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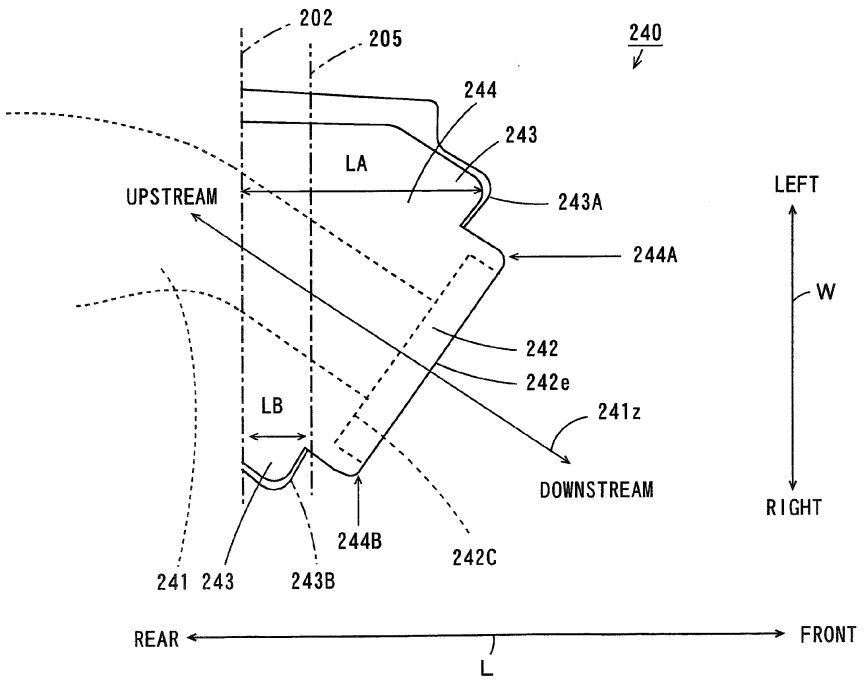
(54) Cylinder head and saddle-straddling type motor vehicle

(57) An exhaust passage that leads gas exhausted from a combustion chamber to an exhaust pipe is defined by an exhaust passage portion. The exhaust passage portion projects from an sidewall. The exhaust pipe is fitted into an exhaust pipe fitting portion of the exhaust passage portion. Bolts for attaching an exhaust pipe is fixed to a bolt fixing portions of the exhaust passage portion. At least part of the bolt fixing portions are provided outside of the exhaust pipe fitting portion in an exhaust passage radial direction as viewed from a cylinder axial direction. The downstream end surface of the exhaust pipe fitting portion in the exhaust passage axial direction is formed to be inclined with respect to the sidewall as viewed from the cylinder axial direction. The downstream end surfaces of the bolt fixing portions are formed at a further upstream position than the downstream end surface of the exhaust pipe fitting portion in the exhaust passage axial direction.

FIG. 5



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Description

BACKGROUND OF THE INVENTION

(1) Field of the Invention

[0001] The present invention relates to a cylinder head and a saddle-straddling type motor vehicle including the cylinder head.

(2) Description of the Background Art

[0002] In a vehicle including an engine, an exhaust pipe is attached between an exhaust pipe attachment portion of a cylinder head and a muffler. Exhaust gas generated in a combustion chamber of the engine is discharged to the outside from an exhaust port of the cylinder head through the exhaust pipe and the muffler (see JP 2010-7645 A, for example).

BRIEF SUMMARY OF THE INVENTION

[0003] In the cylinder head described in JP 2010-7645 A, an axis of the exhaust pipe attachment portion is formed to be inclined towards right with respect to a front and rear direction of a motorcycle. This enables the cylinder head to be connected to the muffler provided at the right rear of the motorcycle through the exhaust pipe.

[0004] However, according to this configuration, because the exhaust pipe is attached to be inclined with respect to the front and rear direction of the motorcycle, the exhaust pipe attachment portion of the cylinder head largely projects from a sidewall of the cylinder head. Thus, a size of the cylinder head increases in the front and rear direction of the motorcycle.

[0005] An object of the present invention is to provide a cylinder head and a saddle-straddling type motor cycle in which an increase in size can be suppressed and an exhaust pipe can be connected to be inclined with respect to a sidewall.

(1) According to an aspect of the present invention, a cylinder head provided on a single-cylinder engine includes a sidewall that defines at least part of a space storing a valve mechanism, and an exhaust passage portion that defines an exhaust passage leading exhaust gas exhausted from a combustion chamber to an exhaust pipe and projects from the sidewall, wherein the exhaust passage portion has an exhaust pipe fitting portion into which the exhaust pipe is fitted and a bolt fixing portion for fixing of a bolt for attaching the exhaust pipe, at least part of the bolt fixing portion is provided outside of the exhaust pipe fitting portion in an exhaust passage radial direction as viewed from a cylinder axial direction, a downstream end surface of the exhaust pipe fitting portion in the exhaust passage axial direction is formed to be inclined with respect to the sidewall as viewed from the cylinder axial direction, and a downstream end surface of the bolt fixing portion in the exhaust passage axial direction is formed at a further upstream position than the downstream end surface of the exhaust pipe fitting portion in the exhaust passage axial direction.

[0006] In this cylinder head, the exhaust passage leading the gas exhausted from the combustion chamber to the exhaust pipe is defined by the exhaust passage portion. The exhaust passage portion projects from the sidewall. The exhaust pipe is fitted into the exhaust pipe fitting portion of the exhaust passage portion. The bolt for attaching an exhaust pipe is fixed to the bolt fixing portion of the exhaust passage portion. At least part of the bolt fitting portion is provided outside of the exhaust pipe fixing portion in the exhaust passage radial direction as viewed from the cylinder axial direction. The downstream end surface of the exhaust pipe fitting portion in the exhaust passage axial direction is formed to be inclined with respect to the sidewall as viewed from the cylinder axial direction. Thus, the exhaust pipe can be compactly attached to the cylinder head.

[0007] Further, the downstream end surface of the bolt fixing portion is formed at the further upstream position than the downstream end surface of the exhaust pipe fitting portion in the exhaust passage axial direction. Thus, a distance from the sidewall to a portion of the bolt fixing portion that is the farthest is smaller as compared with the case in which the downstream end surface of the bolt fixing portion and the downstream end surface of the exhaust pipe fitting portion are arranged on the same plane. Therefore, the size of the cylinder head is reduced in a direction vertical to the sidewall.

[0008] As a result, the exhaust pipe can be connected to be inclined with respect to the sidewall of the cylinder head while an increase in size of the cylinder head is suppressed.

(2) The exhaust passage portion may further have a component attachment portion for attaching a component. In this case, the component can be attached to the cylinder head by making the effective use of the exhaust passage portion. This prevents the increase in size of the cylinder head due to the attachment of the component.

(3) The downstream end surface of the exhaust pipe fitting portion may have a first portion that is the farthest from the sidewall and a second portion that is the closest to the sidewall, as viewed from the cylinder axial direction, and the component attachment portion may be provided at a position closer to the first portion than the second portion in the exhaust passage radial direction.

[0009] In this case, the exhaust passage portion has a larger region at the first portion that is the farthest from the sidewall than the second portion that is the closest

to the sidewall. Thus, the component can be attached to the component attachment portion without interfering with the sidewall.

(4) The cylinder head may further include a flange portion formed at an upper end of the sidewall, wherein the component attachment portion may be arranged outside of an outer periphery of the flange portion as viewed from the cylinder axial direction.

[0010] In this case, the component having a shape extending beyond the flange portion can be attached to the component attachment portion. Further, the attachment of the component to the component attachment portion and the removal of the component from the component attachment portion can be easily performed in a direction crossing the flange portion of the sidewall.

(5) The downstream end surface of the bolt fixing portion may include first and second bolt bearing surfaces, the first bolt bearing surface may be provided at a position farther from the sidewall than the second bolt bearing surface, and the second bolt bearing surface may be provided at a position closer to the sidewall than an end surface of the flange portion.

[0011] In this case, the bolt for attaching an exhaust pipe is attached to the first and second bolt bearing surfaces. This enables the exhaust pipe to be reliably connected to the exhaust passage portion. Further, the second bolt bearing surface is provided at a position closer to the sidewall than the end surface of the flange portion such that the first bolt bearing surface comes closer to the sidewall. Therefore, the size of the cylinder head can be reduced in the direction vertical to the sidewall. Further, because the first bolt bearing surface is provided at a position farther from the sidewall than the second bolt bearing surface, a space for the component attachment portion can be sufficiently ensured at a position far from the sidewall in the exhaust passage portion. As a result, the component can be attached to the component attachment portion without interfering with the sidewall.

(6) The first bolt bearing surface may be formed such that a plane including the first bolt bearing surface intersects with the component attachment portion as viewed from the cylinder axial direction. In this case, because the first bolt bearing surface sufficiently comes closer to the sidewall, the size of the cylinder head can be sufficiently reduced in the direction vertical to the sidewall.

(7) The component may include an oxygen sensor. In this case, the concentration of oxygen of the gas exhausted from the combustion chamber can be measured by the oxygen sensor. Further, a temperature of the oxygen sensor rises due to the heat in the combustion chamber. This enables the rise time of the oxygen sensor to be shortened.

(8) The exhaust pipe fitting portion may have an abutment surface against which an end surface of the exhaust pipe is abuttable, the abutment surface being inside the downstream end surface of the exhaust pipe fitting portion and at a further upstream position than the downstream end surface in the exhaust passage axial direction, and the downstream end surface of the bolt fixing portion may be formed at a further upstream position than the abutment surface in the exhaust passage axial direction.

[0012] In this case, because the downstream end surface of the bolt fixing portion is formed at the further upstream position than the abutment surface in the exhaust passage axial direction, the size of the cylinder head can be reliably reduced in the direction vertical to the sidewall.

(9) The downstream end surface of the exhaust pipe fitting portion may have a notch that is notched in the exhaust passage radial direction, the notch being at a portion overlapping with the downstream end surface of the bolt fixing portion in the exhaust passage radial direction.

[0013] In this case, because the downstream end surface of the bolt fixing portion is formed to link with the downstream end surface of the exhaust pipe fitting portion, a bolt hole of the bolt fixing portion can be formed at a position close to the center of the exhaust pipe fitting portion in the exhaust passage radial direction of the exhaust pipe fitting portion. This can prevent an increase in size of the bolt fixing portion in the exhaust passage radial direction.

(10) A saddle-straddling type motor vehicle according to another aspect of the present invention includes a vehicle body, a single-cylinder engine provided on the vehicle body, a cylinder head according to the one aspect of the present invention provided on the engine, and an exhaust pipe connected to the exhaust passage portion of the cylinder head.

[0014] In this saddle-straddling type motor vehicle, the single-cylinder engine is provided on the vehicle main body. The gas exhausted from the combustion chamber of the engine is led to the exhaust pipe through the exhaust passage portion of the cylinder head.

[0015] In the cylinder head, the downstream end surface of the exhaust pipe fitting portion in the exhaust passage axial direction is formed to be inclined with respect to the sidewall as viewed from the cylinder axial direction. This enables the exhaust pipe to be compactly attached to the cylinder head.

[0016] Further, the downstream end surface of the bolt fixing portion is formed at the further upstream position than the downstream end surface of the exhaust pipe

fitting portion in the exhaust passage axial direction. Thus, a distance from the sidewall to a portion of the bolt fixing portion that is the farthest is smaller as compared with the case in which the downstream end surface of the bolt fixing portion and the downstream end surface of the exhaust pipe fitting portion are arranged on the same plane. Therefore, the size of the cylinder head is reduced in the direction vertical to the sidewall.

[0017] As a result, the exhaust pipe can be connected to be inclined with respect to the sidewall of the cylinder head while the increase in size of the cylinder head is suppressed.

(11) The saddle-straddling type motor vehicle may further include a silencer provided at the exhaust pipe, wherein the silencer may be provided on one side in a width direction of the vehicle body, and a downstream end surface of the exhaust pipe fitting portion of the cylinder head may be formed to be inclined with respect to a front and rear direction of the vehicle main body as viewed from an up-and-down direction of the vehicle main body.

[0018] In this case, because the downstream end surface of the exhaust pipe fitting portion of the cylinder head is inclined with respect to the front and rear direction of the vehicle main body, attachment of the exhaust pipe and the muffler and routing of the exhaust pipe are easily performed.

[0019] The present invention enables the exhaust pipe to be connected to be inclined with respect to the sidewall of the cylinder head while an increase in size is suppressed.

[0020] Other features, elements, characteristics, and advantages of the present invention will become more apparent from the following description of preferred embodiments of the present invention with reference to the attached drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

[0021]

Fig. 1 is a side view of a motorcycle according to an embodiment of the present invention;
Fig. 2 is a plan view of the motorcycle of Fig. 1 as viewed from above;
Fig. 3 is a diagram of a cylinder head as viewed from a cylinder axial direction;
Fig. 4 is a diagram of the cylinder head as viewed from a side of an exhaust passage portion of Fig. 3;
Fig. 5 is an enlarged view of the exhaust passage portion of Fig. 3;
Fig. 6 is an enlarged view of the exhaust passage portion of Fig. 4;
Fig. 7 is a cross sectional view taken along an exhaust passage axial direction of the exhaust passage portion of Fig. 3; and
Fig. 8 is a diagram showing a directional relationship between the cylinder head and the motorcycle.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0022] A cylinder head and a motorcycle according to embodiments of the present invention will be described with reference to the drawings.

(1) Configuration of the Motorcycle

[0023] Fig. 1 is a side view of the motorcycle according to an embodiment of the present invention. Fig. 2 is a plan view of the motorcycle of Fig. 1 as viewed from above. Figs. 1 and 2 show the motorcycle 100 standing up to be vertical to the road surface. A front and rear direction L of the motorcycle 100 is indicated by an arrow. Further, in Fig. 2, a width direction W of the motorcycle 100 is indicated by an arrow.

[0024] As shown in Fig. 1, the motorcycle 100 includes a vehicle body frame 80 constituted by a main-frame 80a and a sub-frame 80b. A head pipe 85 is provided at the front of the vehicle body frame 80, and a handle 81 is provided at the upper end of the head pipe 85. A front fork 82 is attached to the lower end of the head pipe 85.

[0025] In this state, the front fork 82 is rotatable in a predetermined angular range with an axis of the head pipe 85 as a center. A front wheel 83 is supported at the lower end of the front fork 82 to be rotatable. A rear wheel 84 is supported at the rear of the vehicle body frame 80 to be rotatable. A single-cylinder engine 50 is provided at the center of the vehicle body frame 80. The engine 50 is constituted by a cylinder 51, a crank box 52 and a cylinder head 200. A combustion chamber is formed in the cylinder 51. An axial direction of the cylinder 51 (hereinafter referred to as a cylinder axial direction C) is indicated by a one-dot and dash line. In the present embodiment, the engine 50 is attached to the vehicle body frame 80 such that the cylinder axial direction C is inclined forward from the vertical direction. A valve mechanism 260, and an intake valve and an exhaust valve described below are provided in the cylinder head 200. The valve mechanism 260 includes an intake cam, an exhaust cam and a camshaft. The rear wheel 84 is rotated by rotational force of the engine 50.

[0026] An exhaust device 10 that leads exhaust gas to the outside is connected to the cylinder head 200 of the engine 50. The exhaust device 10 includes an exhaust pipe 20 and a muffler (a silencer) 30. An exhaust passage portion 240 is provided at the front of the cylinder head 200.

[0027] As shown in Fig. 2, the muffler 30 is arranged on one side of a vehicle central line L1 in the width direction W. In the present embodiment, the muffler 30 is arranged on the right side of the vehicle central line L1 in the width direction W. Therefore, the exhaust pipe 20 of Fig. 1 is provided to extend obliquely forward rightward

from the exhaust passage portion 240, bend rearward and further extend rearward to the muffler 30. The muffler 30 is provided to extend from the downstream end of the exhaust pipe 20 to the side of the rear wheel 84.

[0028] The upstream end of the exhaust pipe 20 is connected to the exhaust passage portion 240 of the cylinder head 200 of the engine 50. The downstream end of the exhaust pipe 20 is inserted into the upstream end (an inlet) of the muffler 30. The outer peripheral portion of the upstream end of the muffler 30 is fastened by an attachment member such that the muffler 30 is fixed to the exhaust pipe 20.

[0029] The exhaust gas generated by the combustion of a fuel-air mixture in the combustion chamber of the cylinder 51 is sent to the muffler 30 through the exhaust pipe 20. The exhaust gas is exhausted in the atmosphere through the muffler 30. Thus, the exhaust path of the engine 50 includes an exhaust passage 241 of the cylinder head 200, the exhaust pipe 20 and the muffler 30 in this order from the upstream to the downstream.

(2) Configuration of the Cylinder Head

[0030] Fig. 3 is a diagram of the cylinder head 200 as viewed from the cylinder axial direction C. Fig. 4 is a diagram of the cylinder head 200 as viewed from the side of the exhaust passage portion of Fig. 3. The configuration of the cylinder head 200 according to the present embodiment will be described in the following with reference to Figs. 3 and 4. In Fig. 3, the front and rear direction L and the width direction W are indicated by the arrows. The cylinder axial direction C of Fig. 1 is a direction vertical to the paper surface of Fig. 3. In Fig. 4, the cylinder axial direction C is indicated by an arrow.

[0031] As shown in Fig. 3, the cylinder head 200 has sidewalls 201, 202, 203, 204. The sidewalls 201, 202 are formed to be opposite to each other and extend in the width direction W. The sidewalls 203, 204 are formed to be opposite to each other and to connect the both ends of the sidewall 201 and the both ends of the sidewall 202. A space V is defined by the four sidewalls 201 to 204. One or plurality of (two in this example) intake valves 210, one or plurality of (two in this example) exhaust valves 220 and the valve mechanism 260 of Fig. 1 are stored in the space V of the cylinder head 200. In Fig. 3, the valve mechanism 260 is not shown. The plurality of intake valves 210 are provided at a plurality of intake holes to be opened/closed, and the plurality of exhaust valves 220 are provided at a plurality of exhaust holes to be capable of opening/closing. The plurality of intake valves 210 and the plurality of exhaust valves 220 are opened/closed by the valve mechanism 260 of Fig. 1.

[0032] As shown in Fig. 4, a flange portion 205 projecting outward is formed at the upper ends of the sidewalls 201 to 204. The upper surface of the flange portion 205 is formed to be vertical to the cylinder axial direction C and flat. The upper portion of the opening of the cylinder head 200 is closed by a cylinder head cover 250 of Fig. 8 described below. At this time, the lower surface of the cylinder head cover 250 of Fig. 8 described below abuts against the upper surface of the flange portion 205.

[0033] As shown in Fig. 3, the outer surfaces of the sidewalls 201, 202 are formed to be parallel to the width direction W. An intake passage portion 230 is formed to project rearward from the sidewall 201. The intake passage portion 230 defines part of an intake passage (not shown) that leads air to the combustion chamber of the cylinder 51 of Fig. 1. Air is supplied to the combustion chamber through the intake passage and the plurality of intake holes.

[0034] The exhaust passage portion 240 is formed to project obliquely forward from the sidewall 202. The exhaust passage portion 240 defines part of the exhaust passage 241 that leads the exhaust gas exhausted from the combustion chamber to the exhaust pipe 20 of Fig. 1. In the present embodiment, the exhaust passage 241 is formed such that two passages from the two exhaust holes join one passage, the one passage further passes through the exhaust passage portion 240 and opens at the downstream end of the exhaust passage portion 240. The exhaust gas is exhausted into the exhaust pipe 20 of Fig. 1 through the plurality of exhaust holes and the exhaust passage 241.

[0035] The exhaust passage portion 240 has an exhaust pipe fitting portion 242, a plurality of bolt fixing portions 243 and a component attachment portion 244. The exhaust pipe 20 of Fig. 1 is fitted into the exhaust pipe fitting portion 242. The plurality of bolt fixing portions 243 are used for fixing bolts 21 for attaching an exhaust pipe of Fig. 8 described below. In the present embodiment, the two bolt fixing portions 243 are provided at the exhaust passage portion 240. An oxygen sensor 40 is attached to the component attachment portion 244.

[0036] Fig. 5 is an enlarged view of the exhaust passage portion 240 of Fig. 3. Fig. 6 is an enlarged view of the exhaust passage portion 240 of Fig. 4. In Fig. 5, an axial direction of the exhaust passage 241 is referred to as an exhaust passage axial direction 241z. In Fig. 6, a radial direction of the exhaust passage 241 is referred to as an exhaust passage radial direction 241r.

[0037] As shown in Fig. 5, the exhaust passage 241 in the exhaust passage portion 240 is provided such that the exhaust passage axial direction 241z is inclined with respect to the front and rear direction L as viewed from the cylinder axial direction C. In the present embodiment, the exhaust passage 241 in the exhaust passage portion 240 is provided such that the exhaust passage axial direction 241z is inclined obliquely forward rightward with respect to the front and rear direction L.

[0038] The exhaust pipe fitting portion 242 has a circular recess. The circular recess is constituted by a circular bottom surface and an annular projection that partially surrounds the bottom surface. In the exhaust passage axial direction 241z, the end surface of the annular projection is a downstream end surface 242e of the exhaust pipe fitting portion 242. The downstream end sur-

face 242e of the exhaust pipe fitting portion 242 in the exhaust passage axial direction 241z is formed to be inclined with respect to the sidewall 202 as viewed from the cylinder axial direction C. The bottom surface in the recess of the exhaust pipe fitting portion 242 is an abutment surface 242C against which the end surface of the exhaust pipe 20 can abut. The abutment surface 242C is positioned at the further upstream than the downstream end surface 242e in the exhaust passage axial direction 241z. The exhaust passage 241 is opened at the center of the abutment surface 242C.

[0039] The downstream end surfaces of the two bolt fixing portions 243 include bolt bearing surfaces 243A, 243B, respectively. The bolt bearing surfaces 243A, 243B are formed at the further upstream position than the abutment surface 242C of the exhaust pipe fitting portion 242 in the exhaust passage axial direction 241z.

[0040] Here, the bolt bearing surface 243A is provided at a position farther from the sidewall 202 than the bolt bearing surface 243B, and the bolt bearing surface 243B is provided at a position closer to the sidewall 202 than the end surface of the flange portion 205. That is, a distance LA from the bolt bearing surface 243A to the sidewall 202 is longer than a distance LB from the bolt bearing surface 243B to the sidewall 202. In this case, the bolt bearing surface 243B is provided at a position closer to the sidewall 202 than the end surface of the flange portion 205 such that the bolt bearing surface 243A comes closer to the sidewall 202. Therefore, a size of the cylinder head 200 can be reduced in a direction vertical to the sidewall 202.

[0041] As shown in Figs. 3 and 6, the bolt bearing surfaces 243A, 243B of the bolt fixing portions 243 are provided outside of the exhaust pipe fitting portion 242 in the exhaust passage radial direction 241r as viewed from the cylinder axial direction C. Bolt holes 243h are formed at the center of the bolt bearing surfaces 243A, 243B. The bolts 21 for attaching an exhaust pipe of Fig. 8 described below are inserted into the bolt holes 243h, respectively.

[0042] Notches 242A, 242B are formed at portions respectively overlapping with the bolt bearing surfaces 243A, 243B in the exhaust passage radial direction 241r at the downstream end surface 242e of the exhaust pipe fitting portion 242 (an annular projection). In this case, the bottom surfaces of the notches 242A, 242B are formed to be linked to the bolt bearing surfaces 243A, 243B. Thus, the bolt holes 243h of the bolt bearing surfaces 243A, 243B can be formed at positions close to the center of the exhaust pipe fitting portion 242 in the exhaust passage radial direction 241r. As a result, an increase in size of the bolt fixing portions 243 in the exhaust passage radial direction 241r can be prevented.

[0043] As shown in Fig. 5, a portion of the downstream end surface 242e of the exhaust pipe fitting portion 242 that is the farthest from the sidewall 202 as viewed from the cylinder axial direction C is referred to as a first portion 244A. Similarly, a portion of the downstream end surface 242e of the exhaust pipe fitting portion 242 that is the closest to the sidewall 202 as viewed from the cylinder axial direction C is referred to as a second portion 244B. That is, in the downstream end surface 242e of the exhaust pipe fitting portion 242, a distance from the first portion 244A to the sidewall 202 is the longest, and a distance from the second portion 244B to the sidewall 202 is the shortest.

[0044] In the present embodiment, because the bolt bearing surface 243A is provided at a position farther from the sidewall 202 than the bolt bearing surface 243B, a space for the component attachment portion 244 can be sufficiently ensured at a position far from the sidewall 202 in the exhaust passage portion 240.

[0045] Here, the component attachment portion 244 is provided at a position closer to the first portion 244A than the second portion 244B in the exhaust passage radial direction 241r. In this case, the exhaust passage portion 240 has a larger region at the first portion 244A than the second portion 244B. Thus, the oxygen sensor 40 can be attached to the component attachment portion 244 without interfering with the sidewall 202, and an increase in size of the cylinder head 200 due to the attachment of the oxygen sensor 40 is prevented.

[0046] Further, the component attachment portion 244 is arranged outside of an outer periphery of the flange portion 205 as viewed from the cylinder axial direction C. In this case, the oxygen sensor 40 having a shape extending beyond the flange portion 205 can be attached to the component attachment portion 244. Further, attachment of the components to the component attachment portion 244 and removal of the components from the component attachment portion 244 in a direction crossing the flange portion 205 of the sidewall 202 can be easily performed.

[0047] The bolt bearing surface 243A may be formed such that a plane including the bolt bearing surface 243A intersects with the component attachment portion 244 as viewed from the cylinder axial direction C. Alternatively, the bolt bearing surface 243A may be formed such that the plane including the bolt bearing surface 243A is positioned at the further upstream than the component attachment portion 244 as viewed from the cylinder axial direction C. In this case, because the bolt bearing surface 243A sufficiently comes closer to the sidewall 202, the size of the cylinder head 200 can be sufficiently reduced in the direction vertical to the sidewall 202.

[0048] Fig. 7 is a cross sectional view taken along the exhaust passage axial direction 241z of the exhaust passage portion 240 of Fig. 3. As shown in Fig. 7, the oxygen sensor 40 is attached to the component attachment portion 244 of the exhaust passage portion 240 in parallel to the cylinder axial direction C. Here, an oxygen detector provided at the tip end of the oxygen sensor 40 is arranged in the exhaust passage 241. In this case, concentration of oxygen of the exhaust gas exhausted from the combustion chamber of the cylinder 51 through the exhaust passage 241 can be measured by the oxygen

sensor 40. Further, a temperature of the oxygen sensor 40 rises due to the heat in the combustion chamber. This enables the rise time of the oxygen sensor 40 to be shortened.

(3) Directional Relationship between the Cylinder Head and the Motorcycle

[0049] Fig. 8 is a diagram showing the directional relationship between the cylinder head 200 and the motorcycle 100. As shown in Fig. 8, the cylinder head 200 is provided on the vehicle body frame 80 such that the sidewalls 201, 202 are facing the front and rear of the motorcycle 100, respectively.

[0050] The cylinder head cover 250 is attached to the upper surface of the flange portion 205 of Fig. 3 of the cylinder head 200. The exhaust pipe 20 is fitted into the recess of the exhaust pipe fitting portion 242. In this state, the exhaust pipe 20 is fixed to the bolt holes 243h of the bolt bearing surfaces 243A, 243B of the bolt fixing portions 243 by the bolts 21 for attaching an exhaust pipe 20. Thus, the exhaust pipe 20 is connected to the exhaust pipe fitting portion 242.

[0051] According to this configuration, the downstream end surface 242e of the exhaust pipe fitting portion 242 of the cylinder head 200 is inclined to one side (right side in the present embodiment) with respect to the front and rear direction L as viewed from the up-and-down direction of the motorcycle 100. Further, as shown in Fig. 1, the muffler 30 is provided on the one side (right side in the present embodiment) in the width direction W of the vehicle body frame 80. Thus, attachment of the exhaust pipe 20 and the muffler 30 and routing of the exhaust pipe 20 are easily performed.

(4) Effects

[0052] The exhaust passage portion 240 projects from the sidewall 202 in the cylinder head 200 according to the present embodiment. Here, the bolt bearing surfaces 243A, 243B of the bolt fixing portions 243 of the exhaust passage portion 240 are provided outside of the exhaust pipe fitting portion 242 of the exhaust passage portion 240 in the exhaust passage radial direction 241r. The downstream end surface 242e of the exhaust pipe fitting portion 242 in the exhaust passage axial direction 241z is formed to be inclined with respect to the sidewall 202 as viewed from the cylinder axial direction C. This enables the exhaust pipe 20 to be compactly attached to the cylinder head 200.

[0053] Further, the bolt bearing surfaces 243A, 243B of the bolt fixing portions 243 are formed at the further upstream position than the lower end surface 242e of the exhaust pipe fitting portion 242 in the exhaust passage axial direction 241z. Thus, a distance from the sidewall 202 to a portion of the bolt fixing portion 243 that is the farthest is smaller as compared with the case in which the bolt bearing surfaces 243A, 243B and the downstream end surface 242e of the exhaust pipe fitting portion 242 are arranged on the same plane. Therefore, the size of the cylinder head 200 is reduced in the direction vertical to the sidewall 202, that is, the front and rear direction L of the vehicle body of the motorcycle 100.

[0054] As a result, the exhaust pipe 20 can be connected to be inclined with respect to the sidewall 202 of the cylinder head 200 while the increase in size of the cylinder 200 is suppressed. Further, the size of the cylinder head 200 is reduced in the direction vertical to the sidewall 202. Thus, when the cylinder head 200 is manufactured by casting, a number of the cylinder heads 200 that can be manufactured from one mold may be increased. As a result, productivity of the cylinder head 200 can be improved.

(5) Other Embodiments

[0055]

(5-1) The oxygen sensor 40 is attached to the component attachment portion 244 in the embodiment described above, the invention is not limited to this. Another component may be attached to the component attachment portion 244 instead of the oxygen sensor 40. Alternatively, the oxygen sensor 40 may be attached to a member positioned further downstream than the exhaust passage portion 240 such as the exhaust pipe 20 and the like. In this case, the component attachment portion 244 does not have to be provided at the exhaust passage portion 240.

(5-2) The oxygen sensor 40 is attached to the component attachment portion 244 of the exhaust passage portion 240 in parallel to the cylinder axial direction C in the embodiment described above, the invention is not limited to this. The oxygen sensor 40 may be attached to the component attachment portion 244 of the exhaust passage portion 240 to be inclined with respect to the cylinder axial direction C.

(5-3) The notches 242A, 242B are formed at the downstream end surface 242e of the exhaust pipe fitting portion 242 in the embodiment described above, the invention is not limited to this. For example, when bolts having a small diameter are used, the notches 242A, 242B do not have to be formed at the downstream end surface 242e of the exhaust pipe fitting portion 242.

(5-4) The motorcycle 100 is described as an example of the saddle-straddling type motor vehicle in the embodiment described above, the invention is not limited to this. This invention may be applied to another saddle-straddling type motor vehicle such as a motor tricycle, an ATV (All Terrain Vehicle) or the like.

(6) Correspondences between Constituent Elements in Claims and Parts in Preferred Embodiments

[0056] In the following paragraphs, non-limiting exam-

ples of correspondences between various elements recited in the claims below and those described above with respect to various preferred embodiments of the present invention are explained.

[0057] The engine 50 is an example of an engine, the cylinder head 200 is an example of a cylinder head, the valve mechanism 260 is an example of a valve mechanism, the space V is an example of a space, the sidewall 202 is an example of a sidewall and the flange portion 205 is an example of a flange portion. The exhaust pipe 20 is an example of an exhaust pipe, the exhaust passage 241 is an example of an exhaust passage, the exhaust passage portion 240 is an example of an exhaust passage portion and the exhaust pipe fitting portion 242 is an example of an exhaust pipe fitting portion.

[0058] The bolt 21 for attaching an exhaust pipe is an example of a bolt for attaching an exhaust pipe, the bolt fixing portion 243 is an example of a bolt fixing portion and the bolt bearing surfaces 243A, 243B are examples of first and second bolt bearing surfaces, respectively. The exhaust passage radial direction 241r is an example of an exhaust passage radial direction, the exhaust passage axial direction 241z is an example of an exhaust passage axial direction, the downstream end surface 242e is an example of a downstream end surface of the exhaust pipe fitting portion and the cylinder axial direction C is an example of a cylinder axial direction.

[0059] The oxygen sensor 40 is an example of a component or an oxygen sensor, the component attachment portion 244 is an example of a component attachment portion, the first portion 244A is an example of a first portion and the second portion 244B is an example of a second portion. The abutment surface 242C is an example of an abutment surface, the notches 242A, 242B are example of a notch, the vehicle body frame 80 is an example of a vehicle, the motorcycle 100 is an example of a saddle-straddling type motor vehicle and the muffler 30 is an example of a silencer.

[0060] While preferred embodiments of the present invention have been described above, it is to be understood that variations and modifications will be apparent to those skilled in the art without departing the scope and spirit of the present invention. The scope of the present invention, therefore, is to be determined solely by the following claims.

Claims

1. A cylinder head (200) provided on a single-cylinder engine (50), comprising:

a sidewall (202) that defines at least part of a space (V) storing a valve mechanism (260); and
an exhaust passage portion (240) that defines an exhaust passage (241) leading exhaust gas exhausted from a combustion chamber to an exhaust pipe (20) and projects from the sidewall (202), wherein
the exhaust passage portion (240) has an exhaust pipe fitting portion (242) into which the exhaust pipe (20) is fitted and a bolt fixing portion (243)for fixing of a bolt for attaching the exhaust pipe,
at least part of the bolt fixing portion (243) is provided outside of the exhaust pipe fitting portion (242) in an exhaust passage radial direction as viewed from a cylinder axial direction,
a downstream end surface (242e) of the exhaust pipe fitting portion (242) in the exhaust passage axial direction is formed to be inclined with respect to the sidewall (202) as viewed from the cylinder axial direction, and
a downstream end surface of the bolt fixing portion (243) in the exhaust passage axial direction is formed at a further upstream portion than the downstream end surface (242e) of the exhaust pipe fitting portion (242) in the exhaust passage axial direction.

2. The cylinder head (200) according to claim 1, wherein
the exhaust passage portion (240) further has a component attachment portion (244) for attaching a component (40).

3. The cylinder head (200) according to claim 2, wherein
the downstream end surface (242e) of the exhaust pipe fitting portion (242) has a first portion (244A) that is the farthest from the sidewall (202) and a second portion (244B) that is the closest to the sidewall (202), as viewed from the cylinder axial direction, and
the component attachment portion (244) is provided at a position closer to the first portion (244A) than the second portion (244B) in the exhaust passage radial direction.

4. The cylinder head (200) according to claim 2 or 3, further comprising:

a flange portion (205) formed at an upper end of the sidewall (202), wherein
the component attachment portion (244) is arranged outside of an outer periphery of the flange portion (205) as viewed from the cylinder axial direction.

5. The cylinder head (200) according to claim 4, wherein
the downstream end surface of the bolt fixing portion (243) includes first and second bolt bearing surfaces (243A, 243B),
the first bolt bearing surface (243A) is provided at a position farther from the sidewall (202) than the second bolt bearing surface (243B), and

the second bolt bearing surface (243B) is provided at a position closer to the sidewall (202) than an end surface of the flange portion (205).

6. The cylinder head (200) according to claim 5, wherein
the first bolt bearing surface (243A) is formed such that a plane including the first bolt bearing surface (243A) intersects with the component attachment portion (244) as viewed from the cylinder axial direction.

7. The cylinder head (200) according to any one of claims 2 to 6, wherein
the component (40) includes an oxygen sensor.

8. The cylinder head (200) according to any one of claims 1 to 7, wherein
the exhaust pipe fitting portion (242) has an abutment surface (242c) against which an end surface of the exhaust pipe (20) is abuttable, the abutment surface (242c) being inside the downstream end surface of the exhaust pipe fitting portion (242) and at a further upstream position than the downstream end surface in the exhaust passage axial direction, and
the downstream end surface of the bolt fixing portion (243) is formed at a further upstream position than the abutment surface (242c) in the exhaust passage axial direction.

9. The cylinder head (200) according to any one of claims 1 to 8, wherein
the downstream end surface (242e) of the exhaust pipe fitting portion (242) has a notch (242A, 242B) that is notched in the exhaust passage radial direction, the notch (242A, 242B) being at a portion overlapping with the downstream end surface of the bolt fixing portion (243) in the exhaust passage radial direction.

10. A saddle-straddling type motor vehicle comprising:

a vehicle body;
a single-cylinder engine (50) provided on the vehicle body;
a cylinder head (200) according to any one of claims 1 to 9 provided on the engine (50); and
an exhaust pipe (20) connected to the exhaust passage portion (240) of the cylinder head (200).

11. The saddle-straddling type motor vehicle according to claim 10, further comprising:

a silencer (30) provided at the exhaust pipe (20), wherein
the silencer (30) is provided on one side in a width direction of the vehicle body, and
a downstream end surface of the exhaust pipe fitting portion (242) of the cylinder head (200) is formed to be inclined with respect to a front and rear direction of the vehicle main body as viewed from an up-and-down direction of the vehicle main body.

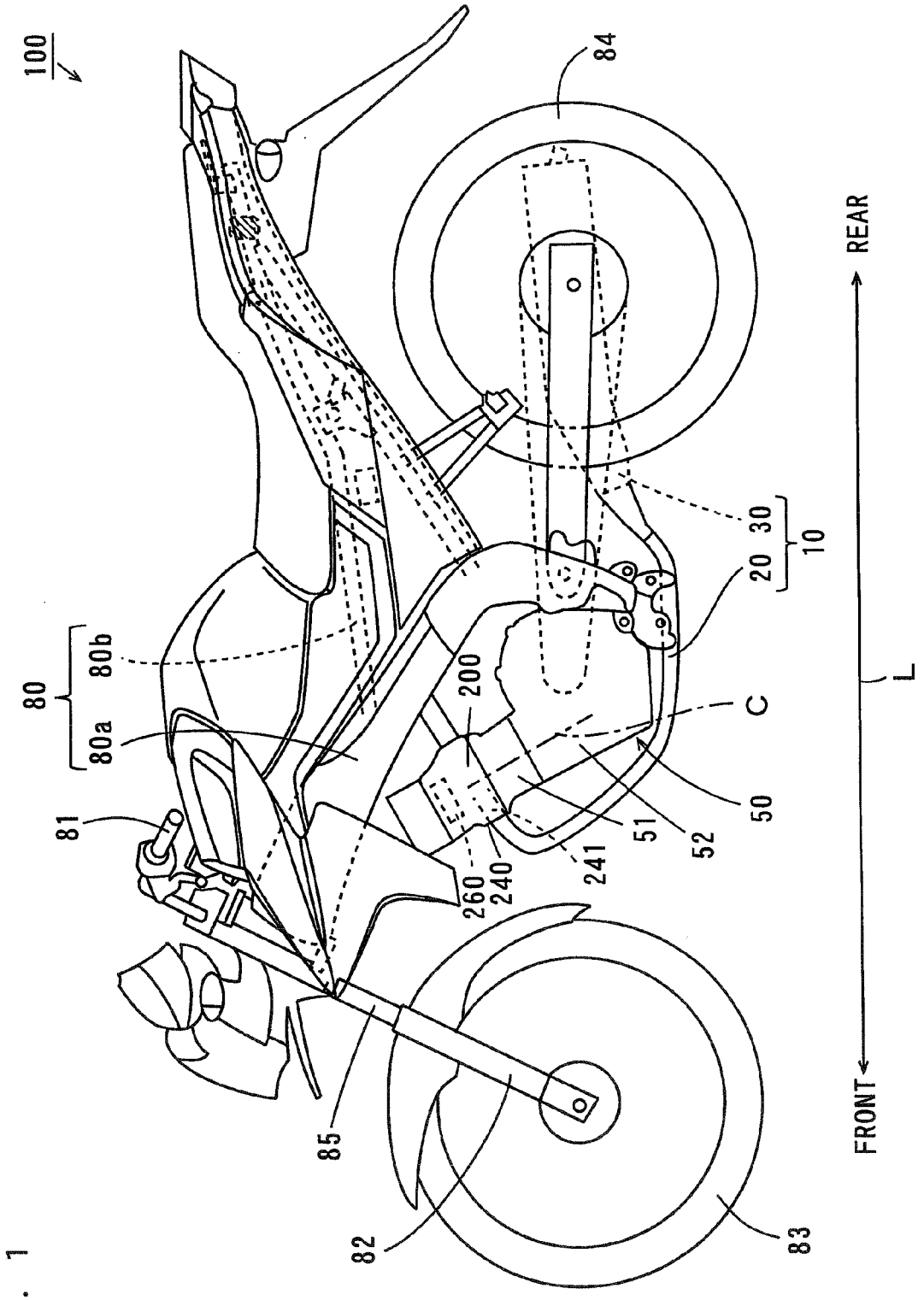

100
84
80
80b
80a
81
200
C
50
51
52
241
240
260
85
82
83
10
30
20
L
REAR
FRONT

FIG. 1

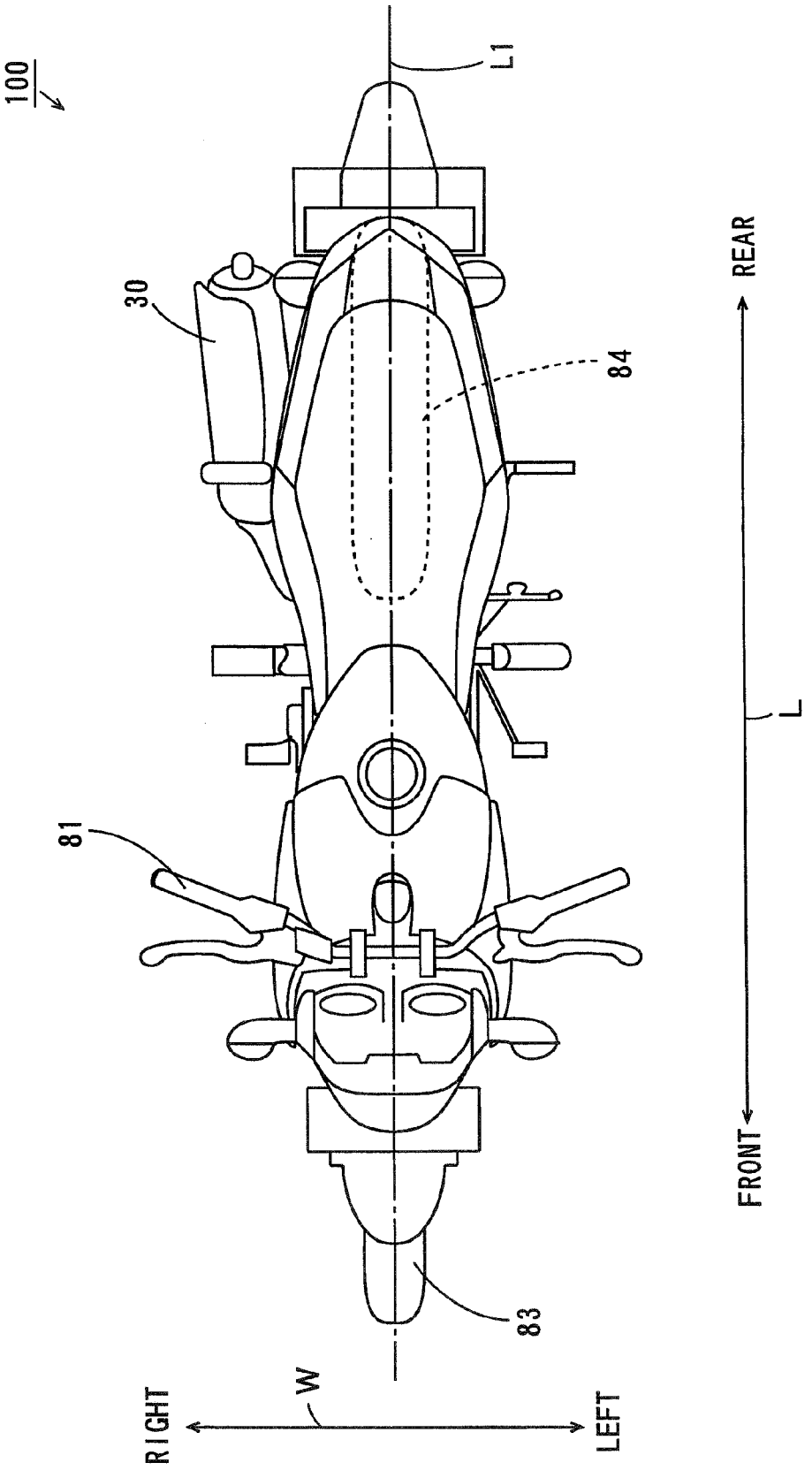


FIG. 2

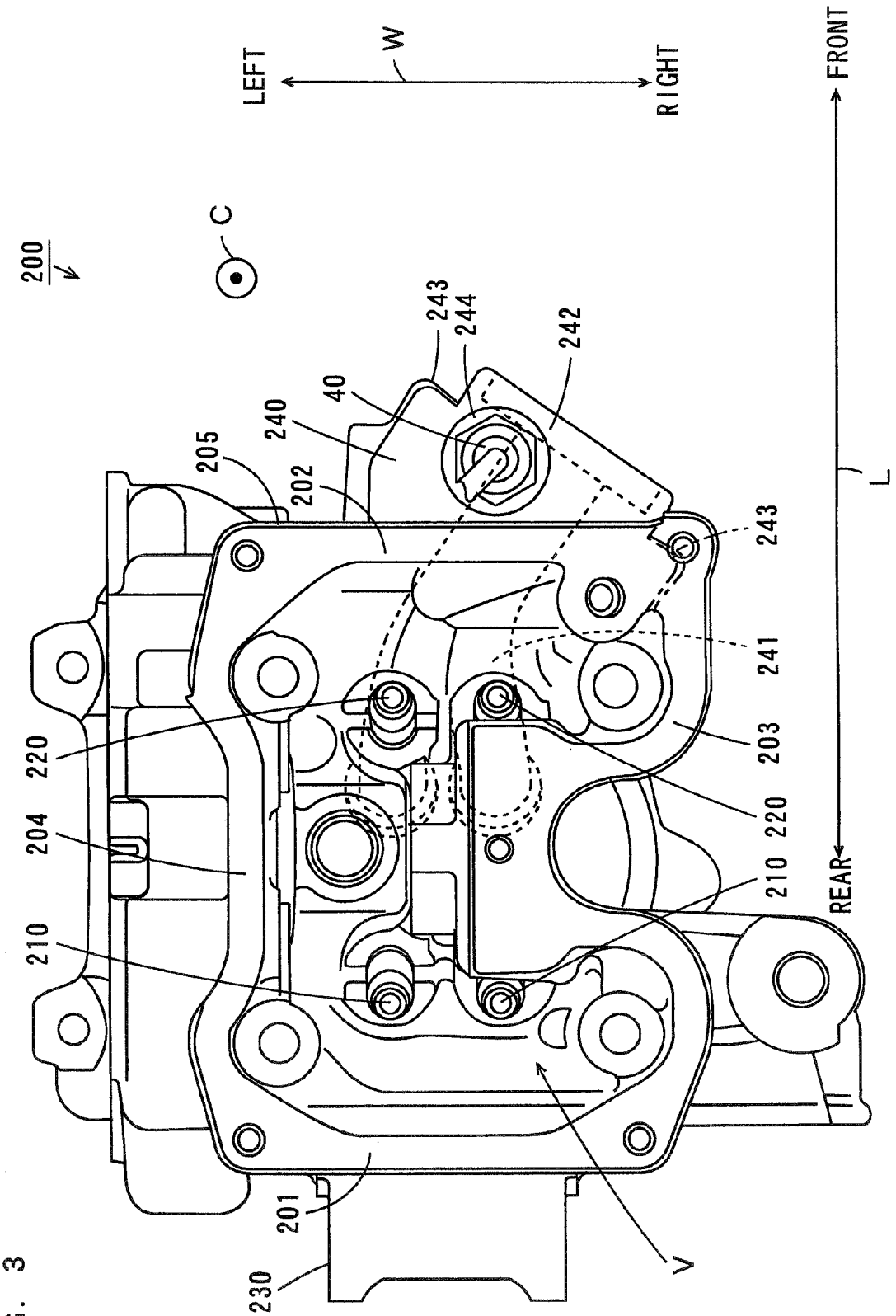

200
C
LEFT
W
RIGHT
FRONT
L
REAR
V
243
244
242
40
240
205
202
243
241
203
220
220
204
210
210
201
230

FIG. 3

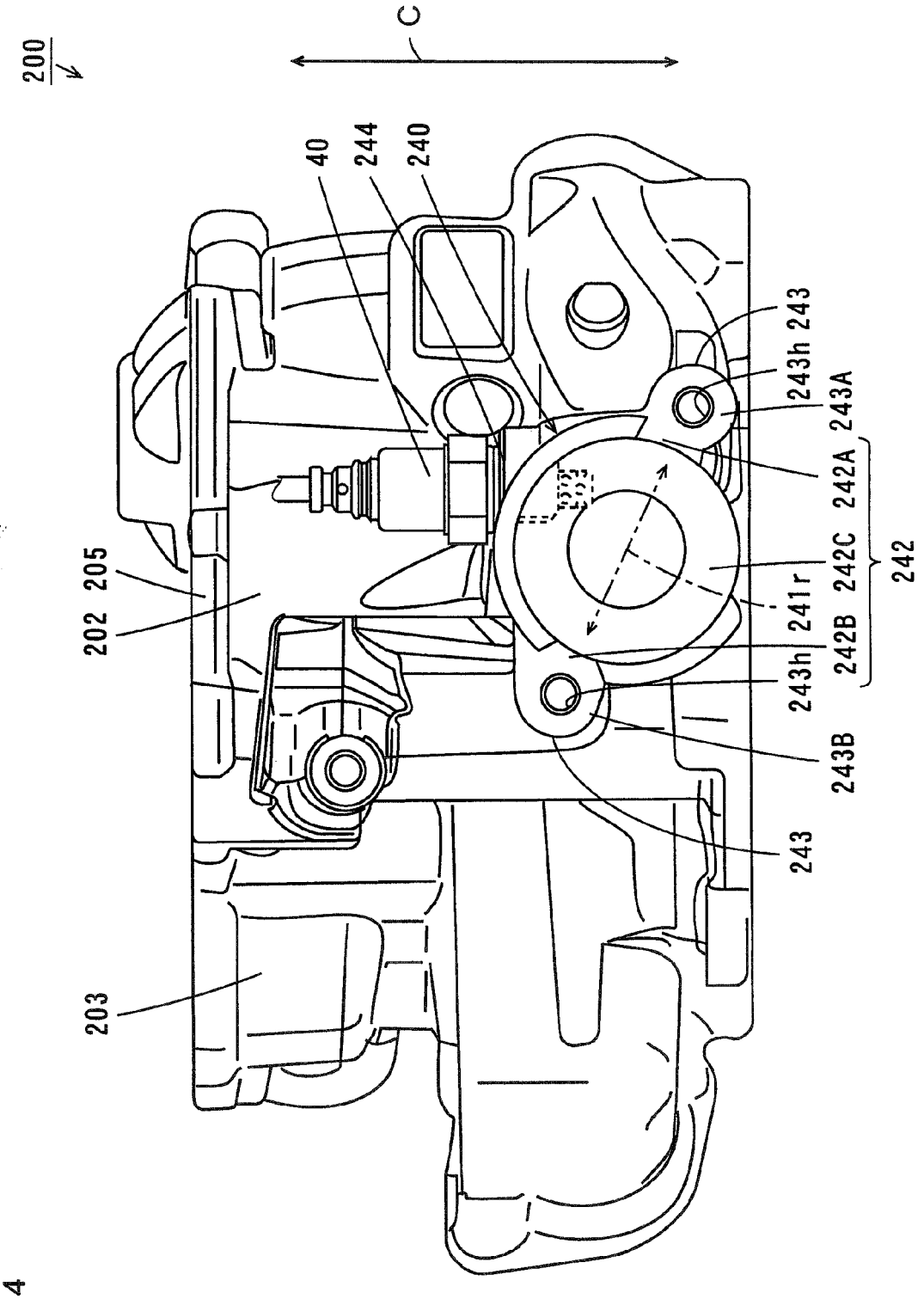

200
C
40
244
240
243h 243
243A
242A
242C
242
241r
243h
242B
243B
243
205
202
203

FIG. 4

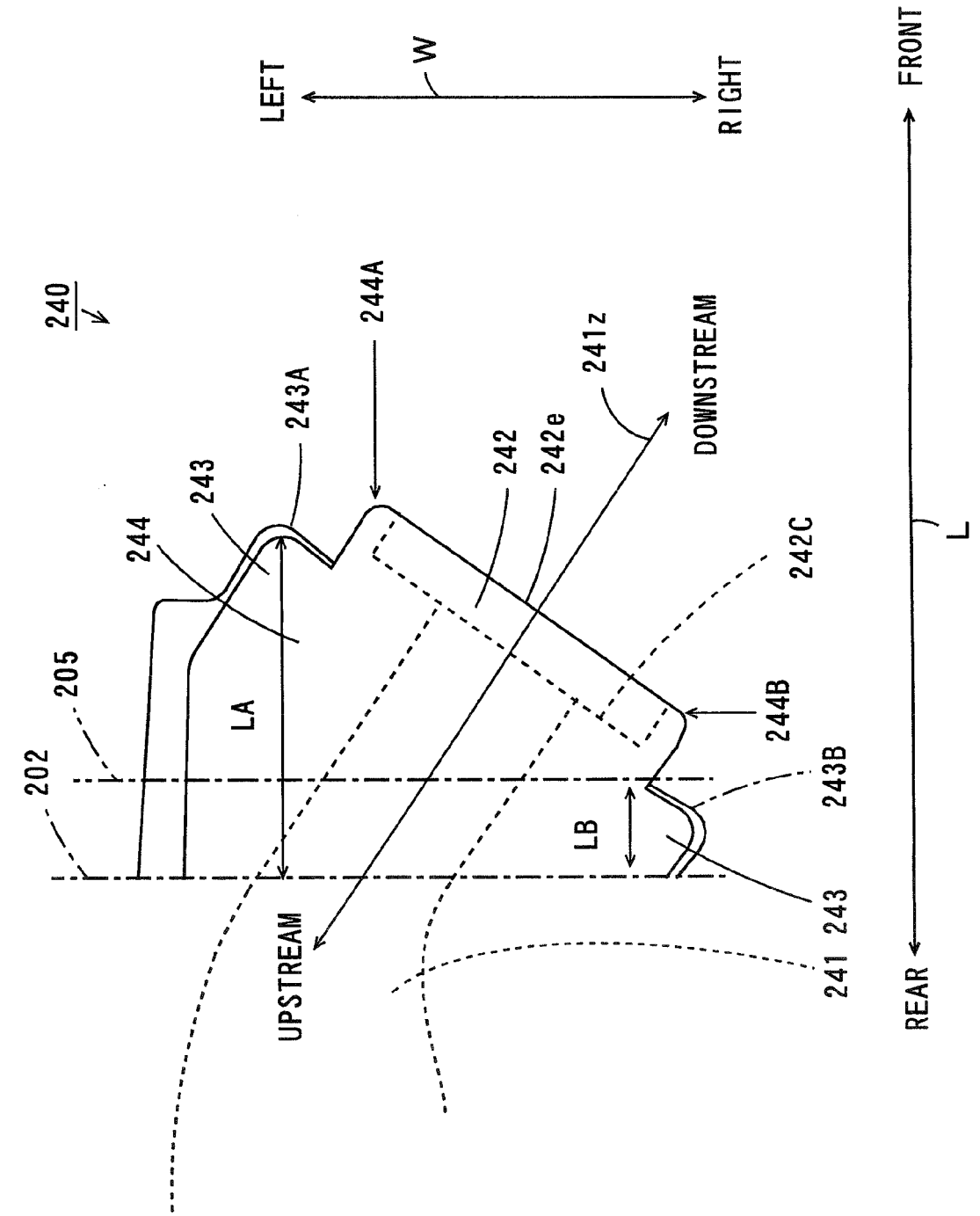

LEFT
W
RIGHT
FRONT
L
REAR
240
244A
243A
243
244
241z
242
242e
DOWNSTREAM
242C
205
LA
202
244B
243B
LB
241 243
UPSTREAM

FIG. 5

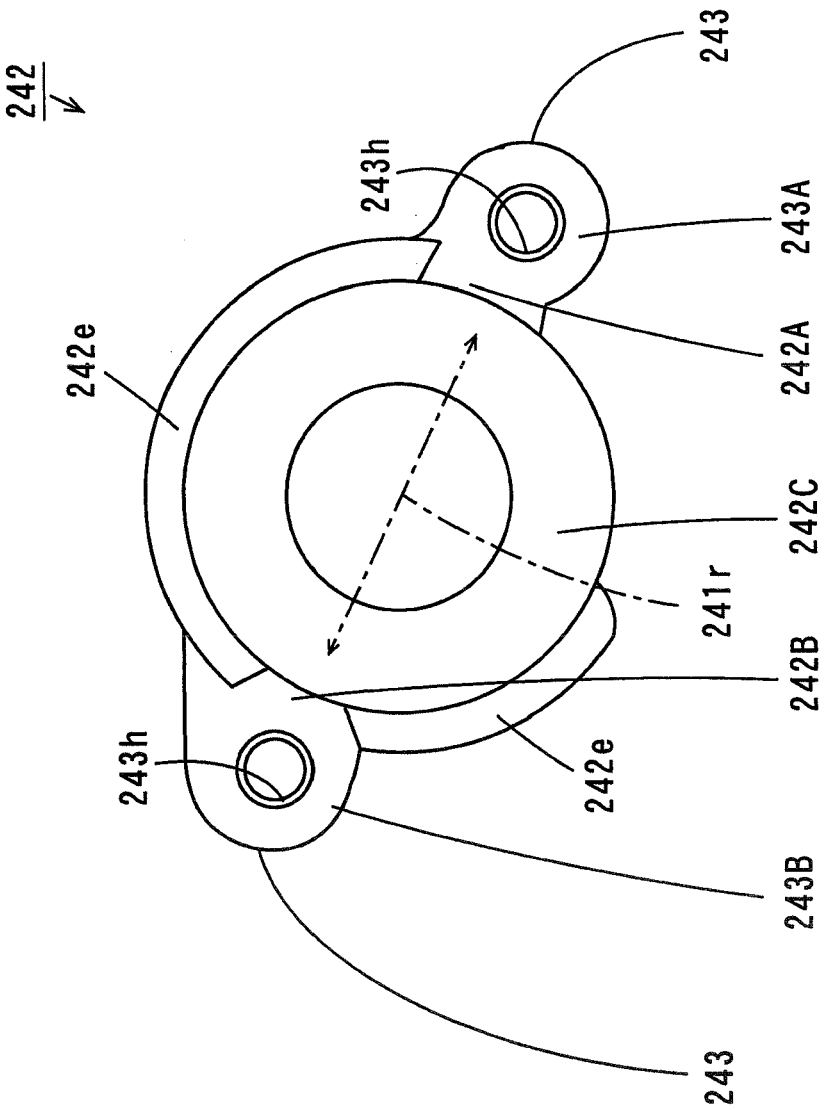
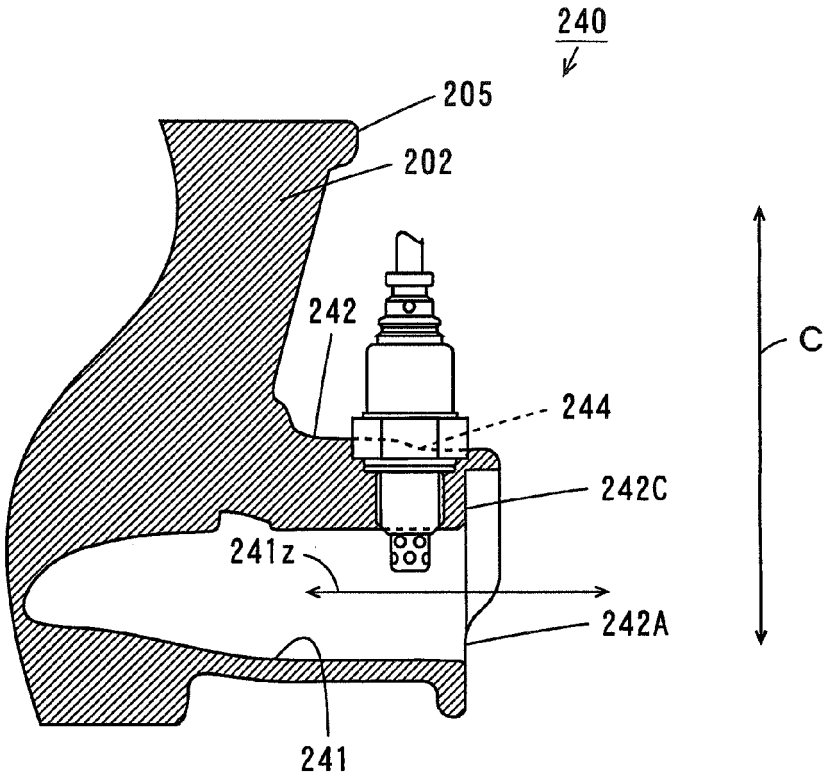


FIG. 6

FIG. 7



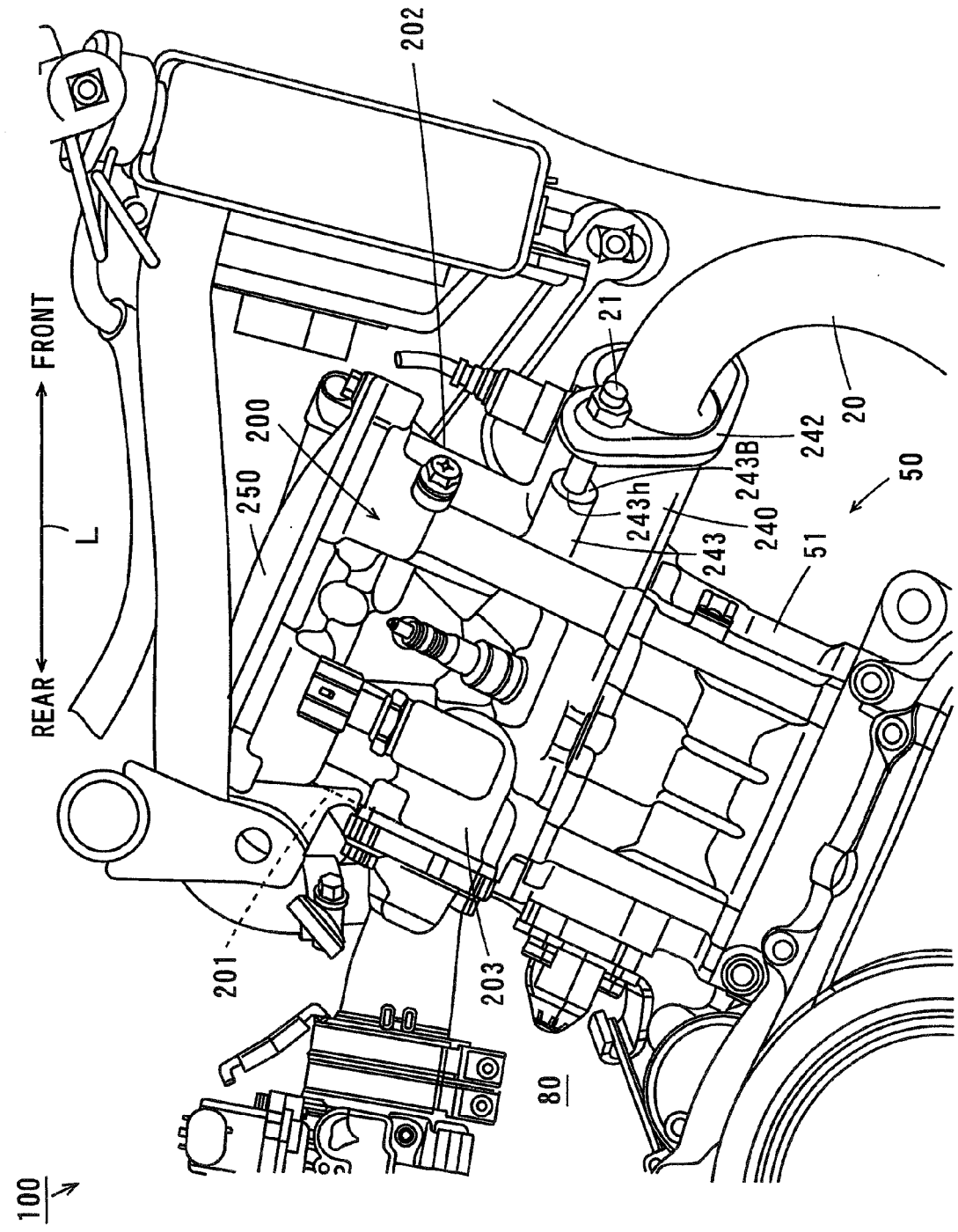

202
21
20
200
250
242
243B
50
243h
240
243
51
FRONT
REAR
L
201
203
80
100

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 13 18 2605

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2009/084098 A1 (TSUBAKINO YUKIHIRO [JP] ET AL) 2 April 2009 (2009-04-02) * paragraph [0049] - paragraph [0051]; figures 1-3 *	1,2,10, 11	INV. F01N13/10 F01N13/18 F02F1/42
A,D	JP 2010 007645 A (HONDA MOTOR CO LTD) 14 January 2010 (2010-01-14) * abstract; figures *	1	

TECHNICAL FIELDS SEARCHED (IPC)

F01N
F02F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	2 December 2013	Mouton, Jean

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1

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02-12-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009084098 A1	02-04-2009	CA 2639531 A1	28-03-2009
		JP 4909229 B2	04-04-2012
		JP 2009085097 A	23-04-2009
		US 2009084098 A1	02-04-2009
JP 2010007645 A	14-01-2010	BR PI0901566 A2	19-06-2012
		JP 4815477 B2	16-11-2011
		JP 2010007645 A	14-01-2010

EPO FORM P0459

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Patent documents cited in the description

- JP 2010007645 A **[0002] [0003]**