoid 107 in the direction along the cylinder axis C, and the top part 87a of the stud bolt 87 is disposed at a position overlapping with at least a part of the solenoid 107 as viewed from the direction along the cylinder axis C as shown in Fig. 6.

[0080] In the meantime, a joining surface 123 of the cylinder head 27 and the head cover 28 is disposed on the cylinder block 26 side of the solenoid 107 in the direction along the cylinder axis C, and knock members 124, 124 are arranged on both sides of the solenoid 107 and between the left side wall of the head cover 28 and the left side wall of the cylinder head 27.

[0081] In the left side wall of the head cover 28, the solenoid storing recess 112 disposed at a position departing from the top part 87a of the stud bolt 87 to the opposite side of the bolt fastening surface 121a in the direction along the cylinder axis C is formed so as to be recessed to the stud bolt 87 side, and the solenoid 107 is attached only to the head cover 28 so that at least a part thereof (a part in the present embodiment) is stored by and disposed in the solenoid storing recess 112.

[0082] Also, the attaching surface 111 of the solenoid 107 formed in the head cover 28 is disposed at a position overlapping with at least a part of the stud bolt boss 121 disposed in the upper part out of two stud bolt bosses 121, 121 which are disposed between the first support wall 85 and the left side wall of the cylinder head 27 as viewed from the direction along the cylinder axis C as shown in Fig. 6.

[0083] The solenoid 107 attached to the attaching surface 111 includes an output shaft 125 that projects in an

ON state by excitation thereof, and a guide tube 126 included in the housing 108 so as to guide movement of the output shaft 125 in the axial direction is fit into an attaching hole 127 arranged in the attaching surface 111.

[0084] Also, a first seal member 128 that seals the gap between the output shaft 125 of the solenoid 107 and the guide tube 126 of the housing 108 and a second seal member 129 that seals the gap between the guide tube 126 and the attaching hole 127 are disposed on the same flat plane perpendicular to the axis of the output shaft 125.

[0085] The working axis CS of the solenoid 107 which is the center axis of the output shaft 125 is disposed lower than the center axis of the first joining pin 97 in the valve motion characteristics changing means 96, and the projected end of the output shaft 125 from the guide tube 126 is made to abut upon the pressure receiving section 104b of a disk shape formed integrally with the end on the solenoid 107 side of the press rod 104.

[0086] Watching Fig. 4 and Fig. 6, in the second support wall 86 of the cylinder head 27, an oil channel 130 leading lubricating oil led from the crankcase 25 to the intake side rocker shaft 78 side through the cylinder block 26 is formed, and the lubricating oil circulating through the oil channel 130 is led to the camshaft 70 side through an oil cannel 131 that is formed coaxially with the intake side rocker shaft 78.

[0087] Next, actions of the present embodiment will be described. Because the solenoid 1107 is attached only to the side wall of the head cover 28 and on the same side of the ignition plug 65 that is attached to the side wall of the cylinder head 27 and heat transfer from the cylinder head 27 to the head cover 28 is suppressed since the gasket 69 is interposed between the cylinder head 27 and the head cover 28, thermal impact can be suppressed from being exerted to the solenoid 107 from the cylinder head 27, and undesired temperature rise of the solenoid 107 can be prevented. Also, because the housing 108 of the solenoid 107 is disposed so as to avoid overlapping with extension of the center axis CP of the ignition plug 65, even when the ignition plug 65 and the solenoid 107 are disposed on the side surface on the same side of the engine body 14, the maintenance space for the ignition plug 65 can be secured. Further, because the solenoid 107 is attached to the head cover 28 by the plurality of bolts 110, it is also easy to dispose the fastening positions of the solenoid 107 by these bolts 110 at positions apart from the ignition plug 65 so as not to become obstacles for maintenance of the ignition plug 65. As a result, in a motorcycle in which the maintenance space is liable to become narrow, a space can be secured on the center axis CP of the ignition plug 65, and attaching/detaching of the ignition plug 65 can be executed easily.

[0088] Also, the distal ends of the first and second fastened arm sections 109a, 109b which are arranged in the housing 108 of the solenoid 107 and are projecting radially from the housing 108 are fastened to the head cover 28 by the bolts 110 respectively, the distal end of the first fastened arm section 109a that is nearest to the ignition plug 65 on a projected plan (refer to Fig. 4) to a flat plane perpendicular to the working axis CS of the solenoid 107 out of the first and second fastened arm sections 109a, 109b is disposed at a position farther from the ignition plug 65 than a distal end of the second fastened arm section 109b that is farthest from the ignition plug 65 out of the first and second fastened arm sections 109a, 109b in the direction along the center axis CP of the ignition plug 65 (refer to Fig. 3), therefore the distal end of the first fastened arm section 109a can be made to hardly become obstacle in attaching/detaching work of the ignition plug 65, and the maintainability of the ignition plug 65 improves.

[0089] Also, because the fastening boss 117 whose axis is disposed at a position departing from the cylinder head 27 than the breather plate 116 attached to the head cover 28 so as to form the breather chamber 115 between the head cover 28 and the breather plate 116 in the direction along the cylinder axis C is arranged in the head cover 28 so as to fasten the distal end of the first fastened arm section 109a, the fastening boss 117 hardly becomes an obstacle in attaching the breather plate 116 to the head cover 28, and attaching of the breather plate 116 to the head cover 28 becomes easy.

[0090] Also, the cylinder head side recess 66 is formed on the left side wall of the cylinder head 27 so that the plug attaching seat 66a for attaching the ignition plug 65 is arranged, the head cover side recess 118 continuing to the cylinder head side recess 66 is formed on the left side wall of the head cover 28, the fastening boss 117 is arranged in the head cover 28 at a position avoiding overlapping of the bolt 110 for fastening the first fastened arm section 109a to the fastening boss 117 out of the plurality of bolts 110 with the bottom section 118a of the head cover side recess 118 and the center axis CP of the ignition plug 65 as viewed from the direction along the cylinder axis C, therefore projection of the fastening boss 117 to the inner surface side of the head cover 28 can be suppressed, and the volume of the breather chamber 115 inside the head cover 28 can be secured sufficiently. Further, the bolt 110 for fastening the first fastened arm section 109a to the fastening boss 117 can be made not to obstruct the maintenance of the ignition plug 65, and the maintenance space for the ignition plug 65 can be secured widely.

[0091] Also, because the solenoid 107 and the ignition plug 65 are disposed on a side facing one side in the vehicle width direction (the left side in the present embodiment) of the engine body 14 that is rockably journaled to the vehicle body frame F, it is easy to get access to the solenoid 107 and the ignition plug 65 from one side in the vehicle width direction, and the maintainability can be improved. Further, because the housing 108 of the solenoid 107 is disposed higher than the center axis CP of the ignition plug 65 in a side view, the harness 135 connected to the solenoid 107 can be laid on the vehicle body frame F side without straddling over the center axis

CP of the ignition plug 65, and the maintenance space of the ignition plug 65 can be secured more.

[0092] Also, because the outlet section 119 which communicates with the breather chamber 115 and to which the breather hose 120 is joined is arranged in the outer surface of the head cover 28 so as to be oriented to a direction different from the side wall side of the head cover 28 to which the solenoid 107 is attached, interference of the breather hose 120 and the solenoid 107 with each other can be prevented easily.

[0093] Also, because the water pump 94 is attached to the right side wall of the cylinder head 27 and on the opposite side of the solenoid 107 with the cylinder axis C in between, the solenoid 107 and the water pump 94 which are heavy items come to be disposed separately so as to embrace the cylinder axis C, the weight balance around the cylinder head 27 improves, and interference of the solenoid 107 and the water pump 94 with each other can be easily avoided.

[0094] Also, because the first support wall 85 that supports the intake side rocker shaft 78 and the stud bolt bosses 121 which are disposed between the left side wall of the cylinder head 27 and the first support wall 85 so that the stud bolts 87 joining the cylinder head 27 and the cylinder block 26 to the crankcase 25 are inserted are arranged in the cylinder head 27 and the bolt fastening surfaces 121a of the stud bolt bosses 121 are formed so that the top parts of the stud bolts 87 are positioned on the cylinder block 26 side of the working axis CS of the solenoid 107 in the direction along the cylinder axis C, projection of the solenoid 107 from the head cover 28 in the direction along the cylinder axis C can be suppressed, because the top parts of the stud bolts 87 are disposed at positions overlapping with at least a part of the solenoid 107 as viewed from the direction along the cylinder axis C, the projection amount of the solenoid 107 from the head cover 28 in the direction perpendicular to the cylinder axis C can be suppressed also, and the maintenance space for the ignition plug 65 can be secured effectively.

[0095] Also, the joining surface 123 of the cylinder head 27 and the head cover 28 is disposed on the cylinder block 26 side of the solenoid 107 in the direction along the cylinder axis C, the solenoid storing recess 112 disposed at a position departing to the opposite side of the bolt fastening surface 121a from the top part of the stud bolt 87 in the direction along the cylinder axis C is formed in the left side wall of the head cover 28 so as to be recessed to the stud bolt 87 side, the solenoid 107 is attached to the head cover 28 so that a part thereof is disposed in the solenoid storing recess 112, and therefore such configuration described above that the top part of the stud bolt boss 121 is made to overlap with at least a part of the solenoid 107 as viewed from the direction along the cylinder axis C can be secured easily.

[0096] Also, because the bolt fastening surfaces 121a of the stud bolt bosses 121 are disposed so that the top parts of the stud bolts 87 are disposed on the cylinder block 26 side of the center axis of the press rod 104 in the direction along the cylinder axis C, projection of the solenoid 107 from the engine body 14 in the direction along the cylinder axis C can be suppressed. Further, because the top parts of the stud bolts 87 are disposed so as to overlap with at least a part of the solenoid 107 as viewed from the direction along the cylinder axis C, projection of the solenoid 107 from the engine body 14 in the direction perpendicular to the cylinder axis C can be suppressed, and the solenoid 107 can be disposed compactly around the engine body 14.

[0097] Also, because the joining surface 123 of the cylinder head 27 and the head cover 28 is disposed on the cylinder block 26 side of the solenoid 107 in the direction along the cylinder axis C, it is easy to form the solenoid storing recess 112 recessed to the stud bolt 87 side as viewed from the direction along the cylinder axis C above the top part of the stud bolt 87 and in the side wall of the head cover 28. Further, because the solenoid 107 is attached to the head cover 28 so that at least a part thereof is disposed in the solenoid storing recess 112, it is easy to dispose the solenoid 107 so that at least a part of the solenoid 107 overlaps with the top part of the stud bolt 87 as viewed from the direction along the cylinder axis C, and the temperature rise of the solenoid 107 can be suppressed by attaching the solenoid 107 to the head cover 28 that is apart from the combustion chamber 31.

[0098] Also, because the attaching surface 111 of the solenoid 107 formed in the left side wall of the head cover 28 is disposed at a position overlapping with the stud bolt boss 121 as viewed from the direction along the cylinder axis C, the attaching surface 111 can be disposed closer to the cylinder axis C side, and the projection amount of the solenoid 107 from the engine body 14 can be effectively suppressed.

[0099] Also, because the solenoid 107 is attached to the attaching surface 111 while fitting a part of the housing 108 into the attaching hole 127 arranged in the attaching surface 111 and the first seal member 128 that seals the gap between the output shaft 125 of the solenoid 107 and the housing 108 and the second seal member 129 that seals the gap between the housing 108 and the attaching hole 127 are disposed on the same flat plane perpendicular to the axis of the output shaft 125, the projection amount of the solenoid 107 from the engine body 14 can be more effectively suppressed.

[0100] Also, because the knock member 124 is arranged between the head cover 28 and the cylinder head 27, a part of the load applied to the head cover 28 side when the press rod 104 is driven by motion of the solenoid 107 attached to the head cover 28 is dispersed to the cylinder head 27 side through the knock member 124, and the pressing movement accuracy of the first and second joining pins 97,98 which is the motion mode switching accuracy of the intake valve 61 can be improved.

[0101] Also, because the solenoid storing recess 112 is formed in the left side wall that faces one side in the vehicle width direction of the head cover 28 constituting

a part of the engine body 14 that is vertically rockably journaled to the vehicle body frame F, projection of the solenoid 107 to the vehicle width direction can be effectively suppressed, interference of the solenoid 107 with the vehicle body frame F and other components such as the storage box and the like disposed around the engine body 14 caused by rocking of the engine body 14 can be prevented easily, the vehicle width is made compact to improve straddling performance of the occupant, the solenoid 107 can be easily got access from the left side in the vehicle width direction, and the maintainability can be improved.

[0102] Also, because the working axis CS of the solenoid 107 is disposed lower than the center axis C1 of the first joining pin 97, upward projection of the solenoid 107 from the engine body 14 rocking vertically can be also suppressed, and interference of the solenoid 107 with the components such as the storage box and the like disposed above the engine body 14 can be prevented effectively.

[0103] Although the embodiments of the present invention have been described above, the present invention is not limited to the embodiments described above, and various design change can be executed without departing from the present invention described in the claims.

[0104] For example, although a case of using the intake valve 61 as an engine valve was described in the embodiments described above, the present invention can be applied to a case using an exhaust valve as an engine valve.

[0105] Further, although a case of using the solenoid 107 as an actuator was described in the embodiments described above, it is also possible to use an actuator working by oil hydraulic pressure.

Reference Signs List

[0106]

14... Engine body
27... Cylinder head
28... Head cover
61... Intake valve that is engine valve
65... Ignition plug
67... Valve chamber
71... First intake side rocker arm that is first rocker arm
72... Second intake side rocker arm that is second rocker arm
66... Cylinder head side recess
66a... Plug attaching seat
78... Intake side rocker shaft that is rocker shaft
85... Support wall
87... Stud bolt
87a... Top part of stud bolt
94... Water pump
97... Joining pin
104... Press rod
107... Solenoid that is actuator
108... housing
109a... First fastened arm section
109b... Second fastened arm section
110... Bolt that is fastening member
111... Attaching surface
112... Solenoid storing recess as actuator storing recess
115... Breather chamber
116... Breather plate
117... Fastening boss
118... Head cover side recess
118a... Bottom of head cover side recess
119...Outlet section
120... Breather hose
121... Stud bolt boss
121a ... Bolt fastening surface
123... Joining surface
124... Knock member
125... Output shaft
127... Attaching hole
128... First seal member
129... Second seal member
C... Cylinder axis
C3 ... Center axis of press rod
CP... Center axis of ignition plug
CS... Working axis of solenoid or Center axis of actuator
F... Vehicle body frame

Claims

1. A variable valve gear of an internal combustion engine for a saddle-ride type vehicle in which: a valve chamber (67) is formed between a cylinder head (27) and a head cover (28) joined to each other while constituting a part of an engine body (14) mounted on a vehicle body frame (F); first and second rocker arms (71,72) arrayed adjacent to each other inside the valve chamber (67) with at least either one thereof being interlocked and joined to an engine valve (61) are rockably journaled to the cylinder head (27) through a rocker shaft (78) so as to be rockable in rocking modes different from each other when the rocker arms (71,72) are in a non-joined state; a joining pin (97) having a center axis parallel to the rocker shaft (78) is slidably fit to the first and second rocker arms (71,72) so as to be movable between a joining position for straddling over between the first and second rocker arms (71,72) and joining both the rocker arms (71,72) to each other and a joining releasing position for being separated from the second rocker arm (72) and releasing joining of both the rocker arms (71,72); and a press rod (104) to which a press force is imparted from a solenoid (107) attached to the engine body (14) is made to abut upon one end of

the joining pin (97) on the opposite side of the second rocker arm (72),
wherein the solenoid (107) is attached only to a side wall of the head cover (27) on the same side of an ignition plug (65) that is attached to a side wall of the cylinder head (27) by a plurality of fastening members (110) so as to avoid that a housing (108) of the solenoid (107) and extension of the center axis (CP) of the ignition plug (65) overlap with each other,
characterized in that
the solenoid (107) and the ignition plug (65) are disposed on a side facing one side in the vehicle width direction of the engine body (14) that is rockably journaled to the vehicle body frame (F); and
the housing (108) of the solenoid (107) is disposed higher than the center axis (CP) of the ignition plug (65) in a side view.

2. The variable valve gear of an internal combustion engine for a saddle-ride type vehicle according to claim 1,
wherein: distal ends of a plurality of fastened arm sections (109a, 109b) arranged in the housing (108) of the solenoid (107) and projecting radially from the housing (108) are each fastened to the head cover (28) by the fastening members (110); and
a distal end of the first fastened arm section (10ga) that is nearest to the ignition plug (65) on a projected plan to a flat plane perpendicular to a working axis (CS) of the solenoid (107) out of the plurality of fastened arm sections (109a, 109b) is disposed at a position far from the ignition plug (65) than a distal end of the other fastened arm section (109b) that is farthest from the ignition plug (65) out of the plurality of fastened arm sections (109a, 109b) in a direction along the center axis (CP) of the ignition plug (65).

3. The variable valve gear of an internal combustion engine for a saddle-ride type vehicle according to claim 2, wherein
a fastening boss (117) whose axis is disposed at a position apart from the cylinder head (27) than a breather plate (116) that is attached to the head cover (28) so as to form a breather chamber (115) between the head cover (28) and the breather plate (116) in a direction along a cylinder axis (C) of the engine body (14) is arranged in the head cover (28) so as to fasten the distal end of the first fastened arm section (109a).

4. The variable valve gear of an internal combustion engine for a saddle-ride type vehicle according to claim 3,
wherein: a cylinder head side recess (66) is formed on the side wall of the cylinder head (27) so that a plug attaching seat (66a) for attaching the ignition plug (65) is arranged;
a head cover side recess (118) continuing to the cylinder head side recess (66) is formed on the side wall of the head cover (28); and
the fastening boss (117) is arranged in the head cover (28) so that the fastening member (110) for fastening the first fastened arm section (109a) to the fastening boss (117) out of the plurality of fastening members (110) is fastened at a position avoiding overlapping of a bottom section (118a) of the head cover side recess (118) and the center axis (CP) of the ignition plug (65) with each other as viewed from a direction along the cylinder axis (C).

5. The variable valve gear of an internal combustion engine for a saddle-ride type vehicle according to claim 3,
wherein an outlet section (119) which communicates with the breather chamber (115) and to which a breather hose (120) is connected is arranged on an outer surface of the head cover (28) so as to be oriented to a direction different from the side wall side of the head cover (28) to which the solenoid (107) is attached.

6. The variable valve gear of an internal combustion engine for a saddle-ride type vehicle according to any one of claims 1 to 5,
wherein a water pump (94) is attached to the other side wall of the cylinder head (27) and on the opposite side of the solenoid (107) with the cylinder axis (C) of the engine body (14) in between.

7. The variable valve gear of an internal combustion engine for a saddle-ride type vehicle according to any one of claims 1 to 6,
wherein: a support wall (85) that supports the rocker shaft (78) and stud bolt bosses (121) disposed between the side wall of the cylinder head (27) and the support wall (85) so that stud bolts (87) joining the cylinder head (27) and a cylinder block (26) to a crankcase (25) are inserted are arranged in the cylinder head (27);
bolt fastening surfaces (121a) of the stud bolt bosses (121) are formed so that top parts (87a) of the stud bolts (87) are positioned on the cylinder block (26) side of the working axis (CS) of the solenoid (107) in a direction along the cylinder axis (C) of the engine body (14); and
the top parts (87a) of the stud bolts (87)are disposed at positions overlapping with at least a part of the solenoid (107) as viewed from a direction along the cylinder axis (C).

8. The variable valve gear of an internal combustion engine for a saddle-ride type vehicle according to claim 7,
wherein: a joining surface (123) of the cylinder head (27) and the head cover (28) is disposed on the cylinder block (26) side of the solenoid (107) in a direc-

tion along the cylinder axis (C);
a solenoid storing recess (112) disposed at a position departing to the opposite side of the bolt fastening surface (121a) from the top part (87a) of the stud bolt (87) in a direction along the cylinder axis (C) is formed in the side wall of the head cover (28) so as to be recessed to the stud bolt (87) side; and
the solenoid (107) is attached to the head cover (28) so that at least a part thereof is stored in the solenoid storing recess (112).

9. The variable valve gear of an internal combustion engine for a saddle-ride type vehicle according claim 8,
wherein an attaching surface (111) of the solenoid (107) formed on the side wall of the head cover (28) is disposed at a position overlapping with the stud bolt boss (121) as viewed from the direction along the cylinder axis (C).

10. The variable valve gear of an internal combustion engine for a saddle-ride type vehicle according to claim 9,
wherein: a housing (108) is attached to the attaching surface (111) while fitting a part of the housing (108) included in the solenoid (107) to an attaching hole (127) arranged in the attaching surface (111); and
a first seal member (128) that seals the gap between an output shaft (125) of the solenoid (107) and the housing (108) and a second seal member (129) that seals the gap between the housing (108) and the attaching hole (127) are disposed on the same flat plane perpendicular to the axis of the output shaft (125).

11. The variable valve gear of an internal combustion engine for a saddle-ride type vehicle according to any one of claims 8 to 10, wherein knock members (124) are arranged between the head cover (28) and the cylinder head (27).

12. The variable valve gear of an internal combustion engine for a saddle-ride type vehicle according to any one of claims 8 to 11, wherein the solenoid storing recess (112) is formed in the side wall that faces one side in the vehicle width direction of the head cover (28) that constitutes a part of the engine body (14) vertically rockably journaled to the vehicle body frame (F).

13. The variable valve gear of an internal combustion engine for a saddle-ride type vehicle according to claim 12, wherein the working axis (CS) of the solenoid (107) is disposed lower than the center axis of the joining pin (97).

Patentansprüche

1. Variabler Ventiltrieb eines Verbrennungsmotors für ein Sattelsitzfahrzeug, in dem:

eine Ventilkammer (67) zwischen einem Zylinderkopf (27) und einem Kopfdeckel (28), die miteinander verbunden sind, ausgebildet ist, während sie einen Teil eines Motorkörpers (14) bildet, der auf einem Fahrzeugkarosserierahmen (F) montiert ist;
erste und zweite Kipphebelarme (71, 72) benachbart zueinander im Inneren der Ventilkammer (67) angeordnet sind, wobei wenigstens einer von ihnen, der mit einem Motorventil (61) ineinandergreift und damit verbunden ist, durch eine Kipphebelwelle (78) kippbar mit dem Zylinderkopf (27) verzapft ist, so dass er in voneinander verschiedenen Kippbetriebsarten kippbar ist, wenn die Kipphebelarme (71, 72) in einem nicht verbundenen Zustand sind; ein Verbindungsstift (97) mit einer Mittelachse parallel zu der Kipphebelwelle (78) verschiebbar an die ersten und zweiten Kipphebelarme (71, 72) angepasst ist, so dass er zwischen einer Verbindungsposition zum Grätschen über den ersten und zweiten Kipphebelarmen (71, 72) und Verbinden der beiden Kipphebelarme (71, 72) miteinander und einer Verbindungslöseposition, so dass er von dem zweiten Kipphebelarm (72) getrennt ist, und Lösen beider Kipphebelarme (71, 72) beweglich ist; und wobei eine Druckstange (104), welcher von einem Elektromagneten (107), der an dem Motorkörper (14) angebracht ist, eine Druckkraft verliehen wird, dazu gebracht wird, auf einem Ende des Verbindungsstifts (97) auf der gegenüberliegenden Seite des zweiten Kipphebelarms (72) aufzuliegen,
wobei der Elektromagnet (107) nur an einer Seitenwand des Kopfdeckels (27) auf der gleichen Seite einer Zündkerze (65) angebracht ist, die durch mehrere Befestigungselemente (110) an einer Seitenwand des Zylinderkopfs (27) angebracht ist, um zu vermeiden, dass ein Gehäuse (108) des Elektromagneten (107) und eine Verlängerung der Mittelachse (CP) der Zündkerze (65) einander überlappen,
dadurch gekennzeichnet, dass
der Elektromagnet (107) und die Zündkerze (65) auf einer Seite angeordnet sind, die einer Seite in der Fahrzeugbreitenrichtung des Motorkörpers (14) zugewandt ist, der kippbar mit dem Fahrzeugkarosserierahmen (F) verzapft ist; und
das Gehäuse (108) des Elektromagneten (107) in einer Seitenansicht höher als die Mittelachse (CP) der Zündkerze (65) angeordnet ist.

2. Variabler Ventiltrieb eines Verbrennungsmotors für

ein Sattelsitzfahrzeug nach Anspruch 1,
wobei: distale Enden mehrerer befestigter Armabschnitte (109a, 109b), die in dem Gehäuse (108) des Elektromagneten (107) angeordnet sind und radial von dem Gehäuse (108) vorstehen, jeweils durch die Befestigungselemente (110) an dem Kopfdeckel (28) befestigt sind; und
ein distales Ende des ersten befestigten Armabschnitts (109a), der auf einem auf eine flache Ebene senkrecht zu einer Wirkachse (CS) des Elektromagneten (107) projizierten Plan aus den mehreren befestigten Armabschnitten (109a, 109b) am nächsten zu der Zündkerze (65) ist, an einer Position weiter weg von der Zündkerze (65) positioniert ist als ein distales Ende des anderen befestigten Armabschnitts (109b), der aus den mehreren befestigten Armabschnitten (109a, 109b) in einer Richtung entlang der Mittelachse (CP) der Zündkerze (65) am weitesten von der Zündkerze (65) ist.

3. Variabler Ventiltrieb eines Verbrennungsmotors für ein Sattelsitzfahrzeug nach Anspruch 2, wobei
ein Befestigungsansatz (117), dessen Achse an einer Position weiter entfernt von dem Zylinderkopf (27) als eine Entlüfterplatte (116) angeordnet ist, die an dem Kopfdeckel (28) angebracht ist, um eine Entlüfterkammer (115) zwischen dem Kopfdeckel (28) und der Entlüfterplatte (116) in einer Richtung entlang einer Zylinderachse (C) des Motorkörpers (14) zu bilden, in dem Kopfdeckel (28) angeordnet ist, um das distale Ende des ersten befestigten Armabschnitts (109a) zu befestigen.

4. Variabler Ventiltrieb eines Verbrennungsmotors für ein Sattelsitzfahrzeug nach Anspruch 3,
wobei: eine zylinderkopfseitige Vertiefung (66) auf der Seitenwand des Zylinderkopfs (27) ausgebildet ist, so dass ein Kolbenbefestigungssitz (66a) zum Befestigen der Zündkerze (65) eingerichtet ist;
eine kopfdeckelseitige Vertiefung (118), die sich zu der zylinderkopfseitigen Vertiefung (66) fortsetzt, auf der Seitenwand des Kopfdeckels (28) ausgebildet ist; und
der Befestigungsansatz (117) in dem Kopfdeckel (28) angeordnet ist, so dass das Befestigungselement (110) zum Befestigen des ersten befestigen Armabschnitts (109a) an dem Befestigungsansatz (117) aus den mehreren Befestigungselementen (110) an einer Position befestigt ist, die das Überlappen eines unteren Abschnitts (118a) der kopfdeckelseitigen Vertiefung (118) und der Mittelachse (CP) der Zündkerze (65) miteinander in einer Richtung entlang der Zylinderachse (C) gesehen vermeidet.

5. Variabler Ventiltrieb eines Verbrennungsmotors für ein Sattelsitzfahrzeug nach Anspruch 3,
wobei ein Auslassabschnitt (119), der mit der Entlüftungskammer (115) in Verbindung steht und mit dem ein Entlüftungsschlauch (120) verbunden ist, auf einer Außenoberfläche des Kopfdeckels (28) angeordnet ist, so dass er in eine andere Richtung als die Seitenwandseite des Kopfdeckels (28) orientiert ist, an welcher der Elektromagnet (107) angebracht ist.

6. Variabler Ventiltrieb eines Verbrennungsmotors für ein Sattelsitzfahrzeug nach einem der Ansprüche 1 bis 5,
wobei eine Wasserpumpe (94) an der anderen Seitenwand des Zylinderkopfs (27) und auf der gegenüberliegenden Seite des Elektromagneten (107) mit der Zylinderachse (C) des Motorkörpers (14) dazwischen angeordnet ist.

7. Variabler Ventiltrieb eines Verbrennungsmotors für ein Sattelsitzfahrzeug nach einem der Ansprüche 1 bis 6,
wobei: eine Haltewand (85), die die Kipphebelwelle (78) und Gewindebolzenansätze (121) hält, die zwischen der Seitenwand des Zylinderkopfs (27) und der Haltewand (85) angeordnet sind, so dass Gewindebolzen (87), die den Zylinderkopf (27) und einen Zylinderblock (26) mit einem Kurbelgehäuse (25) verbinden, eingesetzt sind, in dem Zylinderkopf (27) angeordnet sind;
Bolzenbefestigungsoberflächen (121a) der Gewindebolzenansätze (121) derart ausgebildet sind, dass obere Teile (87a) der Gewindebolzen (87) auf der Seite der Wirkachse (CS) des Elektromagneten (107) des Zylinderblocks (26) in einer Richtung entlang der Zylinderachse (C) des Motorkörpers (14) positioniert sind; und
die oberen Teile (87a) der Gewindebolzen (87) an Positionen angeordnet sind, die aus einer Richtung entlang der Zylinderachse (C) wenigstens einen Teil des Elektromagneten (107) überlappen.

8. Variabler Ventiltrieb eines Verbrennungsmotors für ein Sattelsitzfahrzeug nach Anspruch 7,
wobei: eine Verbindungsoberfläche (123) des Zylinderkopfs (27) und der Kopfdeckel (28) in einer Richtung entlang der Zylinderachse (C) auf der Zylinderblockseite (26) des Elektromagneten (107) angeordnet sind;
eine Elektromagnetlagervertiefung (112), die an einer Position angeordnet ist, die von dem oberen Teil (87a) des Gewindebolzens (87) in einer Richtung entlang der Zylinderachse (C) zu der gegenüberliegenden Seite der Bolzenbefestigungsoberfläche (121a) abweicht, in einer Seitenwand des Kopfdeckels (28) ausgebildet ist, so dass sie zu der Seite des Gewindebolzens (87) vertieft ist; und
der Elektromagnet (107) an dem Kopfdeckel (28) angebracht ist, so dass ein Teil davon in der Elektromagnetlagervertiefung (112) gelagert ist.

9. Variabler Ventiltrieb eines Verbrennungsmotors für ein Sattelsitzfahrzeug nach Anspruch 8, wobei eine Befestigungsoberfläche (111) des Elektromagneten (107), die auf der Seitenwand des Kopfdeckels (28) ausgebildet ist, an einer Position angeordnet ist, die aus der Richtung entlang der Zylinderachse (C) gesehen mit dem Gewindebolzenansatz (121) überlappt.

10. Variabler Ventiltrieb eines Verbrennungsmotors für ein Sattelsitzfahrzeug nach Anspruch 9, wobei: ein Gehäuse (108) an der Befestigungsoberfläche (111) angebracht ist, während ein Teil des Gehäuses (108) der in dem Elektromagneten (107) enthalten ist, in der Befestigungsoberfläche (111) angeordnet ist; und
ein erstes Dichtungselement (128), das die Lücke zwischen einer Ausgangswelle (125) des Elektromagneten (107) und dem Gehäuse (108) abdichtet, und ein zweites Dichtungselement (129), das die Lücke zwischen dem Gehäuse (108) und dem Befestigungsloch (127) abdichtet, auf der gleichen flachen Ebene senkrecht zu der Achse der Ausgangswelle (125) angeordnet sind.

11. Variabler Ventiltrieb eines Verbrennungsmotors für ein Sattelsitzfahrzeug nach einem der Ansprüche 8 bis 10, wobei Klopfelemente (124) zwischen dem Kopfdeckel (28) und dem Zylinderkopf (27) angeordnet sind.

12. Variabler Ventiltrieb eines Verbrennungsmotors für ein Sattelsitzfahrzeug nach einem der Ansprüche 8 bis 11, wobei die Elektromagnetlagervertiefung (112) in der Seitenwand ausgebildet ist, die einer Seite in der Fahrzeugbreitenrichtung des Kopfdeckels (28) zugewandt ist, der einen Teil des Motorkörpers (14) bildet, der vertikal kippbar mit dem Fahrzeugkarosserierahmen (F) verzapft ist.

13. Variabler Ventiltrieb eines Verbrennungsmotors für ein Sattelsitzfahrzeug nach Anspruch 12, wobei die Wirkachse (C) des Elektromagneten (107) tiefer als die Mittelachse des Verbindungsstifts (97) angeordnet ist.

Revendications

1. Commande de soupape variable d'un moteur à combustion interne pour un véhicule de type à selle, dans laquelle: une chambre de soupape (67) est formée entre une culasse (27) et un couvercle de culasse (28) assemblés entre eux tout en constituant une partie d'un corps de moteur (14) monté sur une ossature de véhicule (F) ; des premier et second culbuteurs (71, 72) disposés de manière adjacente entre eux à l'intérieur de la chambre de soupape (67) avec au moins l'un qui est enclenché et assemblé à une soupape de moteur (61), sont tourillonnés selon un mouvement de balancier sur la culasse (27) par le biais d'un arbre de culbuteur (78) afin de pouvoir effectuer un mouvement de balancier dans des modes de balancement différents les uns des autres lorsque les culbuteurs (71, 72) sont dans un état non assemblé ; une broche d'assemblage (97) ayant un axe central parallèle à l'arbre de culbuteur (78) est montée de manière coulissante sur les premier et second culbuteurs (71, 72) afin d'être mobile entre une position d'assemblage pour chevaucher entre les premier et second culbuteurs (71, 72) et assembler les deux culbuteurs (71, 72) entre eux et une position de libération d'assemblage pour être séparée du second culbuteur (72) et libérer l'assemblage des deux culbuteurs (71, 72) ; et une tige de pression (104) sur laquelle une force de pression est communiquée par un solénoïde (107) fixé au corps de moteur (14) est réalisée pour venir en butée sur une extrémité de la broche d'assemblage (97) sur le côté opposé du second culbuteur (72),
dans laquelle le solénoïde (107) est fixé uniquement à une paroi latérale du couvercle de culasse (27) du même côté d'une bougie d'allumage (65) qui est fixée à une paroi latérale de la culasse (27) par une pluralité d'éléments de fixation (110) afin d'éviter qu'un boîtier (108) du solénoïde (107) et l'extension de l'axe central (CP) de la bougie d'allumage (65) ne se chevauchent,
caractérisée en ce que :

le solénoïde (107) et la bougie d'allumage (65) sont disposés sur un côté faisant face à un côté dans le sens de la largeur du véhicule du corps de moteur (14) qui est tourillonné selon un mouvement de balancier sur l'ossature de véhicule (F) ; et
le boîtier (108) du solénoïde (107) est disposé plus haut que l'axe central (CP) de la bougie d'allumage (65) sur une vue latérale.

2. Commande de soupape variable d'un moteur à combustion interne pour un véhicule de type à selle selon la revendication 1,
dans laquelle: les extrémités distales d'une pluralité de sections de bras fixées (109a, 109b) agencées dans le boîtier (108) du solénoïde (107) et faisant saillie radialement à partir du boîtier (108) sont chacune fixées sur le couvercle de culasse (28) par les éléments de fixation (110) ; et
une extrémité distale de la première section de bras fixée (109a) qui est la plus proche de la bougie d'allumage (65) sur un plan projeté par rapport à un plan plat perpendiculaire à un axe de travail (CS) du solénoïde (107) en dehors de la pluralité des sections de bras fixées (109a, 109b) est disposée dans une position plus éloignée de la bougie d'allumage (65)

que d'une extrémité distale de l'autre section de bras fixée (109b) qui est la plus éloignée de la bougie d'allumage (65) en dehors de la pluralité de sections de bras fixées (109a, 109b) dans une direction le long de l'axe central (CP) de la bougie d'allumage (65).

3. Commande de soupape variable d'un moteur à combustion interne pour un véhicule de type à selle selon la revendication 2, dans laquelle :

un bossage de fixation (117) dont l'axe est disposé dans une position plus éloignée de la culasse (27) qu'une plaque de reniflard (116) qui est fixée sur le couvercle de culasse (28) afin de former une chambre de reniflard (115) entre le couvercle de culasse (28) et la plaque de reniflard (116) dans une direction le long d'un axe de cylindre (C) du corps de moteur (14), est agencé dans le couvercle de culasse (28) afin de fixer l'extrémité distale de la première section de bras fixée (109a).

4. Commande de soupape variable d'un moteur à combustion interne pour un véhicule de type à selle selon la revendication 3,
dans laquelle: un évidement du côté de la culasse (66) est formé sur la paroi latérale de la culasse (27) de sorte que l'on agence un siège de fixation de bougie (66a) pour fixer la bougie d'allumage (65) ;
un évidement du côté du couvercle de culasse (118) continuant vers l'évidement du côté de la culasse (66) est formé sur la paroi latérale du couvercle de culasse (28) ; et
le bossage de fixation (117) est agencé dans le couvercle de culasse (28) de sorte que l'élément de fixation (110) pour fixer la première section de bras fixée (109a) au bossage de fixation (117) en dehors de la pluralité d'éléments de fixation (110) est fixé dans une position évitant le chevauchement d'une section inférieure (118a) de l'évidement du côté du couvercle de culasse (118) et de l'axe central (CP) de la bougie d'allumage (65) entre eux, comme observé à partir d'une direction le long de l'axe de cylindre (C).

5. Commande de soupape variable d'un moteur à combustion interne pour un véhicule de type à selle selon la revendication 3,
dans laquelle une section de sortie (119) qui communique avec la chambre reniflard (115) et à laquelle un tuyau de reniflard (120) est raccordé, est agencée sur une surface externe du couvercle de culasse (28) pour être orientée dans une direction différente du côté de paroi latérale du couvercle de culasse (28) sur laquelle le solénoïde (107) est fixé.

6. Commande de soupape variable d'un moteur à combustion interne pour un véhicule de type à selle selon l'une quelconque des revendications 1 à 5,
dans laquelle une pompe à eau (94) est fixée sur l'autre paroi latérale de la culasse (27) et sur le côté opposé du solénoïde (107) avec l'axe de cylindre (C) du corps de moteur (14) entre eux.

7. Commande de soupape variable d'un moteur à combustion interne pour un véhicule de type à selle selon l'une quelconque des revendications 1 à 6,
dans laquelle: une paroi de support (85) qui supporte l'arbre de culbuteur (78) et des bossages goujon (121) disposés entre la paroi latérale de la culasse (27) et la paroi de support (85) de sorte que les boulons (87) assemblant la culasse (27) et le bloc-cylindres (26) à un carter de moteur (25) sont insérés, est agencée dans la culasse (27) ;
des surfaces de fixation de boulon (121a) des bossages de goujon (121) sont formées de sorte que les parties supérieures (87a) des goujons (87) sont positionnées du côté du bloc-cylindres (26) de l'axe de travail (CS) du solénoïde (107) dans une direction le long de l'axe de cylindre (C) du corps de moteur (14) ; et
les parties supérieures (87a) des goujons (87) sont disposées dans des positions chevauchant avec au moins une partie du solénoïde (107), comme observé à partir d'une direction le long de l'axe de cylindre (C).

8. Commande de soupape variable d'un moteur à combustion interne pour un véhicule de type à selle selon la revendication 7,
dans laquelle: une surface d'assemblage (123) de la culasse (27) et du couvercle de culasse (28) est disposée du côté du bloc-cylindres (26) du solénoïde (107) dans une direction le long de l'axe de cylindre (C) ;
un évidement de stockage de solénoïde (112) disposé dans une position s'éloignant du côté opposé de la surface de fixation de boulon (121a) de la partie supérieure (87a) du goujon (87) dans une direction le long de l'axe de cylindre (C) est formé dans la paroi latérale du couvercle de culasse (28) afin d'être évidé vers le côté du goujon (87) ; et
le solénoïde (107) est fixé sur le couvercle de culasse (28) de sorte qu'au moins une partie de ce dernier est stockée dans l'évidement de stockage de solénoïde (112).

9. Commande de soupape variable d'un moteur à combustion interne pour un véhicule de type à selle selon la revendication 8,
dans laquelle une surface de fixation (111) du solénoïde (107) formée sur la paroi latérale du couvercle de culasse (28) est disposée dans une position recouvrant le bossage de goujon (121), comme observé à partir de la direction le long de l'axe de cylindre (C).

10. Commande de soupape variable d'un moteur à combustion interne pour un véhicule de type à selle selon la revendication 9,
dans laquelle: un boîtier (108) est fixé à la surface de fixation (111) tout en montant une partie du boîtier (108) incluse dans le solénoïde (107) sur un trou de fixation (127) agencé dans la surface de fixation (111) ; et
un premier élément de joint d'étanchéité (128) qui scelle l'espace entre un arbre de sortie (125) du solénoïde (107) et le boîtier (108) et un second élément de joint d'étanchéité (129) qui scelle l'espace entre le boîtier (108) et le trou de fixation (127) sont disposés sur le même plan plat perpendiculaire à l'axe de l'arbre de sortie (125).

11. Commande de soupape variable d'un moteur à combustion interne pour un véhicule de type à selle selon l'une quelconque des revendications 8 à 10, dans laquelle des éléments de cognement (124) sont agencés entre le couvercle de culasse (28) et la culasse (27).

12. Commande de soupape variable d'un moteur à combustion interne pour un véhicule de type à selle selon l'une quelconque des revendications 8 à 11, dans laquelle l'évidement de stockage de solénoïde (112) est formé dans la paroi latérale qui fait face à un côté dans le sens de la largeur du véhicule du couvercle de culasse (28) qui constitue une partie du corps de moteur (14) tourillonnée verticalement selon un mouvement de balancier par rapport à l'ossature de véhicule (F).

13. Commande de soupape variable d'un moteur à combustion interne pour un véhicule de type à selle selon la revendication 12, dans laquelle l'axe de travail (CS) du solénoïde (107) est disposé plus bas que l'axe central de la broche d'assemblage (97).

FIG. 1

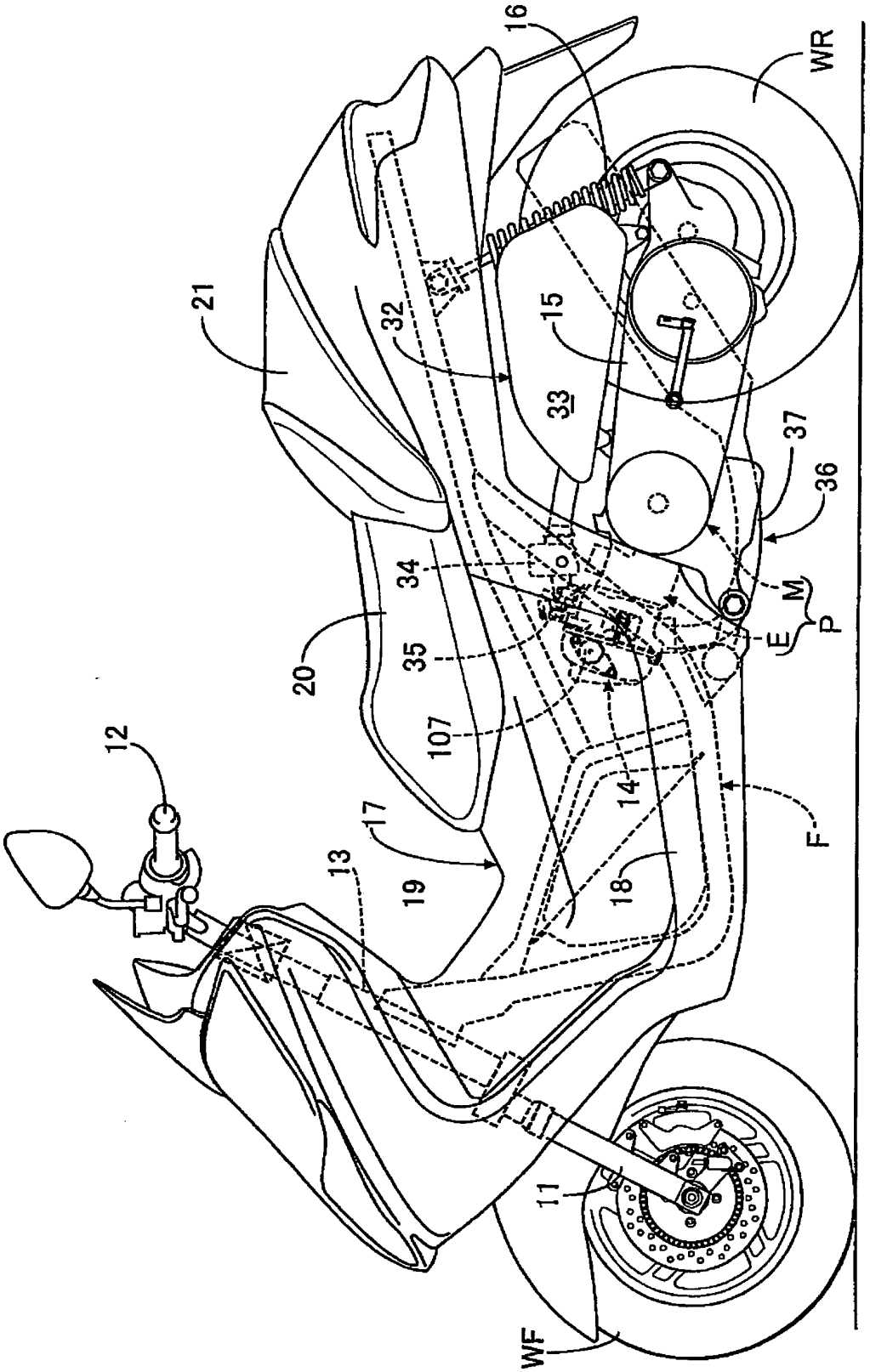
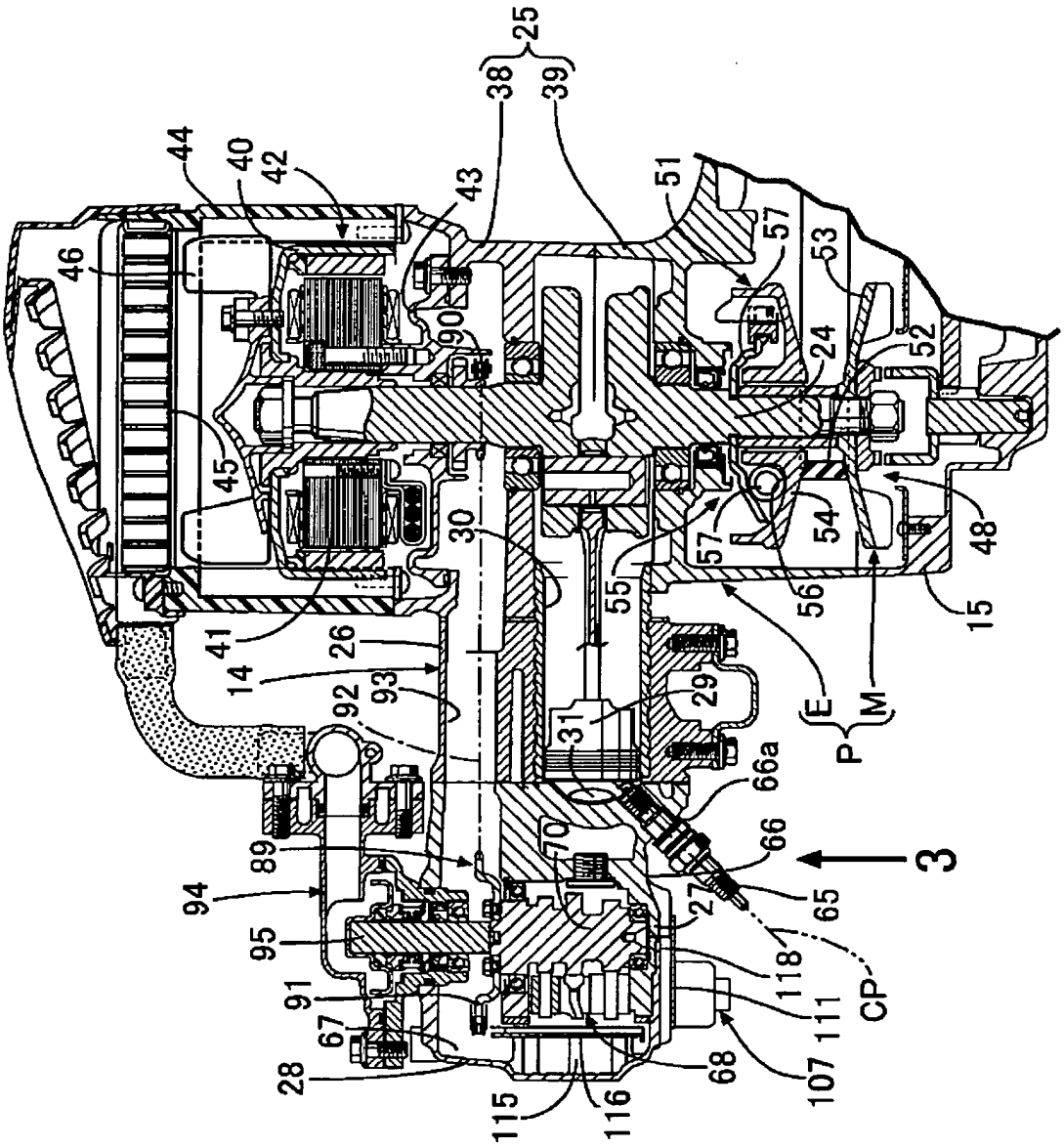


FIG. 2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41
26
14
92
93
29
E
M
P
31
66a
66
70
89
3
94
27
65
95
118
91
CP
111
67
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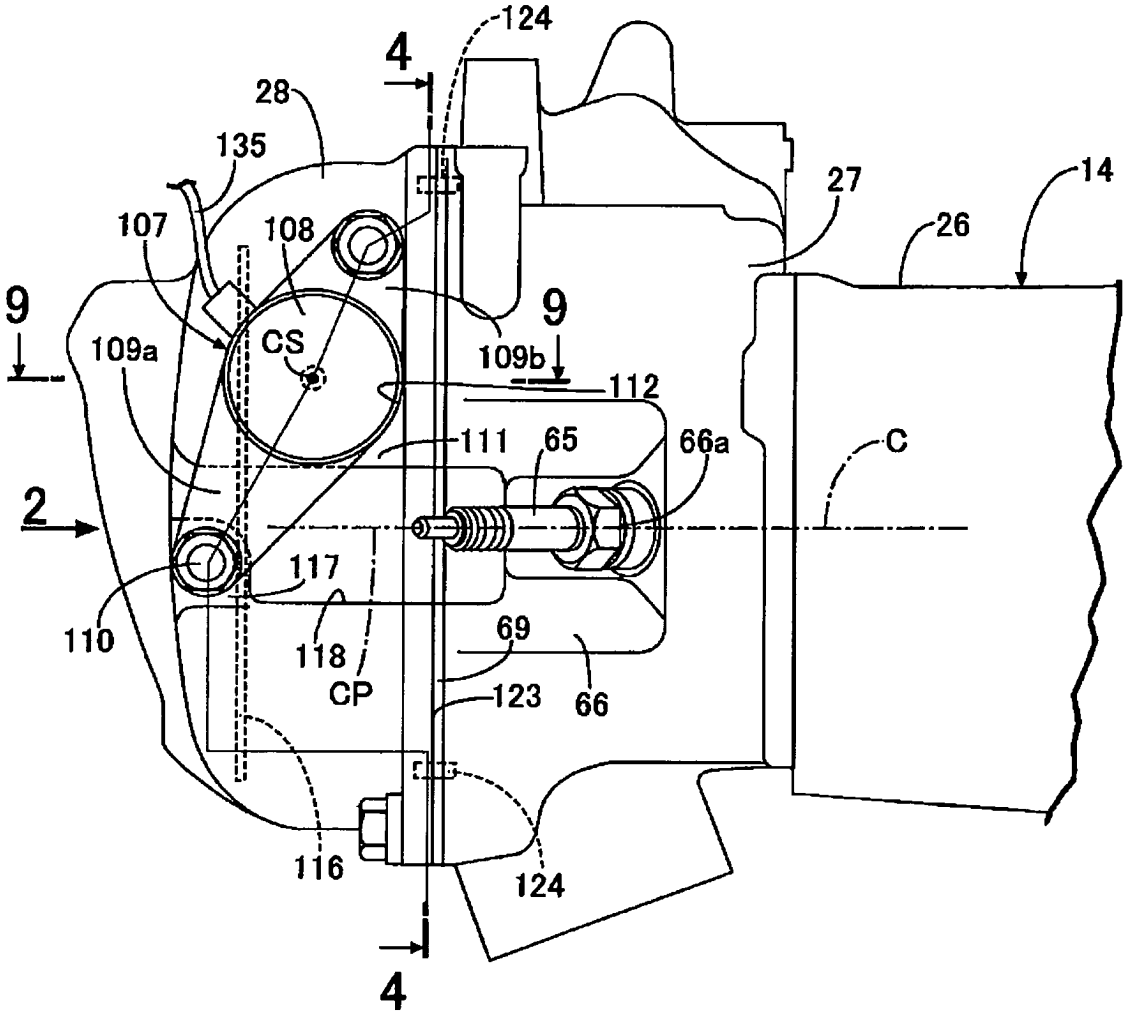
107
28
115
116

FIG. 3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28
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107
108
27
14
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9
9
109a
CS
109b
112
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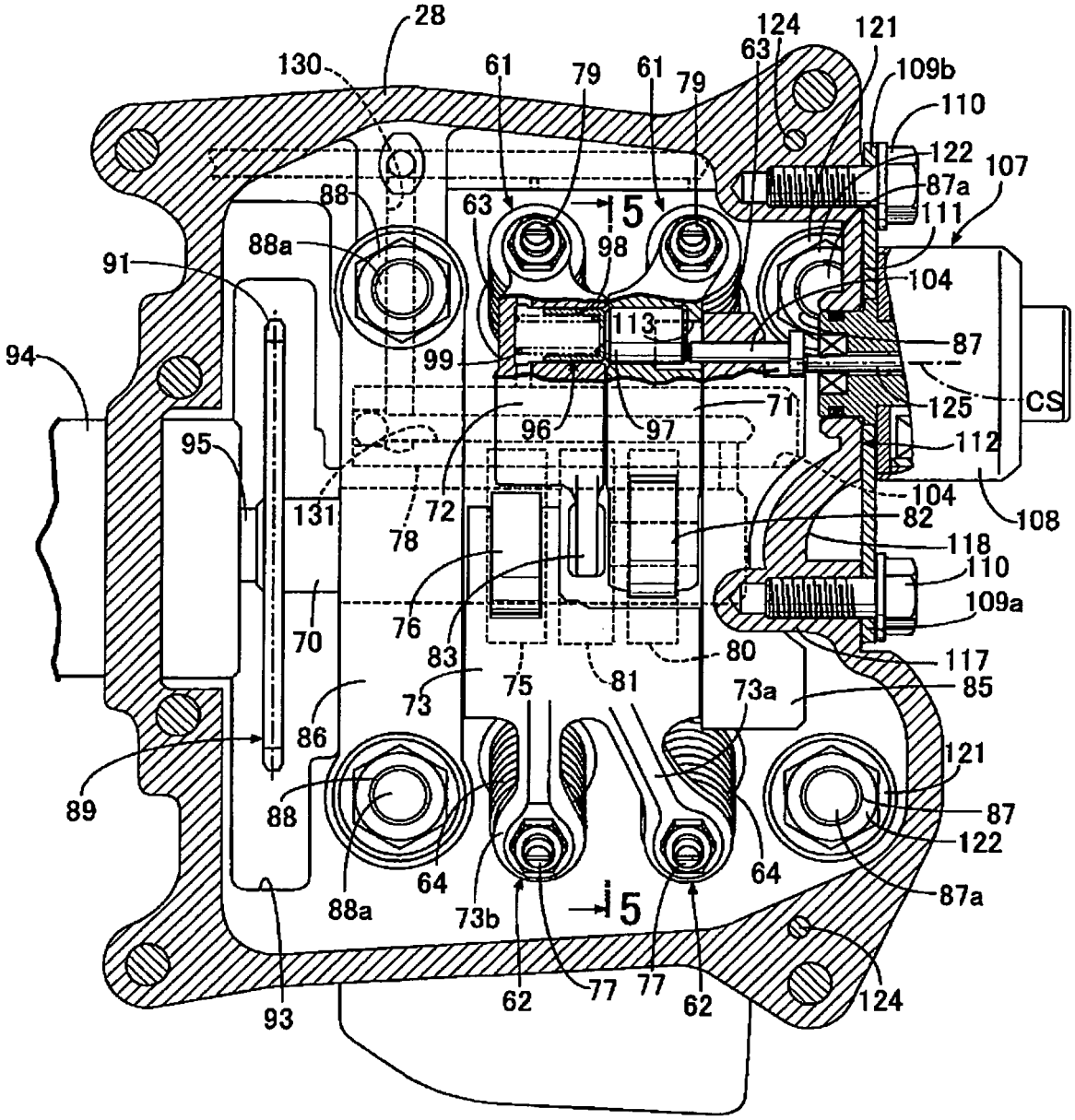
66a
C
2
117
110
118
CP
69
123
66
116
124
4

FIG. 4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91
104
113
87
94
99
125
CS
71
96
97
95
112
104
131
72
82
108
78
118
110
76
109a
70
83
80
117
75
81
73a
85
73
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87a
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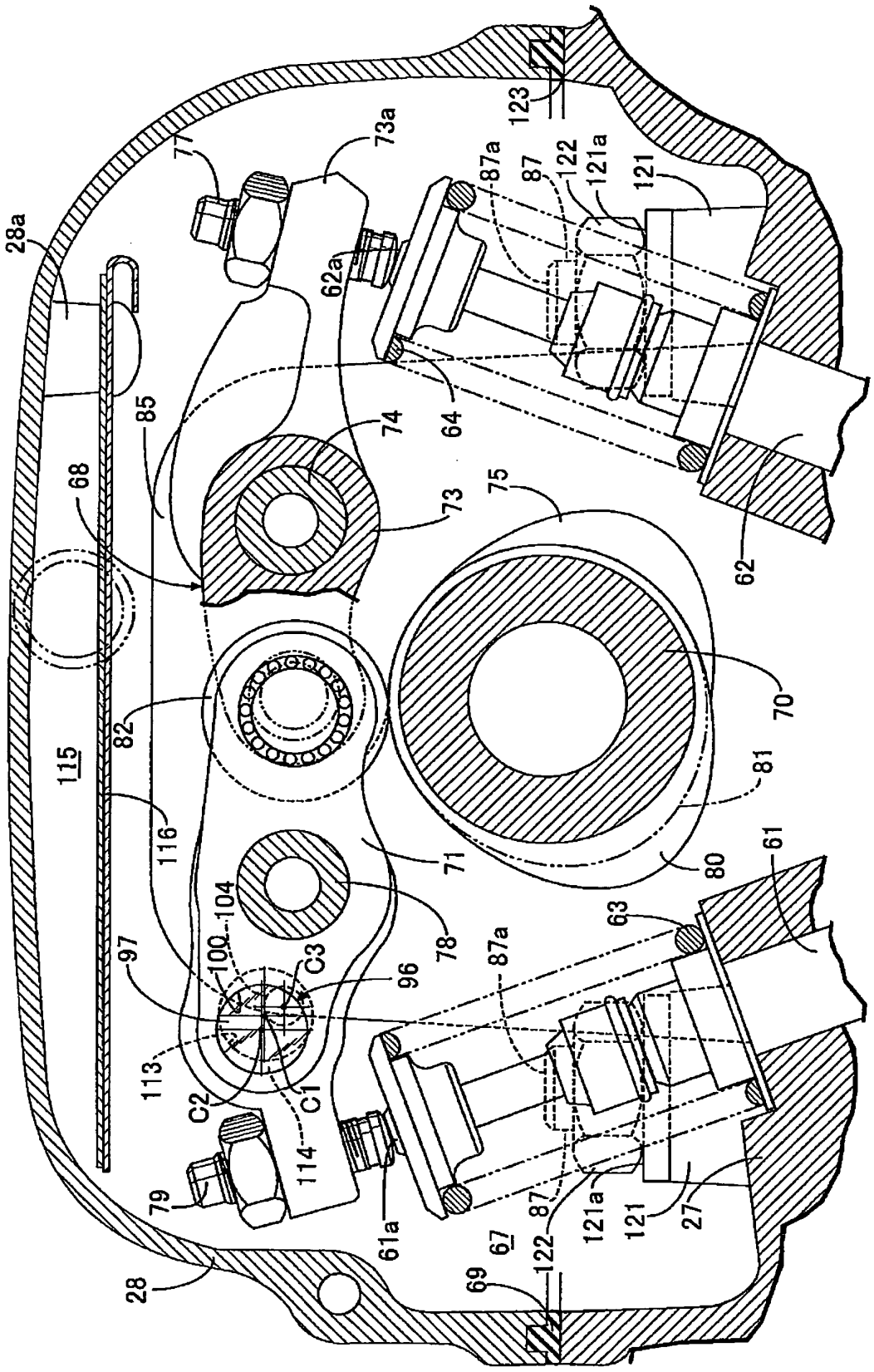
124
93

FIG. 5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116
81
71
80
61
104
63
78
97
100
C3
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87a
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C2
C1
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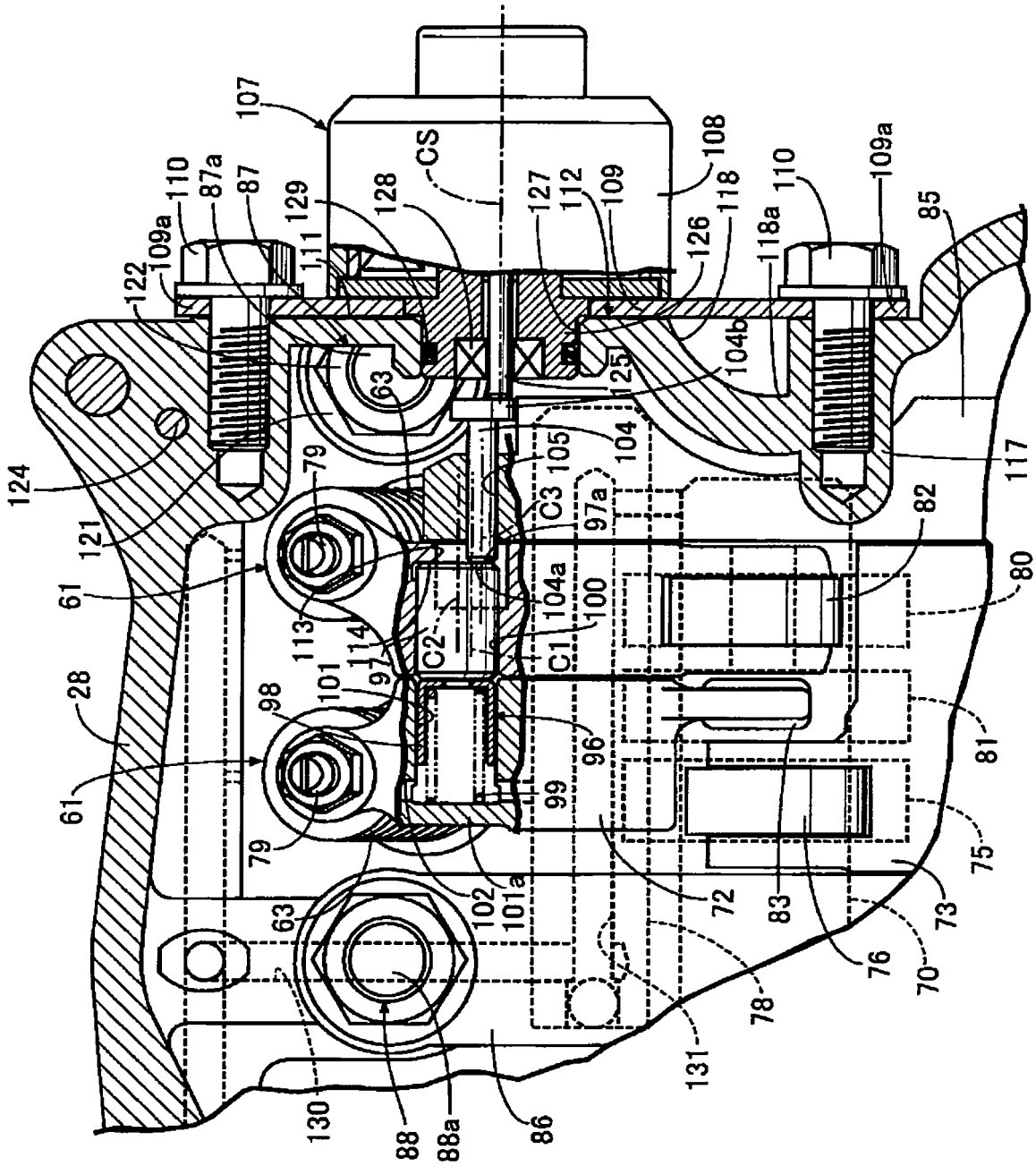
79
61a
87
121a
121
27
67
122
69
28

FIG. 6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118a
104b
125
63
104
105
117
124
79
C3
97a
82
121
61
113
114
C2
C1
104a
100
80
28
101
97
98
96
81
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101a
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76
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131
130
88
88a
86

FIG. 7

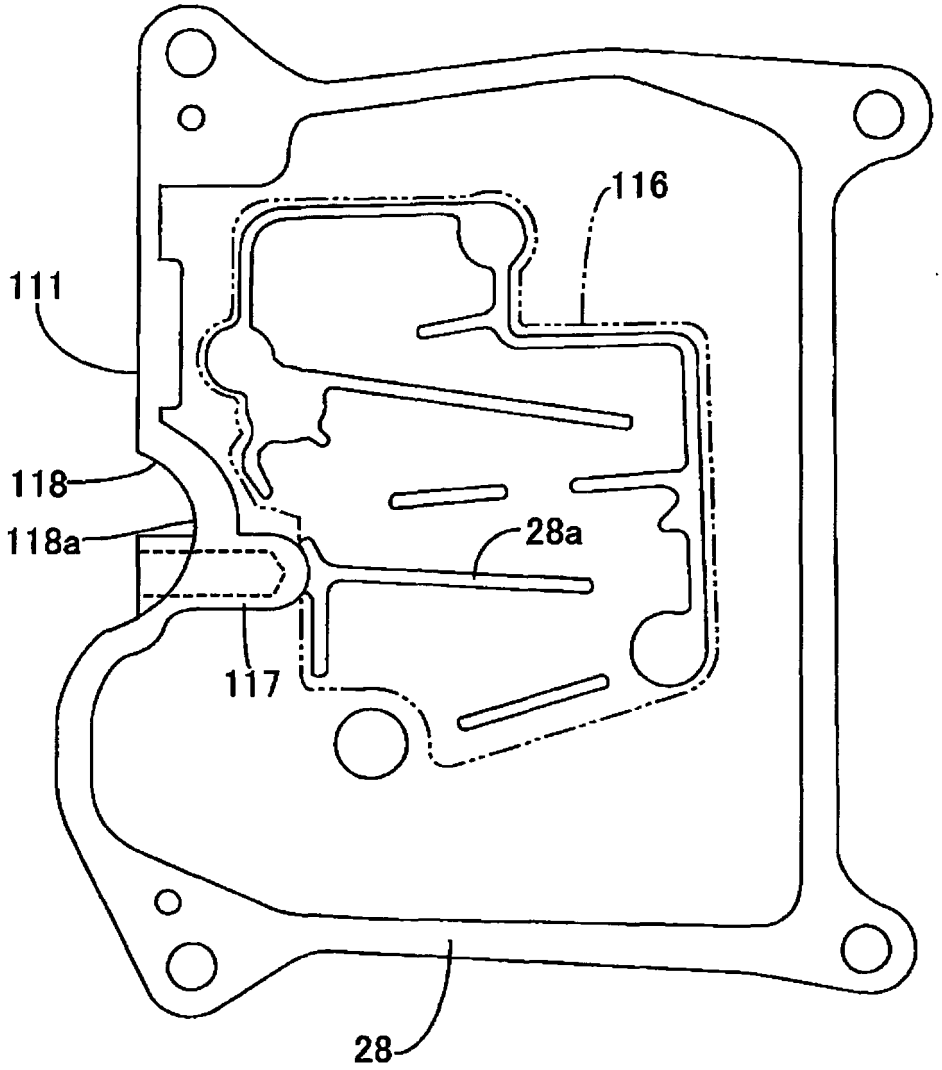
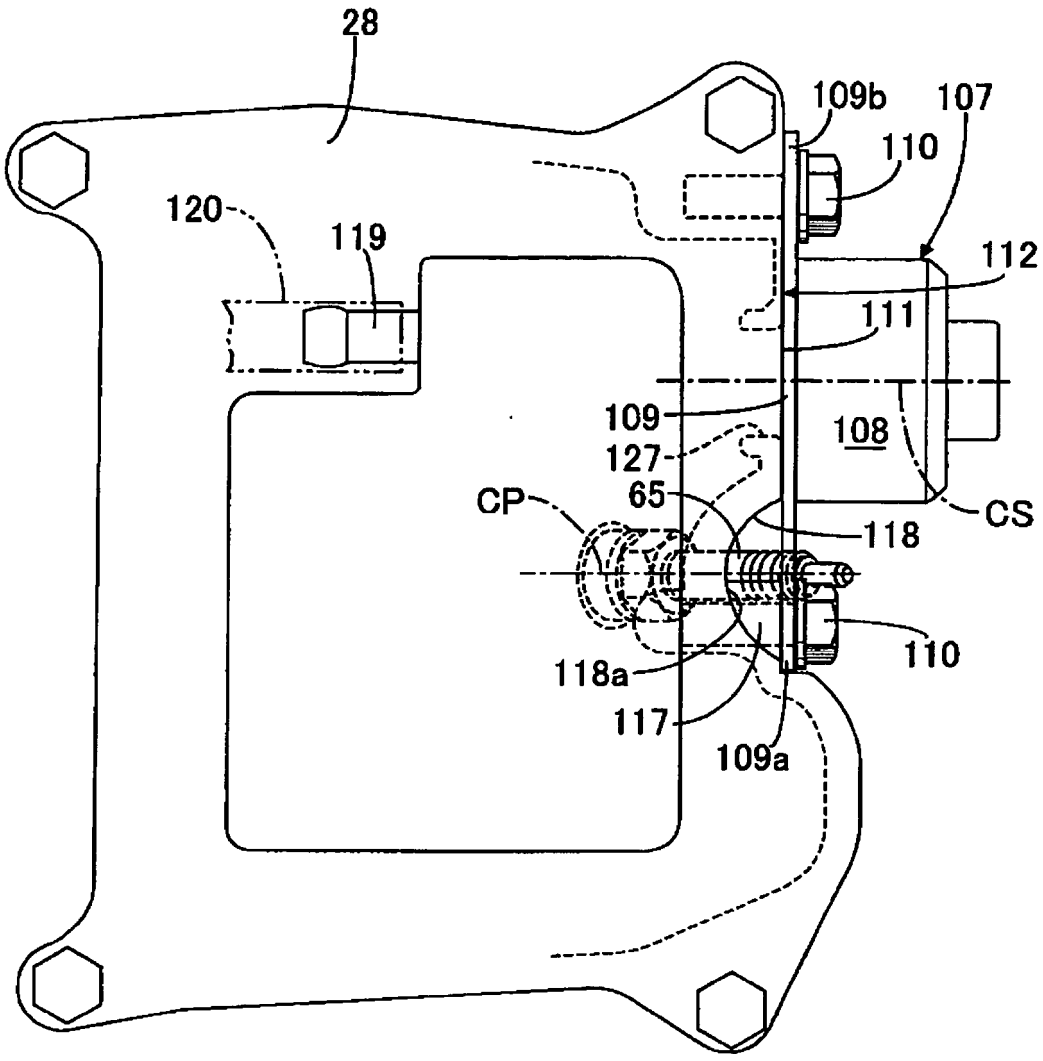


FIG. 8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111
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108
127
65
CP
CS
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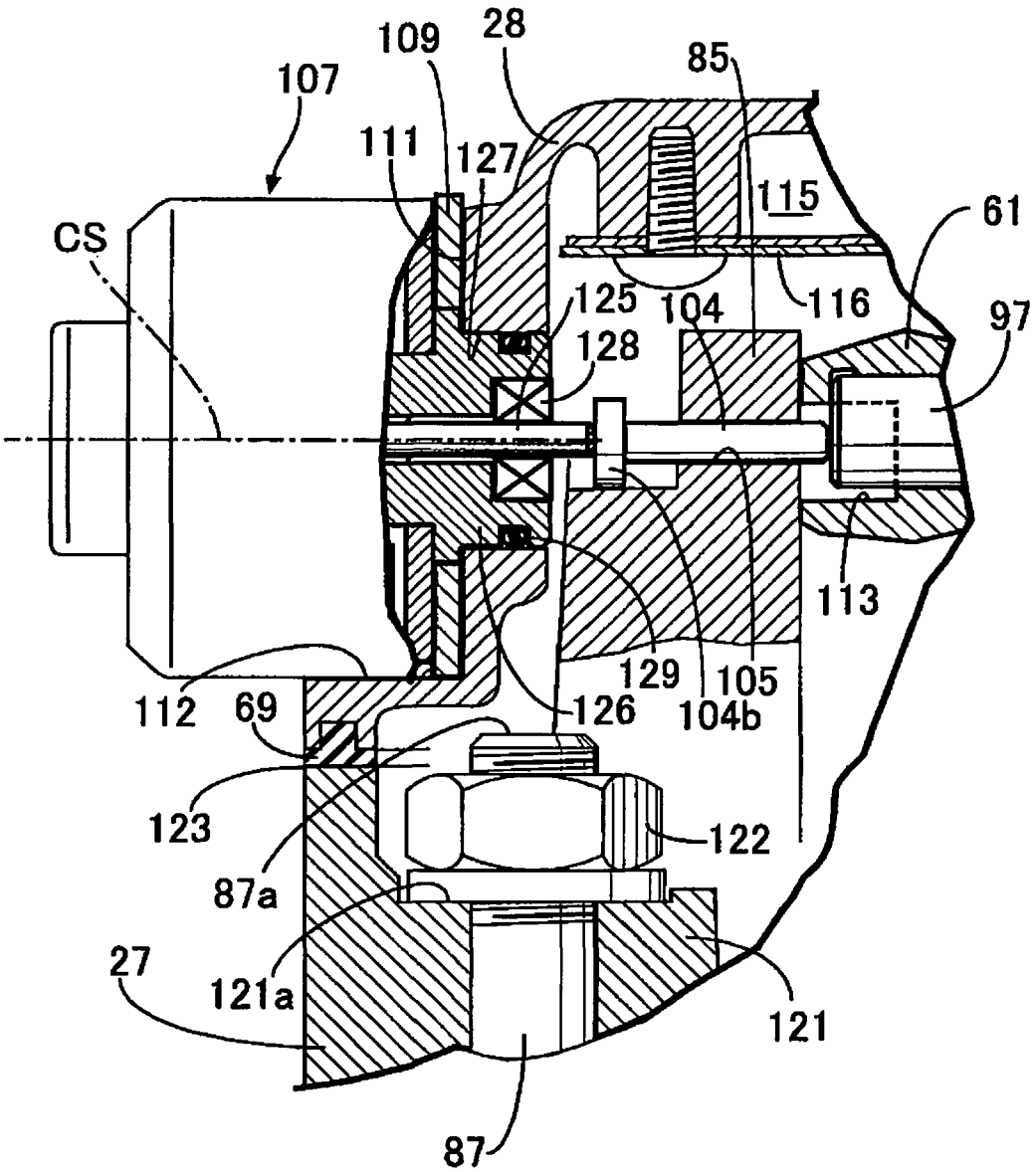
110
118a
117
109a

FIG. 9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104b
123
122
87a
27
121a
121
87

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2012077741 A **[0002]**
- EP 2821601 A2 **[0006]**