



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
12.07.2017 Bulletin 2017/28

(51) Int Cl.:
F01M 1/08 (2006.01) F01M 9/10 (2006.01)

(21) Application number: **15835865.5**

(86) International application number:
PCT/JP2015/060372

(22) Date of filing: **01.04.2015**

(87) International publication number:
WO 2016/031290 (03.03.2016 Gazette 2016/09)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA

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(30) Priority: **27.08.2014 JP 2014172958**

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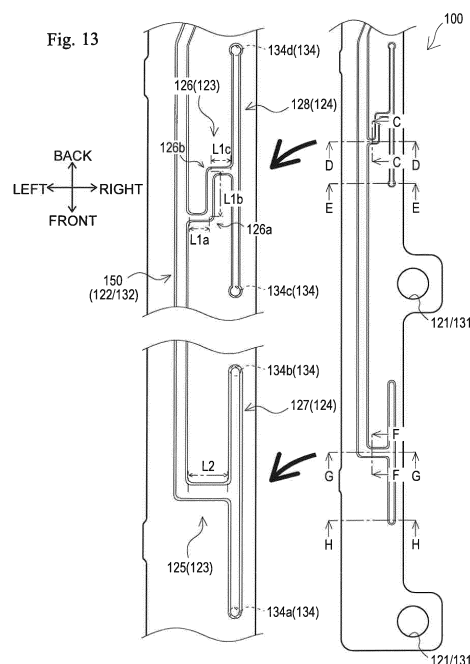
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(54) **OIL FEED MEMBER AND ENGINE LUBRICATING OIL SUPPLY MECHANISM PROVIDED WITH SAME**

(57) Provided are an oil feed member that makes it possible to ensure a wide distance between oil passages and to achieve space saving in the oil passages and a lubricant feed mechanism of an engine provided with the oil feed member.

An oil feed member 100 includes a lubricant passage and a plurality of discharge ports 134 (134a to 134d) that are formed on the downstream end of the lubricant passage and discharge lubricant flowing through the lubricant passage to a lubrication portion. The lubricant passage includes a basis oil passage 150, a first upstream branch oil passage 125 that branches off from the basis oil passage 150 and allows lubricant guided to the discharge ports 134a and 134b to flow therethrough, and a second upstream branch oil passage 126 that branches off from the basis oil passage 150 and allows lubricant guided to the discharge ports 134c and 134d to flow therethrough.



Description

TECHNICAL FIELD

[0001] The present invention relates to techniques of an oil feed member that feeds lubricant to a lubrication portion of a valve gear that opens and closes intake and exhaust valves of an engine and a lubricant feed mechanism of an engine provided with the oil feed member.

BACKGROUND ART

[0002] Conventionally, there have been known techniques of an oil feed member that feeds lubricant to a lubrication portion of a valve gear that opens and closes intake and exhaust valves of an engine and a lubricant feed mechanism of an engine provided with the oil feed member. For example, Patent Literatures 1 and 2 describe such techniques.

[0003] Patent Literature 1 describes a cylinder head which includes a bearing, a camshaft which is rotatably supported by the bearing, a cam cap which is fixed to the cylinder head from the upper side so as to hold the camshaft, and a cam shower pipe (oil feed member) which is connected to the upper part of the cam cap. An oil passage for guiding lubricant in an oil gallery of the cylinder head to the cam shower pipe is formed in the cylinder head, the camshaft, and the cam cap.

[0004] In such a configuration, lubricant can be fed to a lubrication portion of a valve gear which is disposed under the cam shower pipe by dropping the lubricant fed from the oil gallery from the cam shower pipe.

[0005] However, in the technique described in Patent Literature 1, the cam shower pipe is disposed on the upper part of the cam cap. Typically, the upper part of the cam cap is covered with a cylinder head cover, and only a narrow space is left above the cam cap. Thus, disadvantageously, it is difficult to dispose the cam shower pipe.

[0006] In view of this, Patent Literature 2 describes an oil feed member that can be easily disposed even when a space above the cam cap is narrow. Specifically, a recessed groove is formed on one plate-like member by pressing, and the plate-like member is folded in half to form the oil feed member. The groove is configured as an oil passage for guiding lubricant when the plate-like member is folded. In the plate-like oil feed member, the thickness in the up-down direction is relatively small. Thus, even when a space above the cam cap is narrow, the oil feed member can be easily disposed.

[0007] However, in the technique described in Patent Literature 2, a plurality of discharge ports are formed with respect to one oil feed port provided in the oil feed member. That is, in the oil feed member, oil passages (branch oil passages) for distributing lubricant fed to the oil feed port to the discharge ports are formed in an appropriately branching manner. When a plurality of branch oil passages are formed in this manner, disadvantageously, a

wide space is required in the oil feed member for ensuring an enough distance between the branch oil passages.

CITATION LIST

PATENT LITERATURE

[0008]

- Patent Literature 1: JP 2010-164009 A
Patent Literature 2: JP 2014-66214 A

SUMMARY OF INVENTION

TECHNICAL PROBLEMS

[0009] The present invention has been made in view of the above circumstances. To solve the above problems, an object of the present invention is to provide an oil feed member that makes it possible to ensure a wide distance between oil passages and to achieve space saving in the oil passages and a lubricant feed mechanism of an engine provided with the oil feed member.

SOLUTION TO PROBLEMS

[0010] Problems to be solved by the present invention are as described above. Next, means for solving the problems will be described.

- [0011]** An oil feed member of the present invention is an oil feed member for feeding lubricant to a lubrication portion of a valve gear that opens and closes intake and exhaust valves of an engine, the oil feed member including a lubricant passage defined by a recess formed on facing surfaces abutting against each other, and a plurality of discharge ports that are formed on a downstream end of the lubricant passage and discharge lubricant flowing through the lubricant passage to the lubrication portion. The lubricant passage includes a basis oil passage, a first branch oil passage that branches off from the basis oil passage and allows lubricant guided to a first discharge port group including at least two of the discharge ports to flow therethrough, and a second branch oil passage that branches off from the basis oil passage and allows lubricant guided to a second discharge port group including at least two of the discharge ports to flow therethrough.

[0012] In the oil feed member of the present invention, a branch point between the second branch oil passage and the basis oil passage is formed on the upstream side with respect to a branch point between the first branch oil passage and the basis oil passage, and the second branch oil passage includes a pressure loss generating mechanism that generates pressure loss in lubricant flowing through the second branch oil passage.

[0013] In the oil feed member of the present invention, the pressure loss generating mechanism is configured by making the second branch oil passage different from

the first branch oil passage in at least one of the length, the shape, and the flow passage cross-sectional area.

[0014] In the oil feed member of the present invention, a downstream end of the first branch oil passage is disposed near the first discharge port group, and a downstream end of the second branch oil passage is disposed near the second discharge port group.

[0015] A lubricant feed mechanism of an engine of the present invention includes the above oil feed member.

ADVANTAGEOUS EFFECTS OF INVENTION

[0016] The present invention achieves effects as described below.

[0017] In the oil feed member of the present invention, it is possible to ensure a wide distance between the oil passages and to achieve space saving in the oil passages.

[0018] In the oil feed member of the present invention, it is possible to equalize the amount of lubricant discharged from the first discharge port group and the second discharge port group.

[0019] In the oil feed member of the present invention, it is possible to manufacture the oil feed member provided with the pressure loss generating mechanism with a simple configuration.

[0020] In the oil feed member of the present invention, it is possible to further equalize the amount of lubricant discharged from the first discharge port group and the second discharge port group.

[0021] In the lubricant feed mechanism of the engine of the present invention, it is possible to ensure a wide distance between the oil passages and to achieve space saving in the oil passages.

BRIEF DESCRIPTION OF DRAWINGS

[0022]

Fig. 1 is a cross-sectional view of the inside of a cylinder head cover of an engine according to an embodiment of the present invention.

Fig. 2 is a plan view of a cam cap and an oil feed member.

Fig. 3 is a cross-sectional view taken along line A-A in Fig. 2.

Fig. 4 is a perspective view of the oil feed member.

Fig. 5 is a perspective view of the oil feed member in an unfolded state.

Fig. 6 is a plan view of the oil feed member in an unfolded state.

Fig. 7 is a partially enlarged view of the oil feed member in an unfolded state.

Fig. 8 is a perspective view illustrating a state of manufacturing the oil feed member.

Fig. 9 is a plan view of the oil feed member.

Fig. 10(a) is a diagram illustrating a state in which lubricant flows when an in-shaft oil passage and a

cam journal oil passage do not communicate with each other in Fig. 3, and Fig. 10(b) is a diagram illustrating a state in which lubricant flows when the in-shaft oil passage and the cam journal oil passage communicate with each other.

Fig. 11 is a diagram illustrating a state in which lubricant flows through the oil feed member.

Fig. 12 is a diagram illustrating a state in which lubricant is discharged from the oil feed member to a cam of an exhaust-side camshaft.

Fig. 13 is a diagram illustrating upstream branch oil passages and downstream branch oil passages.

Fig. 14(a) is a cross-sectional view taken along line B-B in Fig. 9, Fig. 14(b) is a cross-sectional view taken along line C-C in Fig. 13, Fig. 14(c) is a cross-sectional view taken along line D-D in Fig. 13, and Fig. 14(d) is a cross-sectional view taken along line E-E in Fig. 13.

Fig. 15(a) is a cross-sectional view taken along line F-F in Fig. 13, Fig. 15(b) is a cross-sectional view taken along line G-G in Fig. 13, and Fig. 15(c) is a cross-sectional view taken along line H-H in Fig. 13.

Fig. 16 is a cross-sectional view of the inside of a cylinder head cover of an engine provided with an oil feed member according to a second embodiment of the present invention.

Fig. 17 is a perspective view of the oil feed member in an unfolded state according to the second embodiment.

Fig. 18 is a plan view of the oil feed member according to the second embodiment.

Fig. 19 is a diagram illustrating a state in which lubricant is discharged from the oil feed member to a cam of an exhaust-side camshaft according to the second embodiment.

Fig. 20 is a plan view illustrating an oil feed member according to a third embodiment of the present invention.

Fig. 21 is a cross-sectional view of the inside of a cylinder head cover of an engine according to the third embodiment.

DESCRIPTION OF EMBODIMENTS

[0023] In the following description, the up-down direction, the right-left direction, and the front-back direction are defined in accordance with arrows illustrated in the drawings.

[0024] First, the configurations of an oil feed member 100 and an engine 1 provided with a lubricant feed mechanism according to an embodiment of the present invention will be described with reference to Figs. 1 to 3.

[0025] The engine 1 according to the present embodiment is an inline 4-cylinder double overhead camshaft (DOHC) 16-valve gasoline engine. For convenience of description, the following description will focus mainly on one of four cylinders which are arranged side by side in the front-back direction (specifically, the second cylinder

from the front). The engine 1 is mainly provided with a cylinder head 10, a cylinder head cover 20, a valve gear 30, a cam cap 50, and the oil feed member 100.

[0026] The cylinder head 10 illustrated in Figs. 1 and 3 constitutes a principal structural body of the engine 1 together with a cylinder block (not illustrated). The cylinder head 10 is fixed to the upper part of the cylinder block. The cylinder head 10 is mainly provided with an intake-side bearing 12, an exhaust-side bearing 14, an oil gallery 16, and a cam journal oil passage 18.

[0027] The intake-side bearing 12 illustrated in Fig. 1 rotatably supports an intake-side camshaft 40 (described below) from the lower side. The intake-side bearing 12 is a semicircular recess with the upper side open in front view and is formed in the left part of the cylinder head 10.

[0028] The exhaust-side bearing 14 illustrated in Figs. 1 and 3 rotatably supports an exhaust-side camshaft 42 (described below) from the lower side. The exhaust-side bearing 14 is a semicircular recess with the upper side open in front view and is formed in the right part of the cylinder head 10.

[0029] The oil gallery 16 illustrated in Figs. 1 and 3 is an oil passage for guiding lubricant to each unit (e.g., a lash adjuster 38 (described below)) of the engine 1. The oil gallery 16 passes through the vicinity of each of right and left side walls of the cylinder head 10 in the front-back direction.

[0030] The cam journal oil passage 18 illustrated in Fig. 3 is formed in the right part of the cylinder head 10 and is used for guiding lubricant to the exhaust-side bearing 14. One end of the cam journal oil passage 18 communicates with the oil gallery 16. The other end of the cam journal oil passage 18 communicates with the exhaust-side bearing 14 of the cylinder head 10.

[0031] Although not illustrated in the present embodiment, the cam journal oil passage 18 is formed also in the left part of the cylinder head 10 and allows the left oil gallery 16 and the intake-side bearing 12 to communicate with each other.

[0032] The cylinder head cover 20 illustrated in Fig. 1 covers the upper part of the cylinder head 10. The cylinder head cover 20 is placed on the upper part of the cylinder head 10 and is appropriately fixed thereto with, for example, a bolt.

[0033] The valve gear 30 illustrated in Fig. 1 is used for opening and closing an intake port and an exhaust port (not illustrated) of the engine 1 at a predetermined timing. The valve gear 30 is mainly provided with an intake valve 32, an exhaust valve 34, rocker arms 36, 36, lash adjusters 38, 38, the intake-side camshaft 40, and the exhaust-side camshaft 42.

[0034] The intake valve 32 opens and closes the intake port (not illustrated) of the engine 1. The intake valve 32 is disposed with the longitudinal direction of a rod-like valve stem 32a substantially aligned with the up-down direction. The lower end of the intake valve 32 extends up to the intake port. An up-down middle part of the intake valve 32 is slidably inserted in the cylinder head 10.

[0035] Although not illustrated in the present embodiment, two intake valves 32 are provided with respect to one cylinder and arranged side by side in the front-back direction.

[0036] The exhaust valve 34 opens and closes the exhaust port (not illustrated) of the engine 1. The exhaust valve 34 is disposed with the longitudinal direction of a rod-like valve stem 34a substantially aligned with the up-down direction. The lower end of the exhaust valve 34 extends up to the exhaust port. An up-down middle part of the exhaust valve 34 is slidably inserted in the cylinder head 10.

[0037] Although not illustrated in the present embodiment, two exhaust valves 34 are provided with respect to one cylinder and arranged side by side in the front-back direction.

[0038] The rocker arms 36, 36 are used for opening and closing the intake valve 32 and the exhaust valve 34. One end of one of the rocker arms 36, 36 abuts against the upper end of the intake valve 32 from the upper side. One end of the other rocker arm 36 abuts against the upper end of the exhaust valve 34 from the upper side. Rollers 36a, 36a are disposed on the respective rocker arms 36, 36. Each of the rollers 36a, 36a is rotatable around an axis aligned with the front-back direction. Cams 40a, 40a and cams 42a, 42a (described below) abut against the respective rollers 36a, 36a from the upper side.

[0039] The lash adjusters 38, 38 are used for adjusting a valve clearance. Each of the lash adjusters 38, 38 abuts against the other end of the corresponding one of the rocker arms 36, 36 from the lower side.

[0040] The intake-side camshaft 40 illustrated in Figs. 1 and 2 is used for opening and closing the intake valve 32 by rocking the intake-side rocker arm 36 at a predetermined timing. The intake-side camshaft 40 is placed on the intake-side bearing 12 of the cylinder head 10 with the longitudinal direction thereof aligned with the front-back direction. The intake-side camshaft 40 is mainly provided with the cams 40a, 40a.

[0041] The cams 40a, 40a are used for driving the intake valve 32. Each of the cams 40a, 40a is formed in a plate-like shape having non-uniform length between the rotation center (the center of the intake-side camshaft 40) and the outer periphery. The two cams 40a, 40a are disposed side by side on the front side with respect to a part (cam journal) of the intake-side camshaft 40 placed on the intake-side bearing 12 of the cylinder head 10. The cams 40a, 40a abut against the intake-side rocker arm 36 (specifically, the rollers 36a, 36a) from the upper side.

[0042] The exhaust-side camshaft 42 illustrated in Figs. 1 to 3 is used for opening and closing the exhaust valve 34 by rocking the exhaust-side rocker arm 36 at a predetermined timing. The exhaust-side camshaft 42 is placed on the exhaust-side bearing 14 of the cylinder head 10 with the longitudinal direction thereof aligned with the front-back direction. The exhaust-side camshaft

42 is mainly provided with the cams 42a, 42a and an in-shaft oil passage 42b.

[0043] The cams 42a, 42a are used for driving the exhaust valve 34. Each of the cams 42a, 42a is formed in a plate-like shape having a non-uniform length between the rotation center (the center of the exhaust-side camshaft 42) and the outer periphery. The two cams 42a, 42a are disposed side by side on the front side with respect to a part (cam journal) of the exhaust-side camshaft 42 placed on the exhaust-side bearing 14 of the cylinder head 10. The cams 42a, 42a abut against the exhaust-side rocker arm 36 (specifically, the rollers 36a, 36a) from the upper side.

[0044] The in-shaft oil passage 42b illustrated in Fig. 3 is formed in the part (cam journal) of the exhaust-side camshaft 42 placed on the exhaust-side bearing 14 of the cylinder head 10 and penetrates the exhaust-side camshaft 42. When the exhaust-side camshaft 42 rotates to a predetermined position, one end (one opening) of the in-shaft oil passage 42b faces the cam journal oil passage 18 of the cylinder head 10, and the other end (the other opening) thereof faces leftward.

[0045] Although not illustrated in the present embodiment, an oil passage similar to the in-shaft oil passage 42b in the exhaust-side camshaft 42 is formed also in the intake-side camshaft 40.

[0046] The cam cap 50 illustrated in Figs. 1 to 3 is fixed to the upper part of the cylinder head 10 and holds the intake-side camshaft 40 and the exhaust-side camshaft 42 between the cam cap 50 and the cylinder head 10. The cam cap 50 is formed in a substantially rectangular parallelepiped shape with the longitudinal direction thereof aligned with the right-left direction.

[0047] The cam cap 50 is mainly provided with an intake-side bearing 52, an intake-side recess 54, an intake-side through hole 56, an intake-side communicating oil passage 58, an exhaust-side bearing 60, an exhaust-side recess 62, an exhaust-side through hole 64, and an exhaust-side communicating oil passage 66.

[0048] The intake-side bearing 52 illustrated in Fig. 1 rotatably supports the intake-side camshaft 40 from the upper side. The intake-side bearing 52 is a semicircular recess with the lower side open in front view and is formed in the left part of the cam cap 50. The intake-side bearing 52 of the cam cap 50 is formed at a position facing the intake-side bearing 12 of the cylinder head 10. The intake-side camshaft 40 is rotatably supported (held) between the intake-side bearing 52 and the intake-side bearing 12.

[0049] The intake-side recess 54 illustrated in Figs. 1 and 2 is formed in the left part of the upper face of the cam cap 50 (immediately to the right of the intake-side bearing 52 in the right-left direction). The intake-side recess 54 is recessed downward to a predetermined depth from the surrounding thereof and open on the upper side, the front side, and the back side thereof.

[0050] The intake-side through hole 56 illustrated in Fig. 1 is a bolt hole into which a bolt 180 (described below)

is inserted for fixing the cam cap 50 to the cylinder head 10. The intake-side through hole 56 penetrates the cam cap 50 from the left part of the bottom face of the intake-side recess 54 through the lower face of the cam cap 50. In this manner, the intake-side recess 54 is formed around the upper end of the intake-side through hole 56. The diameter of the intake-side through hole 56 is larger than the diameter of a shaft of the bolt 180. Accordingly, when the shaft of the bolt 180 is inserted into the intake-side through hole 56, a gap is formed between the intake-side through hole 56 and the bolt 180.

[0051] The intake-side communicating oil passage 58 illustrated in Fig. 1 allows the intake-side bearing 52 and the intake-side through hole 56 to communicate with each other. The intake-side communicating oil passage 58 is formed in a substantially front-back central part of the lower face of the cam cap 50 (not illustrated). One end of the intake-side communicating oil passage 58 communicates with the intake-side bearing 52, and the other end of the intake-side communicating oil passage 58 communicates with the intake-side through hole 56.

[0052] The exhaust-side bearing 60 illustrated in Figs. 1 and 3 rotatably supports the exhaust-side camshaft 42 from the upper side. The exhaust-side bearing 60 is a semicircular recess with the lower side open in front view and is formed in the right part of the cam cap 50. The exhaust-side bearing 60 of the cam cap 50 is formed at a position facing the exhaust-side bearing 14 of the cylinder head 10. The exhaust-side camshaft 42 is rotatably supported (held) between the exhaust-side bearing 60 and the exhaust-side bearing 14.

[0053] The exhaust-side recess 62 illustrated in Figs. 1 to 3 is formed in the right part of the upper face of the cam cap 50 (immediately to the left of the exhaust-side bearing 60 in the right-left direction). The exhaust-side recess 62 is recessed downward to a predetermined depth from the surrounding thereof and open on the upper side, the front side, and the back side thereof.

[0054] The exhaust-side through hole 64 illustrated in Figs. 1 and 3 is a bolt hole into which a bolt 180 (described below) is inserted for fixing the cam cap 50 to the cylinder head 10. The exhaust-side through hole 64 penetrates the cam cap 50 from the right part of the bottom face of the exhaust-side recess 62 through the lower face of the cam cap 50. In this manner, the exhaust-side recess 62 is formed around the upper end of the exhaust-side through hole 64. The diameter of the exhaust-side through hole 64 is larger than the diameter of a shaft of the bolt 180 (described below). Accordingly, when the shaft of the bolt 180 is inserted into the exhaust-side through hole 64, a gap is formed between the exhaust-side through hole 64 and the bolt 180.

[0055] The exhaust-side communicating oil passage 66 illustrated in Figs. 1 and 3 allows the exhaust-side bearing 60 and the exhaust-side through hole 64 to communicate with each other. The exhaust-side communicating oil passage 66 is formed in a substantially front-back central part of the lower face of the cam cap 50.

One end of the exhaust-side communicating oil passage 66 communicates with the exhaust-side bearing 60, and the other end of the exhaust-side communicating oil passage 66 communicates with the exhaust-side through hole 64.

[0056] In the present embodiment, the cylinder head 10 and the cam cap 50 configured in the above manner constitute a cam housing which rotatably supports the intake-side camshaft 40 and the exhaust-side camshaft 42 of the valve gear 30.

[0057] Hereinbelow, the configuration of the oil feed member 100 will be described with reference to Figs. 1 to 9.

[0058] The oil feed member 100 illustrated in Figs. 1 to 4, and 9 is used for feeding lubricant to a lubrication portion of the valve gear 30 (the cams 40a of the intake-side camshaft 40 and the cams 42a of the exhaust-side camshaft 42 in the present embodiment). As described below, the oil feed member 100 is formed by folding a plate-like member in half (refer to Fig. 8). As described below, an oil passage through which lubricant flows is formed in the oil feed member 100. As illustrated in Figs. 1 and 2, the oil feed member 100 is disposed at each of the intake and exhaust sides for feeding lubricant to the intake-side lubrication portion and the exhaust-side lubrication portion of the valve gear 30. In this manner, the engine 1 is provided with two oil feed members 100.

[0059] A principal difference in configuration between the two oil feed members 100 is that the shapes of the two oil feed members 100 are right-left symmetric. Thus, hereinbelow, the configuration of one of the two oil feed members 100 that feeds lubricant to the exhaust-side lubrication portion of the valve gear 30 (the right oil feed member 100 illustrated in Fig. 1) will be described, and description for the configuration of the oil feed member 100 that feeds lubricant to the intake-side lubrication portion of the valve gear 30 (the left oil feed member 100 illustrated in Fig. 1) will be appropriately omitted unless otherwise specifically noted.

[0060] The oil feed member 100 is integrally formed so as to extend over four cylinders which are arranged side by side in the front-back direction. As illustrated in Fig. 4, the oil feed member 100 includes four parts P which are arranged side by side in the front-back direction so as to correspond to the respective four cylinders.

[0061] A principal difference in configuration between an oil passage formed in the two front parts P, P and an oil passage formed in the two back parts P, P is that the shapes of the oil passages are front-back symmetric. Thus, hereinbelow, in the four parts P, the configuration of the oil passage in the two front parts P, P will be described, and description for the configuration of the two back parts P, P will be appropriately omitted unless otherwise specifically noted.

[0062] First, the configuration of the oil feed member 100 in an unfolded state will be described with reference to Figs. 5 to 7.

[0063] Figs. 5 to 7 illustrate the oil feed member 100

in an unfolded state.

[0064] As illustrated in Figs. 5 and 6, the oil feed member 100 in an unfolded state is one plate-like member. Hereinbelow, for convenience of description, the oil feed member 100 in an unfolded state is merely referred to as a "panel member 110". The panel member 110 is mainly provided with an upper body 120, a lower body 130, and a coupling portion 140.

[0065] The upper body 120 illustrated in Figs. 5 to 7 constitutes a principal structural body of the oil feed member 100 together with the lower body 130. Specifically, the upper body 120 constitutes the upper part of the oil feed member 100 when the panel member 110 is folded (refer to Fig. 4). The upper body 120 is formed in an elongated plate-like shape. The upper body 120 is disposed with the plate surfaces facing up and down and the longitudinal direction aligned with the front-back direction. The upper body 120 is mainly provided with an upper through hole 121, an upper basis oil passage 122, an upstream branch oil passage 123, and a downstream branch oil passage 124.

[0066] The upper through hole 121 penetrates the upper body 120 in the up-down direction. The upper through hole 121 is formed in the left end part (the part projecting leftward) of the upper body 120. In the present embodiment, four upper through holes 121 are formed in the upper body 120. The four upper through holes 121 are disposed at substantially regular intervals in the front-back direction.

[0067] The upper basis oil passage 122 forms one oil passage (a basis oil passage 150 (described below)) together with a lower basis oil passage 132. Lubricant fed to the oil feed member 100 is first guided to the basis oil passage 150 through a lower cut-away portion 133. The upper face of the upper body 120 is recessed downward to form the upper basis oil passage 122. The upper basis oil passage 122 substantially linearly extends in the front-back direction at a position that is separated leftward by a predetermined distance from the right end of the upper body 120. A front-back middle part of the upper basis oil passage 122 is slightly curved leftward.

[0068] The upstream branch oil passage 123 branches off from the upper basis oil passage 122 (that is, the basis oil passage 150). The upstream branch oil passage 123 forms an oil passage to which the lubricant flowing through the basis oil passage 150 is guided next. The upper face of the upper body 120 is recessed downward to form the upstream branch oil passage 123. As illustrated in Fig. 7, the upstream branch oil passage 123 includes a first upstream branch oil passage 125 and a second upstream branch oil passage 126.

[0069] The configurations of the first upstream branch oil passage 125 and the second upstream branch oil passage 126 will be described in detail below.

[0070] The downstream branch oil passage 124 branches off from the upstream branch oil passage 123. The downstream branch oil passage 124 forms an oil passage to which the lubricant flowing through the up-

stream branch oil passage 123 (the first upstream branch oil passage 125 and the second upstream branch oil passage 126) is guided next. The upper face of the upper body 120 is recessed downward to form downstream branch oil passage 124. As illustrated in Fig. 7, the downstream branch oil passage 124 includes a first downstream branch oil passage 127 and a second downstream branch oil passage 128.

[0071] The configurations of the first downstream branch oil passage 127 and the second downstream branch oil passage 128 will be described in detail below.

[0072] The lower body 130 constitutes the principal structural body of the oil feed member 100 together with the upper body 120. Specifically, the lower body 130 constitutes the lower part of the oil feed member 100 when the panel member 110 is folded (refer to Fig. 4). The lower body 130 is formed in an elongated plate-like shape. The lower body 130 is disposed with the plate surfaces facing up and down and the longitudinal direction aligned with the front-back direction. As illustrated in Fig. 6, the lower body 130 and the upper body 120 are right-left symmetric with respect to the coupling portion 140. The lower body 130 is mainly provided with a lower through hole 131, a lower basis oil passage 132, a lower cut-away portion 133, and a discharge port 134.

[0073] The lower through hole 131 penetrates the lower body 130 in the up-down direction. The lower through hole 131 is formed in the right end part (the part projecting rightward) of the lower body 130. In the present embodiment, four lower through holes 131 are formed in the lower body 130. The four lower through holes 131 are disposed at substantially regular intervals in the front-back direction.

[0074] The lower basis oil passage 132 forms one oil passage (the basis oil passage 150) together with the upper basis oil passage 122. The upper face of the lower body 130 is recessed downward to form the lower basis oil passage 132. In the present embodiment, two lower basis oil passages 132 are independently provided in the front part and the back part of the lower body 130. Each of the lower basis oil passages 132 which are independently provided substantially linearly extends in the front-back direction at a position that is separated rightward by a predetermined distance from the left end of the lower body 130.

[0075] As illustrated in Figs. 5 and 6, the left end of the third lower through hole 131 from the front of the lower body 130 is cut away leftward by a predetermined length to form the lower cut-away portion 133.

[0076] The discharge port 134 is a port for discharging lubricant fed to the oil feed member 100 from the oil feed member 100. More specifically, the discharge port 134 is a port for discharging lubricant flowing through the downstream branch oil passage 124 (the first downstream branch oil passage 127 and the second downstream branch oil passage 128) toward the lubrication portion of the valve gear 30. The discharge port 134 is formed in the right end part of the lower body 130. In the

present embodiment, eight discharge ports 134 are formed in the lower body 130. The eight discharge ports 134 are disposed at appropriate intervals in the front-back direction.

[0077] The coupling portion 140 couples the upper body 120 and the lower body 130 to each other. The coupling portion 140 couples the right end of the upper body 120 and the left end of the lower body 130 at four positions. The coupling portion 140 is integrally formed with the upper body 120 and the lower body 130.

[0078] Hereinbelow, a method for manufacturing the oil feed member 100 and the configuration of the oil feed member 100 manufactured by the method (after the panel member 110 is folded) will be described with reference to Figs. 4, 8, 14 and 15.

[0079] One panel member is punched by pressing to form the outer shape and the through holes of the panel member 110 having the above configuration. Then, the panel member 110 is plastically deformed by the next pressing to form the upper basis oil passage 122 and the lower basis oil passages 132.

[0080] Then, as illustrated in Fig. 8, the panel member 110 is folded in half along the coupling portion 140 in such a manner that the upper body 120 is laid on the lower body 130. Then, the folded panel member 110 is appropriately swaged by pressing or welded. In this manner, the panel member 110 is maintained with the upper body 120 and the lower body 130 abutting against each other and manufactured as the oil feed member 100.

[0081] When the panel member 110 is folded to manufacture the oil feed member 100 in this manner, as illustrated in Figs. 14(c), 14(d), and 15(b), the open side of the upper basis oil passage 122 and the open side of each of the lower basis oil passages 132 face each other and overlap each other in plan view. A space defined by the upper basis oil passage 122 and each of the lower basis oil passages 132 in this manner is formed as an oil passage (specifically, the basis oil passage 150) through which lubricant can flow.

[0082] As described above, the lower basis oil passages 132 are independently formed on the front part and the back part of the lower body 130. That is, in the front-back central part of the basis oil passage 150 (specifically, the front-back middle part which is slightly curved leftward in the upper basis oil passage 122), the open side of the upper basis oil passage 122 faces not the lower basis oil passage 132, but the upper face of the lower body 130, and overlaps the upper face of the lower body 130 in plan view (not illustrated).

[0083] When the panel member 110 is folded to manufacture the oil feed member 100, as illustrated in Figs. 14(b), 14(c), 15(a) and 15(b), the open side of each of the upstream branch oil passages 123 (the first upstream branch oil passages 125 and the second upstream branch oil passages 126) and the open side of each of the downstream branch oil passages 124 (the first downstream branch oil passages 127 and the second downstream branch oil passages 128) of the upper body 120

face the upper face of the lower body 130 and overlap the upper face of the lower body 130 in plan view. In this manner, a space defined by the upstream branch oil passage 123 (the first upstream branch oil passage 125 and the second upstream branch oil passage 126) and the downstream branch oil passage 124 (the first downstream branch oil passage 127 and the second downstream branch oil passage 128), and the upper face of the lower body 130 is formed as an oil passage through which lubricant can flow.

[0084] When the panel member 110 is folded to manufacture the oil feed member 100, as illustrated in Figs. 14(a), the open side of the upper basis oil passage 122 and the left end of the lower cut-away portion 133 of the lower body 130 face each other and overlap each other in plan view. With such a configuration, the lower cut-away portion 133 of the lower body 130 (and thus the third lower through hole 131 from the front) is connected to (communicates with) the basis oil passage 150.

[0085] When the panel member 110 is folded to manufacture the oil feed member 100, as illustrated in Figs. 14(d) and 15(c), the front and back ends of each of the downstream branch oil passages 124 (the first downstream branch oil passages 127 and the second downstream branch oil passages 128) of the upper body 120 and the discharge ports 134 of the lower body 130 face each other and overlap each other in plan view. With such a configuration, the discharge ports 134 are connected to (communicate with) the downstream branch oil passages 124 (the first downstream branch oil passages 127 and the second downstream branch oil passages 128).

[0086] In this manner, when the panel member 110 is folded to manufacture the oil feed member 100, the third lower through hole 131 from the front, the lower cut-away portion 133, the basis oil passage 150, the upstream branch oil passages 123 (the first upstream branch oil passages 125 and the second upstream branch oil passages 126), the downstream branch oil passages 124 (the first downstream branch oil passages 127 and the second downstream branch oil passages 128), and the discharge ports 134 communicate with each other (in the order of guiding lubricant). That is, when the oil feed member 100 is manufactured, one oil passage through which lubricant flows from the third lower through hole 131 from the front (which serves as the oil feed port) to each of the discharge ports 134 in a sequential order is formed in the oil feed member 100.

[0087] Hereinbelow, a mode of attaching the oil feed member 100 to the cam cap 50 will be described with reference to Figs. 1 to 3.

[0088] In the following description, the cam cap 50 indicates the cam cap 50 that corresponds to the third upper through hole 121 and the third lower through hole 131 from the front of the oil feed member 100 unless otherwise specifically noted.

[0089] As illustrated in Figs. 1 to 3, a part of the oil feed member 100 (the part in which the upper through hole

121 and the lower through hole 131 are formed) is housed inside the exhaust-side recess 62 of the cam cap 50. As illustrated in Fig. 3, when the part of the oil feed member 100 is housed in the exhaust-side recess 62, the upper through hole 121 and the lower through hole 131 of the oil feed member 100 overlap the exhaust-side through hole 64 of the cam cap 50 in the up-down direction.

[0090] Then, as illustrated in Fig. 3, the bolt 180 is inserted into the upper through hole 121 and the lower through hole 131 of the oil feed member 100 from the upper side and fastened to the cylinder head 10. In this manner, the oil feed member 100 is fixed to the cam cap 50, and the cam cap 50 is fixed to the cylinder head 10 by co-fastening with the bolt 180.

[0091] As illustrated in Fig. 3, when the oil feed member 100 is fixed to the cam cap 50, the exhaust-side through hole 64 of the cam cap 50 communicates with the lower through hole 131 of the oil feed member 100. That is, when the oil feed member 100 is fixed to the cam cap 50, the oil feed member 100 is communicable with the oil gallery 16 of the cylinder head 10 through a predetermined oil passage.

[0092] Further, when the oil feed member 100 is fixed to the cam cap 50, the eight discharge ports 134 of the oil feed member 100 are disposed at the same positions in the front-back direction as the respective cams 42a of the exhaust-side camshaft 42. That is, when the oil feed member 100 is fixed to the cam cap 50, the eight discharge ports 134 of the oil feed member 100 are disposed above the respective cams 42a of the exhaust-side camshaft 42.

[0093] Hereinbelow, a mode of feeding lubricant to the cams 42a of the exhaust-side camshaft 42 (the lubrication portion of the valve gear 30) in the lubricant feed mechanism of the engine 1 will be described with reference to Figs. 10 to 12.

[0094] When the engine 1 is driven, the exhaust-side camshaft 42 rotates. When one end of the in-shaft oil passage 42b does not face the cam journal oil passage 18 of the cylinder head 10 as illustrated in Fig. 10(a), lubricant flowing through the oil gallery 16 is fed to the exhaust-side bearing 14 through the cam journal oil passage 18. The lubricant is not fed into the in-shaft oil passage 42b, but lubricates sliding surfaces between the exhaust-side camshaft 42 and the exhaust-side bearing 14 and between the exhaust-side camshaft 42 and the exhaust-side bearing 60.

[0095] As illustrated in Fig. 10(b), every time the exhaust-side camshaft 42 makes a rotation of 360°, one end of the in-shaft oil passage 42b faces the cam journal oil passage 18 of the cylinder head 10 and the other end of the in-shaft oil passage 42b faces the exhaust-side communicating oil passage 66 once. In this case, lubricant flowing through the oil gallery 16 is fed to the in-shaft oil passage 42b through the cam journal oil passage 18.

[0096] The lubricant fed to the in-shaft oil passage 42b is fed to the exhaust-side through hole 64 through the in-shaft oil passage 42b and the exhaust-side communicat-

ing oil passage 66. As illustrated in Fig. 10(b), although the bolt 180 is inserted in the exhaust-side through hole 64, the lubricant can flow through the exhaust-side through hole 64 due to the gap formed between the exhaust-side through hole 64 and the bolt 180. The lubricant fed to the exhaust-side through hole 64 flows upward inside the exhaust-side through hole 64 and is fed to the oil feed member 100.

[0097] As illustrated in Fig. 11, the lubricant fed to the third lower through hole 131 from the front is guided into the basis oil passage 150 through the lower cut-away portion 133. The lubricant guided to the basis oil passage 150 is guided to the upstream branch oil passages 123 (the first upstream branch oil passage 125 and the second upstream branch oil passage 126) from the basis oil passage 150. The lubricant guided to the upstream branch oil passages 123 (the first upstream branch oil passage 125 and the second upstream branch oil passage 126) is guided to the downstream branch oil passages 124 (the first downstream branch oil passage 127 and the second downstream branch oil passage 128) from the upstream branch oil passages 123. The lubricant guided to the downstream branch oil passages 124 is discharged downward from the discharge ports 134.

[0098] As described above, the discharge ports 134 of the oil feed member 100 are located substantially above the respective cams 42a of the exhaust-side camshaft 42. As illustrated in Fig. 12, the lubricant discharged downward from the discharge ports 134 of the oil feed member 100 is fed to the cams 42a of the exhaust-side camshaft 42. That is, the cams 42a of the exhaust-side camshaft 42 can be lubricated using the oil feed member 100.

[0099] In the lubricant feed mechanism of the engine 1, as illustrated in Figs. 10(a) and 10(b), when the exhaust-side camshaft 42 rotates to a predetermined angle, lubricant is fed to the cams 42a. That is, the lubricant is intermittently fed to the cams 42a (once during one rotation of the exhaust-side camshaft 42). In this manner, the lubricant is not constantly fed to the cams 42a. Thus, it is possible to prevent the lubricant from being excessively fed to the cams 42a.

[0100] Pressure loss occurs in lubricant flowing through the basis oil passage 150 from the front-back center to the front side. That is, the pressure loss in the lubricant becomes larger as the lubricant flows to the front side. Thus, for example, the amount of lubricant guided (distributed) to the upstream branch oil passage 123 (the first upstream branch oil passage 125) connected to the front end of the basis oil passage 150 may be smaller than the amount of lubricant guided (distributed) to the upstream branch oil passage 123 (the second upstream branch oil passage 126) connected to the vicinity of the front-back central part of the basis oil passage 150.

[0101] In such a case, the amount of lubricant discharged from the discharge ports 134 of the upstream branch oil passage 123 (the first upstream branch oil passage 125) connected to the front end is smaller than the

amount of lubricant discharged from the discharge ports 134 of the upstream branch oil passage 123 (the second upstream branch oil passage 126) connected to the vicinity of the front-back central part. That is, in this case, the amount of lubricant to be discharged may not be equal between the plurality of discharge ports 134.

[0102] On the other hand, in the lubricant feed mechanism of the engine 1, the configuration of the oil passages (specifically, the upstream branch oil passage 123 and the downstream branch oil passage 124) of the oil feed member 100 equalizes the amount of lubricant discharged from the plurality of discharge ports 134.

[0103] Hereinbelow, the configurations of the upstream branch oil passage 123 and the downstream branch oil passage 124 will be specifically described with reference to Figs. 13 to 15.

[0104] As illustrated in Fig. 13, in the following description, four discharge ports 134 disposed in the two front parts P, P will be referred to as discharge ports 134a, 134b, 134c and 134d from the front side.

[0105] As described above, the upstream branch oil passage 123 includes the first upstream branch oil passage 125 and the second upstream branch oil passage 126.

[0106] The first upstream branch oil passage 125 is an oil passage for guiding lubricant guided from the basis oil passage 150 to the discharge ports 134a and 134b (through the first downstream branch oil passage 127 (described below)). The first upstream branch oil passage 125 is formed between the first upper and lower through holes 121, 131 from the front and the second upper and lower through holes 121, 131 from the front.

[0107] The first upstream branch oil passage 125 linearly extends in the right-left direction. The upstream end (the left end in Fig. 13) of the first upstream branch oil passage 125 is connected to the front end of the basis oil passage 150. In the flowing path of lubricant in the basis oil passage 150, a connection point (branch point) between the first upstream branch oil passage 125 and the basis oil passage 150 is formed at a position farther from a connection point between the lower cut-away portion 133 and the basis oil passage 150 than a connection point (branch point) between the second upstream branch oil passage 126 and the basis oil passage 150. That is, the connection point (branch point) between the first upstream branch oil passage 125 and the basis oil passage 150 is formed on the downstream side with respect to the connection point (branch point) between the second upstream branch oil passage 126 and the basis oil passage 150.

[0108] The downstream end (the right end in Fig. 13) of the first upstream branch oil passage 125 is connected to the first downstream branch oil passage 127. In this manner, a connection point between the first upstream branch oil passage 125 and the first downstream branch oil passage 127 is disposed at the same position as the discharge ports 134a and 134b in the right-left direction. The connection point between the first upstream branch

oil passage 125 and the first downstream branch oil passage 127 is disposed at the central position between the discharge ports 134a and 134b in the front-back direction. In this manner, the downstream end of the first upstream branch oil passage 125 is disposed at the position relatively close to the discharge ports 134a and 134b to which lubricant is guided.

[0109] As illustrated in Figs. 14(d) and 15(a), the flow passage cross-sectional area (the area of the cross section perpendicular to the flowing direction of lubricant in the oil passage) of the first upstream branch oil passage 125 is smaller than the flow passage cross-sectional area of the basis oil passage 150 (more specifically, a part of the basis oil passage 150 except the slightly curved front-back middle part).

[0110] The second upstream branch oil passage 126 is an oil passage for guiding lubricant guided from the basis oil passage 150 to the discharge ports 134c and 134d (through the second downstream branch oil passage 128 (described below)). The second upstream branch oil passage 126 is formed between the second upper and lower through holes 121, 131 from the front and the third upper and lower through holes 121, 131 from the front in the front-back direction.

[0111] The second upstream branch oil passage 126 is appropriately bent so as to extend in a zigzag shape in plan view. Specifically, the second upstream branch oil passage 126 includes a first bend 126a and a second bend 126b which are located in this order from the basis oil passage 150 and bent at a substantially right angle.

[0112] The upstream end (the left end in Fig. 13) of the second upstream branch oil passage 126 is connected to the front-back middle part in the front part of the basis oil passage 150. In the flowing path of lubricant in the basis oil passage 150, the connection point (branch point) between the second upstream branch oil passage 126 and the basis oil passage 150 is formed at a position closer to the connection point between the lower cut-away portion 133 and the basis oil passage 150 than the connection point (branch point) between the first upstream branch oil passage 125 and the basis oil passage 150. That is, the connection point (branch point) between the second upstream branch oil passage 126 and the basis oil passage 150 is formed on the upstream side with respect to the connection point (branch point) between the first upstream branch oil passage 125 and the basis oil passage 150.

[0113] The downstream end (the right end in Fig. 13) of the second upstream branch oil passage 126 is connected to the second downstream branch oil passage 128. In this manner, a connection point between the second upstream branch oil passage 126 and the second downstream branch oil passage 128 is disposed at the same position as the discharge ports 134c and 134d in the right-left direction. The connection point between the second upstream branch oil passage 126 and the second downstream branch oil passage 128 is disposed at the central position between the discharge ports 134c and

134d in the front-back direction. In this manner, the downstream end of the second upstream branch oil passage 126 is disposed at the position relatively close to the discharge ports 134c and 134d to which lubricant is guided.

[0114] As illustrated in Figs. 14(b) and 15(a), the flow passage cross-sectional area of the second upstream branch oil passage 126 is smaller than the flow passage cross-sectional area of the basis oil passage 150 (more specifically, the part of the basis oil passage 150 except the slightly curved front-back middle part).

[0115] As illustrated in Figs. 14(b) and 15(a), the flow passage cross-sectional area of the second upstream branch oil passage 126 is smaller than the flow passage cross-sectional area of the first upstream branch oil passage 125.

[0116] The length of the second upstream branch oil passage 126 (specifically, the total length of a length L1a between the connection point with the basis oil passage 150 and the first bend 126a, a length L1b between the first bend 126a and the second bend 126b, and a length L1c between the second bend 126b and the connection point with the second downstream branch oil passage 128 illustrated in Fig. 13) is longer than the length of the first upstream branch oil passage 125 (specifically, a length L2 between the connection point with the basis oil passage 150 and the connection point with the first downstream branch oil passage 127 illustrated in Fig. 13).

[0117] As described above, the downstream branch oil passage 124 includes the first downstream branch oil passage 127 and the second downstream branch oil passage 128.

[0118] The first downstream branch oil passage 127 is an oil passage for guiding lubricant guided from the first upstream branch oil passage 125 to the discharge ports 134a and 134b. The first downstream branch oil passage 127 is formed between the first upper and lower through holes 121, 131 from the front and the second upper and lower through holes 121, 131 from the front in the front-back direction.

[0119] The first downstream branch oil passage 127 linearly extends in the front-back direction. The front end of the first downstream branch oil passage 127 is connected to the discharge port 134a. The back end of the first downstream branch oil passage 127 is connected to the discharge port 134b. The front-back central part of the first downstream branch oil passage 127 is connected to the downstream end (the right end in Fig. 13) of the first upstream branch oil passage 125.

[0120] As illustrated in Figs. 15(a) and 15(b), the flow passage cross-sectional area of the first downstream branch oil passage 127 is smaller than the flow passage cross-sectional area of the first upstream branch oil passage 125.

[0121] The second downstream branch oil passage 128 is an oil passage for guiding lubricant guided from the second upstream branch oil passage 126 to the discharge ports 134c and 134d. The second downstream branch oil passage 128 is formed between the second

upper and lower through holes 121, 131 from the front and the third upper and lower through holes 121, 131 from the front in the front-back direction.

[0122] The second downstream branch oil passage 128 linearly extends in the front-back direction. The front end of the second downstream branch oil passage 128 is slightly expanded in diameter and connected to the discharge port 134c. The back end of the second downstream branch oil passage 128 is slightly expanded in diameter and connected to the discharge port 134d. The front-back central part of the second downstream branch oil passage 128 is connected to the downstream end (the right end in Fig. 13) of the second upstream branch oil passage 126.

[0123] As illustrated in Figs. 14(b) and 14(c), the flow passage cross-sectional area of the second downstream branch oil passage 128 is smaller than the flow passage cross-sectional area of the second upstream branch oil passage 126.

[0124] As illustrated in Figs. 14(c) and 15(b), the flow passage cross-sectional area of the second downstream branch oil passage 128 is smaller than the flow passage cross-sectional area of the first downstream branch oil passage 127.

[0125] Hereinbelow, effects achieved by the configurations of the upstream branch oil passage 123 and the downstream branch oil passage 124 will be described.

[0126] The second upstream branch oil passage 126 has a smaller flow passage cross-sectional area and a longer length than the first upstream branch oil passage 125. This configuration enables lubricant flowing through the second upstream branch oil passage 126 to have a larger pressure loss than lubricant flowing through the first upstream branch oil passage 125.

[0127] The second upstream branch oil passage 126 is formed in a zigzag shape including the first bend 126a and the second bend 126b which are bent at a substantially right angle. On the other hand, the first upstream branch oil passage 125 is formed in a straight shape. This configuration enables lubricant flowing through the second upstream branch oil passage 126 to have a larger pressure loss than lubricant flowing through the first upstream branch oil passage 125.

[0128] The flow passage cross-sectional area of the second downstream branch oil passage 128 which guides lubricant from the second upstream branch oil passage 126 to the discharge ports 134c and 134d is smaller than the flow passage cross-sectional area of the first downstream branch oil passage 127 which guides lubricant from the first upstream branch oil passage 125 to the discharge ports 134a and 134b. This configuration enables lubricant flowing through the second downstream branch oil passage 128 to have a larger pressure loss than lubricant flowing through the first downstream branch oil passage 127.

[0129] In this manner, in the oil feed member 100, the configuration of the oil passage (the second upstream branch oil passage 126 and the second downstream

branch oil passage 128) which guides lubricant from the basis oil passage 150 to the discharge ports 134c and 134d appropriately generates a larger pressure loss in lubricant flowing through the second upstream branch oil passage 126 and the second downstream branch oil passage 128 than in lubricant flowing through the first upstream branch oil passage 125 and the first downstream branch oil passage 127.

[0130] This configuration makes it possible to equalize the amount of lubricant discharged from the discharge ports 134c and 134d to which lubricant is guided from the upstream side of the basis oil passage 150 and the amount of lubricant discharged from the discharge ports 134a and 134b to which lubricant is guided from the downstream side of the basis oil passage 150 even though pressure loss occurs in lubricant flowing through the basis oil passage 150 from the front-back center to the front side.

[0131] As described above, the length, the shape, and the cross-sectional area of the second upstream branch oil passage 126 and the flow passage cross-sectional area of the second downstream branch oil passage 128 are made different from those of the first upstream branch oil passage 125 and the first downstream branch oil passage 127 as a configuration for appropriately generating a large pressure loss in lubricant flowing through the second upstream branch oil passage 126 and the second downstream branch oil passage 128.

[0132] In this manner, it is possible to appropriately generate pressure loss in lubricant flowing through the second upstream branch oil passage 126 and the second downstream branch oil passage 128 with a simple configuration.

[0133] The basis oil passage 150 is an oil passage for guiding lubricant to the discharge ports 134a, 134b, 134c and 134d. The first upstream branch oil passage 125 and the first downstream branch oil passage 127 are oil passages for guiding lubricant to the discharge ports 134a and 134b. The second upstream branch oil passage 126 and the second downstream branch oil passage 128 are oil passages for guiding lubricant to the discharge ports 134c and 134d. In this manner, the oil feed member 100 uses as many common oil passages as possible with respect to a plurality of discharge ports to achieve integration of oil passages.

[0134] Such a configuration makes it possible to ensure a wide distance between oil passages and to achieve space saving in the oil passages compared to the case when not so many common oil passages are used.

[0135] Further, in the oil feed member 100, the downstream end of the first upstream branch oil passage 125 is disposed at the position relatively close to the discharge ports 134a and 134b to which lubricant is guided. The downstream end of second upstream branch oil passage 126 is disposed at the position relatively close to the discharge ports 134c and 134d to which lubricant is guided.

[0136] That is, in the oil feed member 100, a common oil passage is used up to a relatively close position with respect to a plurality of discharge ports (the discharge ports 134a and 134b, or the discharge ports 134c and 134d). Specifically, the first upstream branch oil passage 125 is used up to the relatively close position with respect to the discharge ports 134a and 134b. Further, the second upstream branch oil passage 126 is used up to the relatively close position with respect to the discharge ports 134c and 134d.

[0137] Such a configuration makes it possible to equalize the amount of lubricant (to reduce variations in the amount of lubricant) discharged from a plurality of discharge ports (the discharge ports 134a and 134b, or the discharge ports 134c and 134d).

[0138] In the above description, for convenience, there is described the configuration for feeding lubricant to the cams 42a of the exhaust-side camshaft 42 which opens and closes the exhaust valve 34 of the engine 1. However, a configuration for feeding lubricant to the cams 40a of the intake-side camshaft 40 which opens and closes the intake valve 32 is similar to the described configuration.

[0139] As described above, the oil feed member 100 according to an embodiment of the present invention is an oil feed member 100 for feeding lubricant to the cams 42a of the exhaust-side camshaft 42 (the lubrication portion of the valve gear 30) which opens and closes the exhaust valve 34 of the engine 1. The oil feed member 100 includes the lubricant passage defined by the recess (the upper basis oil passage 122, the upstream branch oil passage 123, the downstream branch oil passage 124, and the lower basis oil passage 132) formed on the facing surfaces of the upper body 120 and the lower body 130 (the facing surfaces abutting against each other) and the plurality of discharge ports 134 which are formed on the downstream end of the lubricant passage and discharge lubricant flowing through the lubricant passage to the lubrication portion. The lubricant passage includes the basis oil passage 150, the first upstream branch oil passage 125 (the first branch oil passage) which branches off from the basis oil passage 150 and allows lubricant guided to a first discharge port group including at least two of the discharge ports 134 (the discharge ports 134a and 134b) to flow therethrough, and the second upstream branch oil passage 126 (the second branch oil passage) which branches off from the basis oil passage 150 and allows lubricant guided to a second discharge port group including at least two of the discharge ports 134 (the discharge ports 134c and 134d) to flow therethrough.

[0140] Such a configuration makes it possible to ensure a wide distance between the oil passages and to achieve space saving in the oil passages.

[0141] In the oil feed member 100, the branch point between the second upstream branch oil passage 126 (the second branch oil passage) and the basis oil passage 150 is formed on the upstream side with respect to the branch point between the first upstream branch oil

passage 125 (the first branch oil passage) and the basis oil passage 150. Further, the second upstream branch oil passage 126 (the second branch oil passage) includes a pressure loss generating mechanism which generates pressure loss in lubricant flowing through the second upstream branch oil passage 126 (the second branch oil passage).

[0142] Such a configuration makes it possible to equalize the amount of lubricant discharged from the first discharge port group (the discharge ports 134a and 134b) and the second discharge port group (the discharge ports 134c and 134d).

[0143] In the oil feed member 100, the pressure loss generating mechanism is configured by making the second upstream branch oil passage 126 (the second branch oil passage) different from the first upstream branch oil passage 125 (the first branch oil passage) in at least one of the length, the shape, and the flow passage cross-sectional area.

[0144] Such a configuration makes it possible to manufacture the oil feed member 100 provided with the pressure loss generating mechanism with a simple configuration.

[0145] In the oil feed member 100, the downstream end of the first upstream branch oil passage 125 (the first branch oil passage) is disposed near the first discharge port group (the discharge ports 134a and 134b), and the downstream end of the second upstream branch oil passage 126 (the second branch oil passage) is disposed near the second discharge port group (the discharge ports 134c and 134d).

[0146] Such a configuration makes it possible to further equalize the amount of lubricant discharged from the first discharge port group (the discharge ports 134a and 134b) and the second discharge port group (the discharge ports 134c and 134d).

[0147] The lubricant feed mechanism of the engine 1 according to an embodiment of the present invention includes the oil feed member 100.

[0148] Such a configuration makes it possible to ensure a wide distance between the oil passages and to achieve space saving in the oil passages.

[0149] The cams 42a of the exhaust-side camshaft 42 according to the present embodiment are one embodiment of the lubrication portion according to the present invention.

[0150] The basis oil passage 150, the upstream branch oil passage 123, and the downstream branch oil passage 124 according to the present embodiment are one embodiment of the lubricant passage according to the present invention.

[0151] The discharge ports 134a and 134b according to the present embodiment are one embodiment of the first discharge port group according to the present invention.

[0152] The discharge ports 134c and 134d according to the present embodiment are one embodiment of the second discharge port group according to the present

invention.

[0153] The first upstream branch oil passage 125 according to the present embodiment is one embodiment of the first branch oil passage according to the present invention.

[0154] The second upstream branch oil passage 126 according to the present embodiment is one embodiment of the second branch oil passage according to the present invention.

[0155] The length, the shape, and the flow passage cross-sectional area of the second upstream branch oil passage 126 (more specifically, differences from the length, the shape, and the flow passage cross-sectional area of the first upstream branch oil passage 125) according to the present embodiment are one embodiment of the pressure loss generating mechanism according to the present invention.

[0156] The embodiment of the present invention has been described above. However, the present invention is not limited to the above configuration, and various modifications may be made within the scope of the invention defined in the claims.

[0157] For example, the engine 1 according to the present embodiment is described as an inline 4-cylinder double overhead camshaft (DOHC) 16-valve gasoline engine. However, an engine to which the present invention is applicable is not limited thereto.

[0158] The shapes of the oil gallery 16, the cam journal oil passage 18, the in-shaft oil passage 42b, the exhaust-side communicating oil passage 66, and the exhaust-side through hole 64 are not limited to the present embodiment. These shapes can be determined in any manner.

[0159] Although, in the present embodiment, four cam caps 50 are provided at each side, the present invention is not limited thereto. For example, the number of cam caps 50 may be a number other than four, or four cam caps 50 may be integrally formed.

[0160] Although, in the present embodiment, the oil feed member 100 is integrally formed over all the four cylinders of the engine 1, the present invention is not limited thereto. For example, the oil feed member 100 may be integrally formed over two or three of the four cylinders of the engine 1.

[0161] In the oil feed member 100, a seal member such as a gasket may be interposed between the facing panel members.

[0162] Although, in the present embodiment, the cams 42a of the exhaust-side camshaft 42 are set as the lubrication portion of the valve gear 30, the present invention is not limited thereto. Any portion, for example, the valve stem 34a of the exhaust valve 34, may be set as the lubrication portion of the valve gear 30 to feed lubricant.

[0163] Although, in the present embodiment, all the length, the shape, and the flow passage cross-sectional area of the second upstream branch oil passage 126 are made different from the length, the shape, and the flow passage cross-sectional area of the first upstream

branch oil passage 125, the present invention is not limited thereto. Specifically, the pressure loss generating mechanism according to the present invention may be configured by making at least one of the length, the shape, and the flow passage cross-sectional area of the second upstream branch oil passage 126 different from at least one of the length, the shape, and the flow passage cross-sectional area of the first upstream branch oil passage 125. The length, the shape, and the flow passage cross-sectional area of the second upstream branch oil passage 126 are not limited to those of the present embodiment, and may be determined in any manner.

[0164] In the present embodiment, the flow passage cross-sectional area of the second downstream branch oil passage 128 is made different from the flow passage cross-sectional area of the first downstream branch oil passage 127. The flow passage cross-sectional area of the second downstream branch oil passage 128 (more specifically, the difference from the flow passage cross-sectional area of the first downstream branch oil passage 127) is included in the pressure loss generating mechanism. The second downstream branch oil passage 128 may differ from the first downstream branch oil passage 127 not only in the flow passage cross-sectional area, but also in the length and the shape.

[0165] As described above, in the pressure loss generating mechanism according to the present invention, when at least one of the length, the shape, and the flow passage cross-sectional area of the second upstream branch oil passage 126 is made different from at least one of the length, the shape, and the flow passage cross-sectional area of the first upstream branch oil passage 125, it is desirable to first make the flow passage cross-sectional areas different from each other to largely adjust the amount of flowing lubricant, and then make the lengths different from each other to finely adjust pressure loss generated in the lubricant. Such a configuration makes it possible to further equalize the amount of lubricant discharged from the plurality of discharge ports 134. Further, it is possible to easily equalize the amount of lubricant discharged from the plurality of discharge ports 134.

[0166] Although, in the present embodiment, the discharge ports 134a and 134b are one embodiment of the first discharge port group according to the present invention, the present invention is not limited thereto. That is, the first discharge port group according to the present invention is only required to include at least two discharge ports and may include, for example, three or four discharge ports. Similarly, the second discharge port group according to the present invention is also only required to include at least two discharge ports.

[0167] In the present embodiment, the oil feed member 100 is attached to the cam cap 50. Alternatively, the oil feed member according to the present invention may be attached to another member of the engine 1 (e.g., the cylinder head cover 20).

[0168] Hereinbelow, the configuration of an oil feed

member 200 which is attached to the cylinder head cover 20 will be described as a second embodiment with reference to Figs. 16 to 19.

[0169] In the following description, a difference between the configuration of the oil feed member 200 according to the second embodiment and the configuration of the oil feed member 100 according to the first embodiment will be mainly described.

[0170] The oil feed member 200 according to the second embodiment differs from the oil feed member 100 according to the first embodiment in that an upper cut-away portion 233 is provided instead of the lower cut-away portion 133.

[0171] As illustrated in Fig. 17, in the oil feed member 200 in an unfolded state, the right end of the third upper through hole 121 from the front of the upper body 120 is cut away rightward by a predetermined length to form the upper cut-away portion 233. The right end of the upper cut-away portion 233 is connected to the upper basis oil passage 122.

[0172] As illustrated in Fig. 18, when the oil feed member 200 is manufactured by being folded, the upper cut-away portion 233 and the upper face of the lower body 130 face each other and overlap each other in plan view. A space defined by the upper cut-away portion 233 and the upper face of the lower body 130 in this manner is formed as an oil passage through which lubricant can flow. Further, the third upper through hole 121 from the front, the upper cut-away portion 233, the basis oil passage 150, the upstream branch oil passages 123 (the first upstream branch oil passage 125 and the second upstream branch oil passage 126), the downstream branch oil passages 124 (the first downstream branch oil passage 127 and the second downstream branch oil passage 128), and the discharge ports 134 communicate with each other (in the order of guiding lubricant). That is, when the oil feed member 200 is manufactured, one oil passage through which lubricant flows from the third upper through hole 121 from the front (which serves as the oil feed port) to each of the discharge ports 134 in a sequential order is formed in the oil feed member 200.

[0173] The oil feed member 200 formed in this manner is attached to the inner side of the cylinder head cover 20. More specifically, as illustrated in Fig. 16, a bolt 280 is inserted into the upper through hole 121 and the lower through hole 131 of the oil feed member 200 from the lower side and fastened to the cylinder head cover 20. In this manner, the oil feed member 200 is fixed to the inner side of the cylinder head cover 20 by fastening with the bolt 280.

[0174] A gap is present between the bolt 280 and a bolt hole (not illustrated). The gap communicates with the oil gallery 16 provided in the cylinder head 10 through a predetermined oil passage formed in the cylinder head cover 20 (not illustrated). That is, when the oil feed member 200 is fixed to the cylinder head cover 20, lubricant from the oil gallery 16 can be fed to the oil feed member 200 through the predetermined oil passage and the gap.

[0175] When the engine 1 is driven, lubricant fed to the oil feed member 200, more specifically, lubricant fed to the third upper through hole 121 from the front is guided into the basis oil passage 150 through the upper cut-away portion 233. The lubricant guided to the basis oil passage 150 is guided to the upstream branch oil passages 123 (the first upstream branch oil passages 125 and the second upstream branch oil passages 126) from the basis oil passage 150. The lubricant guided to the upstream branch oil passages 123 (the first upstream branch oil passages 125 and the second upstream branch oil passages 126) is guided to the downstream branch oil passages 124 (the first downstream branch oil passages 127 and the second downstream branch oil passages 128) from the upstream branch oil passages 123. The lubricant guided to the downstream branch oil passages 124 is discharged downward from the discharge ports 134.

[0176] The discharge ports 134 of the oil feed member 200 are located substantially above the respective cams 42a of the exhaust-side camshaft 42. As illustrated in Fig. 19, the lubricant discharged downward from the discharge ports 134 of the oil feed member 200 is fed to the cams 42a of the exhaust-side camshaft 42. That is, the cams 42a of the exhaust-side camshaft 42 can be lubricated using the oil feed member 200 which is attached to the cylinder head cover 20.

[0177] In the second embodiment, two oil feed members 200 are provided at the intake side and the exhaust side for feeding lubricant to the intake-side lubrication portion and the exhaust-side lubrication portion of the valve gear 30. However, the oil feed member according to the present invention is not limited thereto. That is, the oil feed member according to the present invention may include a configuration (that is, an oil passage) for feeding lubricant to the intake-side and exhaust-side lubrication portions of the valve gear 30 in a single member.

[0178] Hereinbelow, the configuration of an oil feed member 300 which is attached to the cylinder head cover 20 and includes oil passages for feeding lubricant to the intake-side and exhaust-side lubrication portions of the valve gear 30 will be described as a third embodiment with reference to Figs. 20 and 21.

[0179] In the following description, a difference between the configuration of the oil feed member 300 according to the third embodiment and the configuration of the oil feed member 200 according to the second embodiment will be mainly described.

[0180] As described above, the oil feed member 300 according to the third embodiment includes oil passages for feeding lubricant to the intake-side and exhaust-side lubrication portions of the valve gear 30 differently from the oil feed member 200 according to the second embodiment. In the oil feed member 300, a principal difference between the configuration of an oil passage for feeding lubricant to the intake-side lubrication portion of the valve gear 30 and the configuration of an oil passage for feeding lubricant to the exhaust-side lubrication por-

tion of the valve gear 30 is that the shapes of the oil passages are right-left symmetric.

[0181] Thus, in the following description, in the configurations of the oil passages for feeding lubricant to the intake-side and exhaust-side lubrication portions of the valve gear 30, the configuration of the oil passage (the right oil passage illustrated in Fig. 20) for feeding lubricant to the exhaust-side lubrication portion of the valve gear 30 will be described, and description for the configuration of the oil passage (the left oil passage illustrated in Fig. 20) for feeding lubricant to the intake-side lubrication portion of the valve gear 30 will be appropriately omitted unless otherwise specifically noted.

[0182] The oil passage of the oil feed member 300 is mainly provided with an oil feed port 310, a discharge port 320, a basis oil passage 330, an upstream branch oil passage 340, and a downstream branch oil passage 350.

[0183] The oil feed port 310 is a port through which lubricant is fed to the oil feed member 300. The oil feed port 310 is formed on the upstream end of the basis oil passage 330 (described below). The oil feed port 310 is open downward and allows the outside and the inside (specifically, the basis oil passage 330) of the oil feed member 300 to communicate with each other.

[0184] The discharge port 320 is a port for discharging lubricant fed to the oil feed member 300 from the oil feed member 300. More specifically, the discharge port 320 is a port for discharging lubricant flowing through the downstream branch oil passage 350 (described below) toward the lubrication portion of the valve gear 30. The discharge port 320 is open downward. In the present embodiment, eight discharge ports 320 are formed. The eight discharge ports 320 are disposed at appropriate intervals in the front-back direction.

[0185] In the following description, the eight discharge ports 320 are referred to as, in the order from the back side, first discharge ports 321a, 321b (a first discharge port group), second discharge ports 322a, 322b (a second discharge port group), third discharge ports 323a, 323b (a third discharge port group), and fourth discharge ports 324a, 324b (a fourth discharge port group).

[0186] The basis oil passage 330 is an oil passage to which lubricant fed to the oil feed member 300 is first guided through the oil feed port 310. The basis oil passage 330 linearly extends in the front-back direction from the front end through the back end of the oil feed member 300. The front end of the basis oil passage 330 extends leftward and is connected to the oil feed port 310.

[0187] The upstream branch oil passage 340 branches off from the basis oil passage 330. The upstream branch oil passage 340 is an oil passage to which lubricant flowing through the basis oil passage 330 is guided next. The flow passage cross-sectional area of the upstream branch oil passage 340 is smaller than the flow passage cross-sectional area of the basis oil passage 330. This enables lubricant flowing through the upstream branch oil passage 340 to have a larger pressure loss than lu-

bricant flowing through the basis oil passage 330.

[0188] In the present embodiment, four upstream branch oil passages 340 are formed. The four upstream branch oil passages 340 are disposed at appropriate intervals in the front-back direction. In the following description, the four upstream branch oil passages 340 are referred to as, in the order from the back side (that is, from a position away from the oil feed port 310), a first upstream branch oil passage 341, a second upstream branch oil passage 342, a third upstream branch oil passage 343, a fourth upstream branch oil passage 344.

[0189] The first upstream branch oil passage 341 branches off from the basis oil passage 330 and linearly extends rightward.

[0190] The second upstream branch oil passage 342 branches off from the basis oil passage 330 and linearly extends rightward. The length of the second upstream branch oil passage 342 is longer than the length of the first upstream branch oil passage 341. This enables lubricant flowing through the second upstream branch oil passage 342 to have a larger pressure loss than lubricant flowing through the first upstream branch oil passage 341.

[0191] The third upstream branch oil passage 343 branches off from the basis oil passage 330 and extends rightward in an appropriately bent form. The third upstream branch oil passage 343 includes four bends in total which are bent at a substantially right angle. The length of the third upstream branch oil passage 343 is longer than the length of the second upstream branch oil passage 342. This enables lubricant flowing through the third upstream branch oil passage 343 to have a larger pressure loss than lubricant flowing through the second upstream branch oil passage 342.

[0192] The fourth upstream branch oil passage 344 branches off from the basis oil passage 330 and extends rightward in an appropriately bent form. The fourth upstream branch oil passage 344 includes eight bends in total which are bent at a substantially right angle. The length of the fourth upstream branch oil passage 344 is longer than the length of the third upstream branch oil passage 343. This enables lubricant flowing through the fourth upstream branch oil passage 344 to have a larger pressure loss than lubricant flowing through the third upstream branch oil passage 343.

[0193] The downstream branch oil passage 350 branches off from the upstream branch oil passage 340. The downstream branch oil passage 350 is an oil passage to which lubricant flowing through the upstream branch oil passage 340 is guided next. The flow passage cross-sectional area of the downstream branch oil passage 350 is smaller than the flow passage cross-sectional area of the basis oil passage 330. This enables lubricant flowing through the downstream branch oil passage 350 to have a larger pressure loss than lubricant flowing through the basis oil passage 330.

[0194] In the present embodiment, four downstream branch oil passages 350 are formed. The four down-

stream branch oil passage 350 are connected to the respective upstream branch oil passages 340 (more specifically, the first upstream branch oil passage 341, the second upstream branch oil passage 342, the third upstream branch oil passage 343, and the fourth upstream branch oil passage 344). In the following description, the downstream branch oil passage 350 connected to the first upstream branch oil passage 341 is referred to as a first downstream branch oil passage 351, the downstream branch oil passage 350 connected to the second upstream branch oil passage 342 is referred to as a second downstream branch oil passage 352, the downstream branch oil passage 350 connected to the third upstream branch oil passage 343 is referred to as a third downstream branch oil passage 353, and the downstream branch oil passage 350 connected to the fourth upstream branch oil passage 344 is referred to as a fourth downstream branch oil passage 354.

[0195] The first downstream branch oil passage 351 branches off from the first upstream branch oil passage 341 and linearly extends in the front-back direction. The first discharge ports 321a, 321b are connected the respective ends of the first downstream branch oil passage 351.

[0196] The second downstream branch oil passage 352 branches off from the second upstream branch oil passage 342, extends in the front-back direction, and is then bent to extend leftward. That is, the second downstream branch oil passage 352 is formed in a U-shape in plan view. The second discharge ports 322a, 322b are connected to the respective ends of the second downstream branch oil passage 352. The length between a connection point with the second upstream branch oil passage 342 and each of the second discharge ports 322a, 322b in the second downstream branch oil passage 352 is longer than the length between a connection point with the first upstream branch oil passage 341 and each of the first discharge ports 321a, 321b in the first downstream branch oil passage 351. This enables lubricant flowing through the second downstream branch oil passage 352 to have a larger pressure loss than lubricant flowing through the first downstream branch oil passage 351.

[0197] The third downstream branch oil passage 353 branches off from the third upstream branch oil passage 343, extends in the front-back direction, and is then bent to extend leftward. That is, the third downstream branch oil passage 353 is formed in a U-shape in plan view. The third discharge ports 323a, 323b are connected to the respective ends of the third downstream branch oil passage 353. The length between a connection point with the third upstream branch oil passage 343 and each of the third discharge ports 323a, 323b in the third downstream branch oil passage 353 is longer than the length between the connection point with the second upstream branch oil passage 342 and each of the second discharge ports 322a, 322b in the second downstream branch oil passage 352. This enables lubricant flowing through the

third downstream branch oil passage 353 to have a larger pressure loss than lubricant flowing through the second downstream branch oil passage 352.

[0198] The fourth downstream branch oil passage 354 branches off from the fourth upstream branch oil passage 344, extends in the front-back direction, and is then bent to extend leftward. That is, the fourth downstream branch oil passage 354 is formed in a U-shape in plan view. The fourth discharge ports 324a, 324b are connected to the respective ends of the fourth downstream branch oil passage 354. The length between a connection point with the fourth upstream branch oil passage 344 and each of the fourth discharge ports 324a, 324b in the fourth downstream branch oil passage 354 is longer than the length between the connection point with the third upstream branch oil passage 343 and each of the third discharge ports 323a, 323b in the third downstream branch oil passage 353. This enables lubricant flowing through the fourth downstream branch oil passage 354 to have a larger pressure loss than lubricant flowing through the third downstream branch oil passage 353.

[0199] With such a configuration, when lubricant flowing through the basis oil passage 330 reaches the discharge port 320 through the upstream branch oil passage 340 and the downstream branch oil passage 350, the amount of pressure loss generated in the flowing lubricant differs according to which one of the upstream branch oil passages 340 and one of the downstream branch oil passages 350 the lubricant flows through.

[0200] Specifically, when lubricant reaches the second discharge ports 322a, 322b through the second upstream branch oil passage 342 and the second downstream branch oil passage 352, a larger pressure loss occurs in the flowing lubricant than in the case where lubricant reaches the first discharge ports 321a, 321b through the first upstream branch oil passage 341 and the first downstream branch oil passage 351.

[0201] When lubricant reaches the third discharge ports 323a, 323b through the third upstream branch oil passage 343 and the third downstream branch oil passage 353, a larger pressure loss occurs in the flowing lubricant than in the case where lubricant reaches the second discharge ports 322a, 322b through the second upstream branch oil passage 342 and the second downstream branch oil passage 352.

[0202] When lubricant reaches the fourth discharge ports 324a, 324b through the fourth upstream branch oil passage 344 and the fourth downstream branch oil passage 354, a larger pressure loss occurs in the flowing lubricant than in the case where lubricant reaches the third discharge ports 323a, 323b through the third upstream branch oil passage 343 and the third downstream branch oil passage 353.

[0203] In this manner, in the oil feed member 300, when lubricant is guided from the basis oil passage 330 to the discharge port 320, a larger pressure loss occurs in lubricant flowing through the upstream branch oil passage 340 and the downstream branch oil passage 350 in the

case of the discharge port 320 disposed at a position farther from the oil feed port 310.

[0204] In this manner, in the oil feed member 300, it is possible to equalize the amount of lubricant discharged from the plurality of discharge ports 320 (the first discharge ports 321a, 321b, the second discharge ports 322a, 322b, the third discharge ports 323a, 323b, and the fourth discharge ports 324a, 324b) even though pressure loss occurs in lubricant flowing through the basis oil passage 330 from the front side to the back side.

[0205] Hereinbelow, a mode of attaching the oil feed member 300 to the cylinder head cover 20 will be described.

[0206] As illustrated in Fig. 21, the oil feed member 300 is appropriately fixed to the inner side of the cylinder head cover 20 which is formed in a bowl shape with the lower side open with, for example, a bolt. When the oil feed member 300 is fixed to the cylinder head cover 20, the oil feed port 310 of the oil feed member 300 communicates with the oil gallery 12 through a predetermined oil passage. In this manner, lubricant from the oil gallery 12 is fed to the oil feed member 300.

[0207] Further, the oil feed member 300 has a function as a baffle plate. Specifically, when the oil feed member 300 is fixed, a predetermined space is defined between the oil feed member 300 and the upper wall of the cylinder head cover 20 inside the cylinder head cover 20. The space constitutes an oil separator chamber R. Such a configuration makes it possible to reduce the number of components in a space above the valve gear 30 in which a space for disposing components is relatively small.

INDUSTRIAL APPLICABILITY

[0208] The present invention is applicable to an oil feed member that feeds lubricant to a lubrication portion of a valve gear that opens and closes intake and exhaust valves of an engine and a lubricant feed mechanism of an engine provided with the oil feed member.

REFERENCE SIGNS LIST

[0209]

- 1: Engine
- 30: Valve gear
- 32: Intake valve
- 34: Exhaust valve
- 42: Exhaust-side camshaft
- 42a: Cam
- 120: Upper body
- 122: Upper basis oil passage
- 123: Upstream branch oil passage
- 124: Downstream branch oil passage
- 130: Lower body
- 132: Lower basis oil passage
- 134: Discharge port
- 150: Basis oil passage

Claims

1. An oil feed member for feeding lubricant to a lubrication portion of a valve gear that opens and closes intake and exhaust valves of an engine, the oil feed member comprising:

a lubricant passage defined by a recess formed on facing surfaces abutting against each other; and

a plurality of discharge ports that are formed on a downstream end of the lubricant passage and discharge lubricant flowing through the lubricant passage to the lubrication portion, wherein the lubricant passage includes

a basis oil passage,

a first branch oil passage that branches off from the basis oil passage and allows lubricant guided to a first discharge port group including at least two of the discharge ports to flow therethrough, and

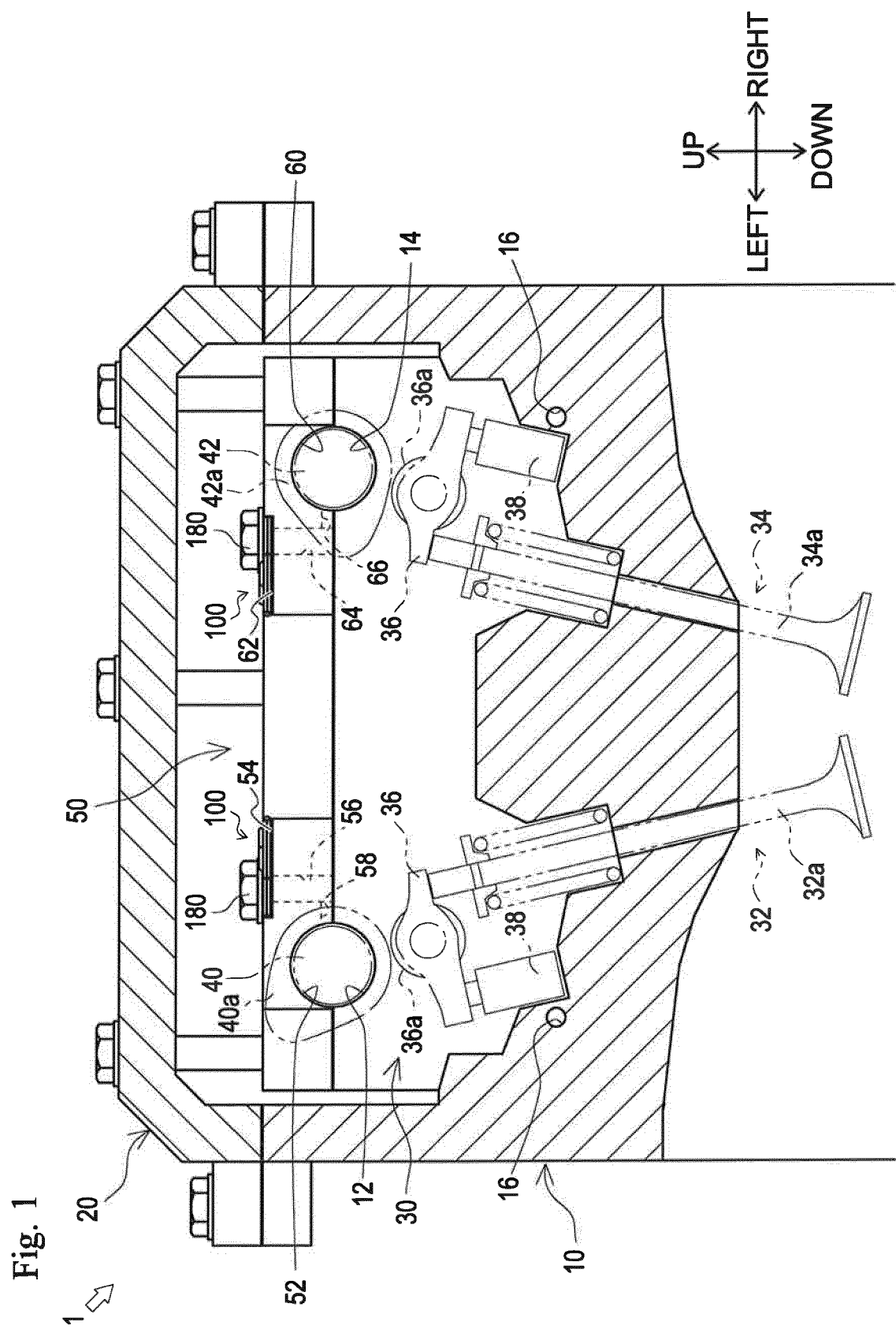
a second branch oil passage that branches off from the basis oil passage and allows lubricant guided to a second discharge port group including at least two of the discharge ports to flow therethrough.

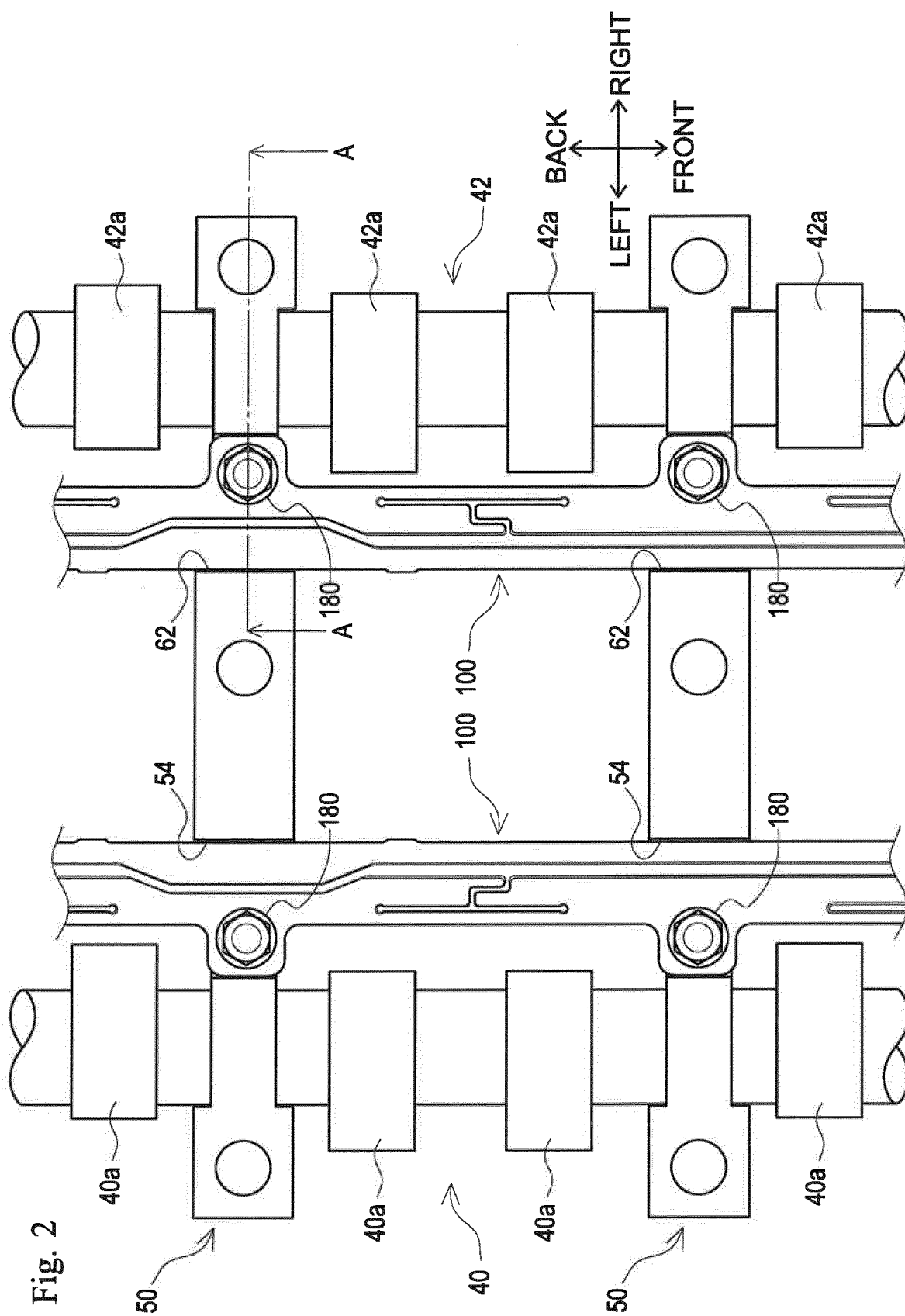
2. The oil feed member according to claim 1, wherein a branch point between the second branch oil passage and the basis oil passage is formed on the upstream side with respect to a branch point between the first branch oil passage and the basis oil passage, and the second branch oil passage includes a pressure loss generating mechanism that generates pressure loss in lubricant flowing through the second branch oil passage.

3. The oil feed member according to claim 2, wherein the pressure loss generating mechanism is configured by making the second branch oil passage different from the first branch oil passage in at least one of the length, the shape, and the flow passage cross-sectional area.

4. The oil feed member according to claim 2 or 3, wherein a downstream end of the first branch oil passage is disposed near the first discharge port group, and a downstream end of the second branch oil passage is disposed near the second discharge port group.

5. A lubricant feed mechanism of an engine comprising the oil feed member according to any one of claims 1 to 4.





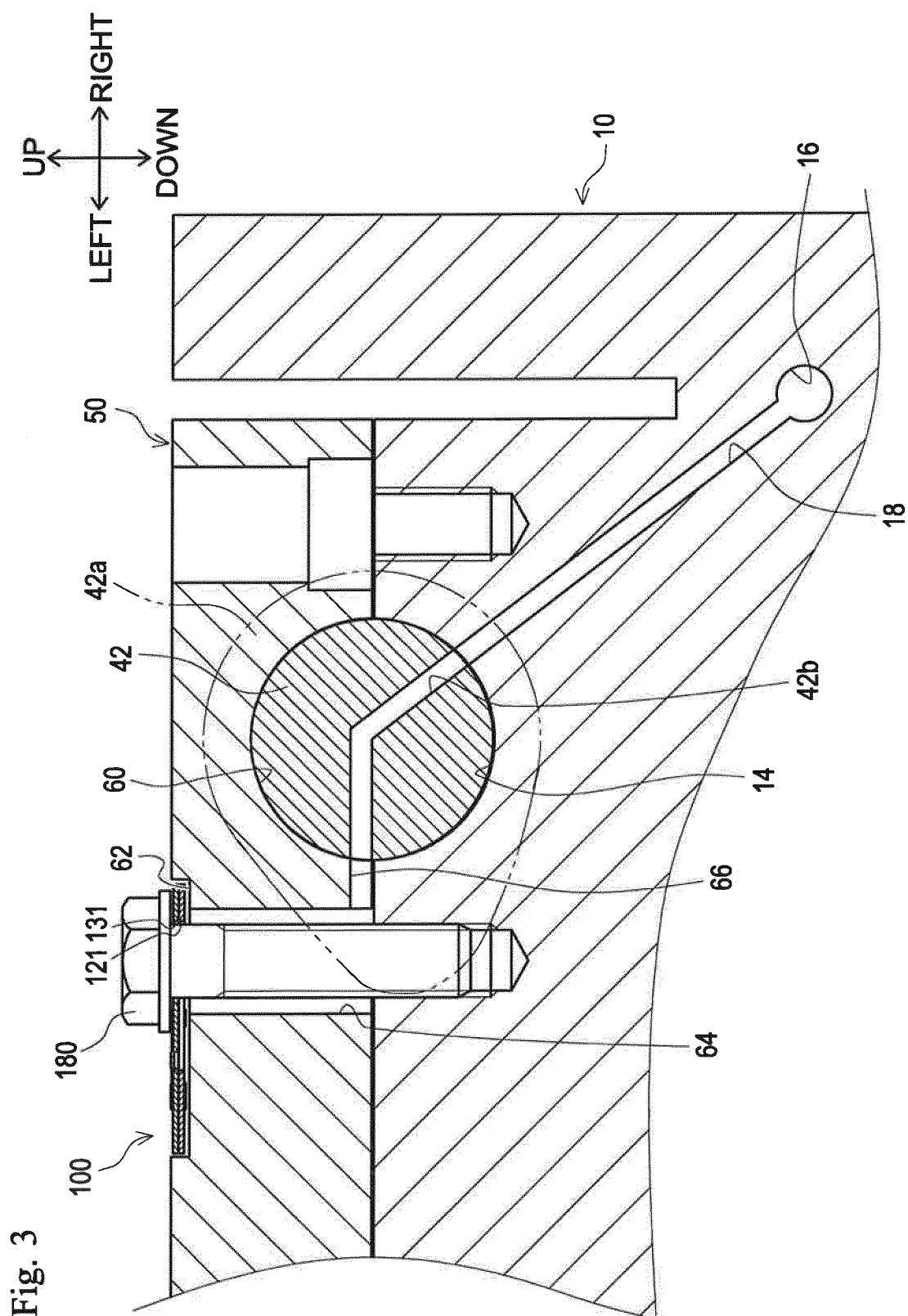


Fig. 4

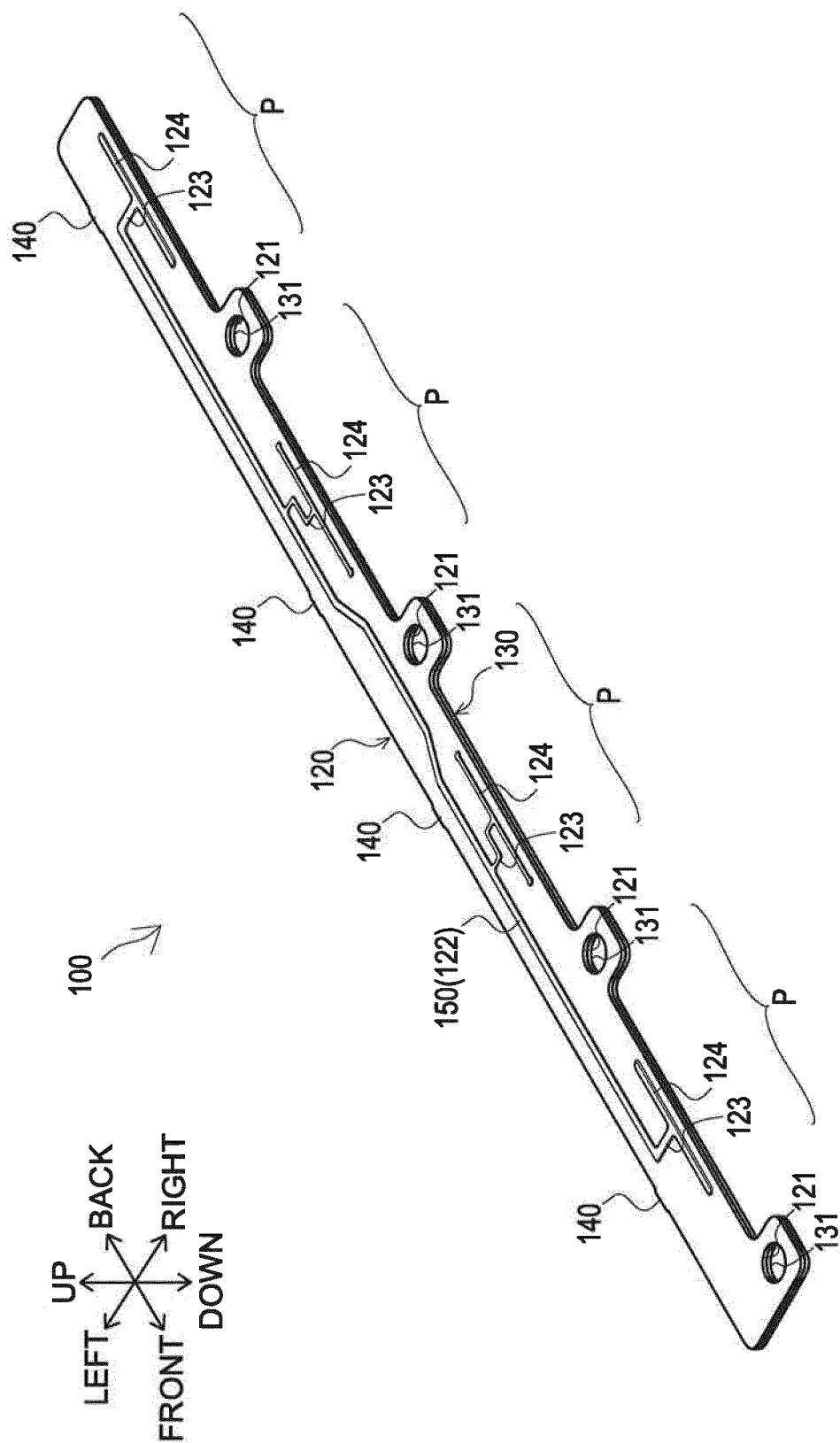


Fig. 5

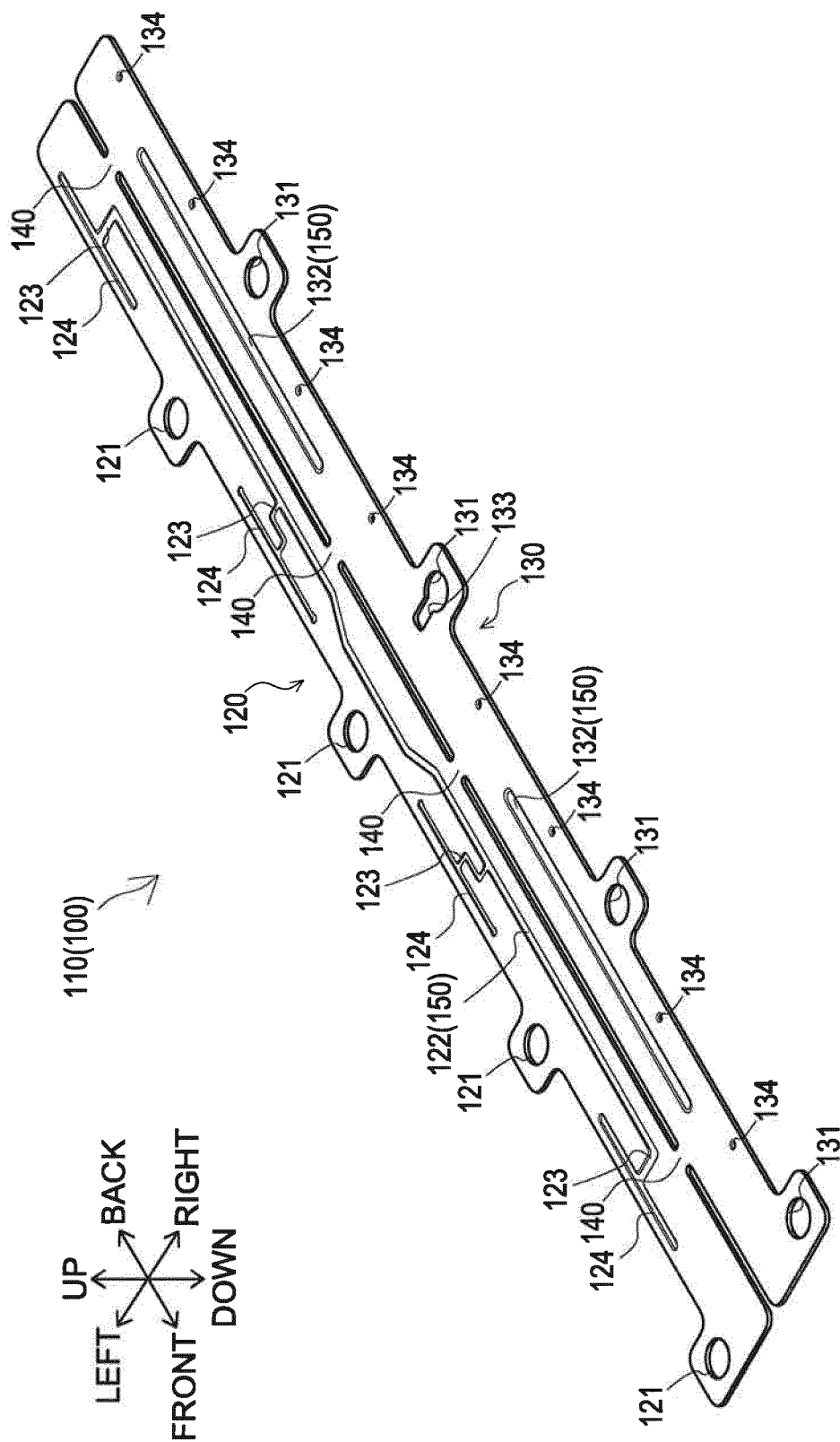


Fig. 6

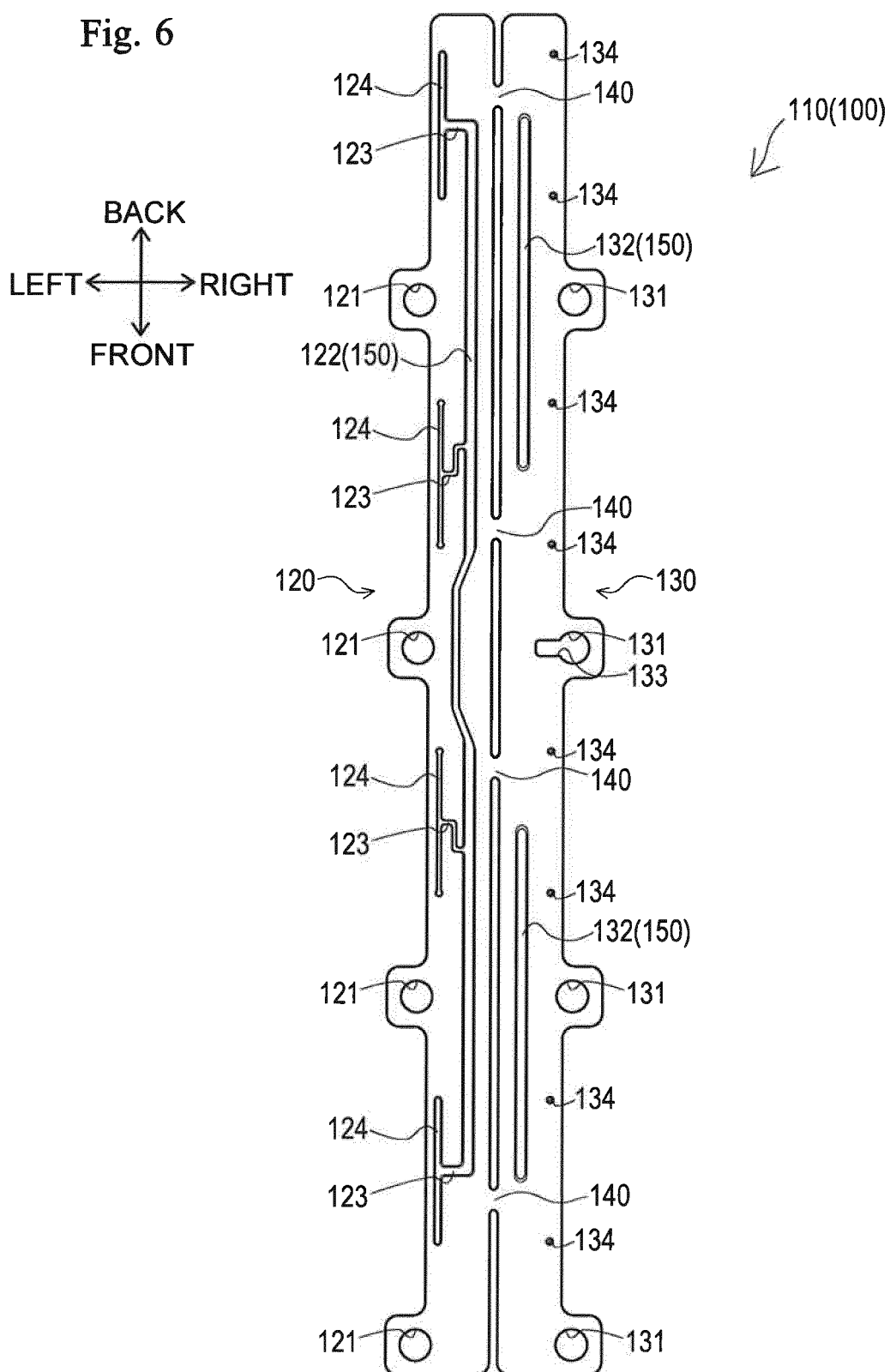


Fig. 7

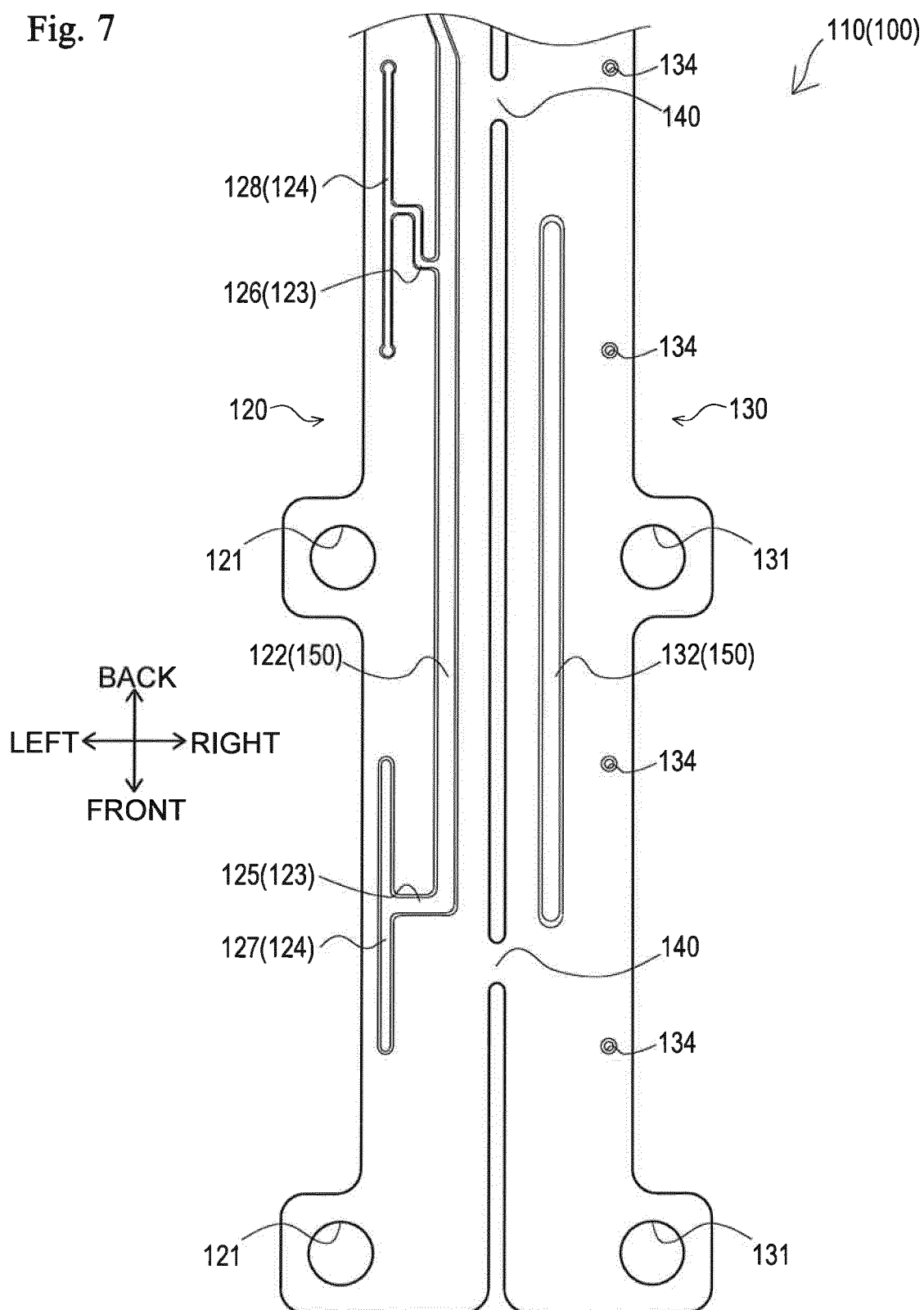


Fig. 8

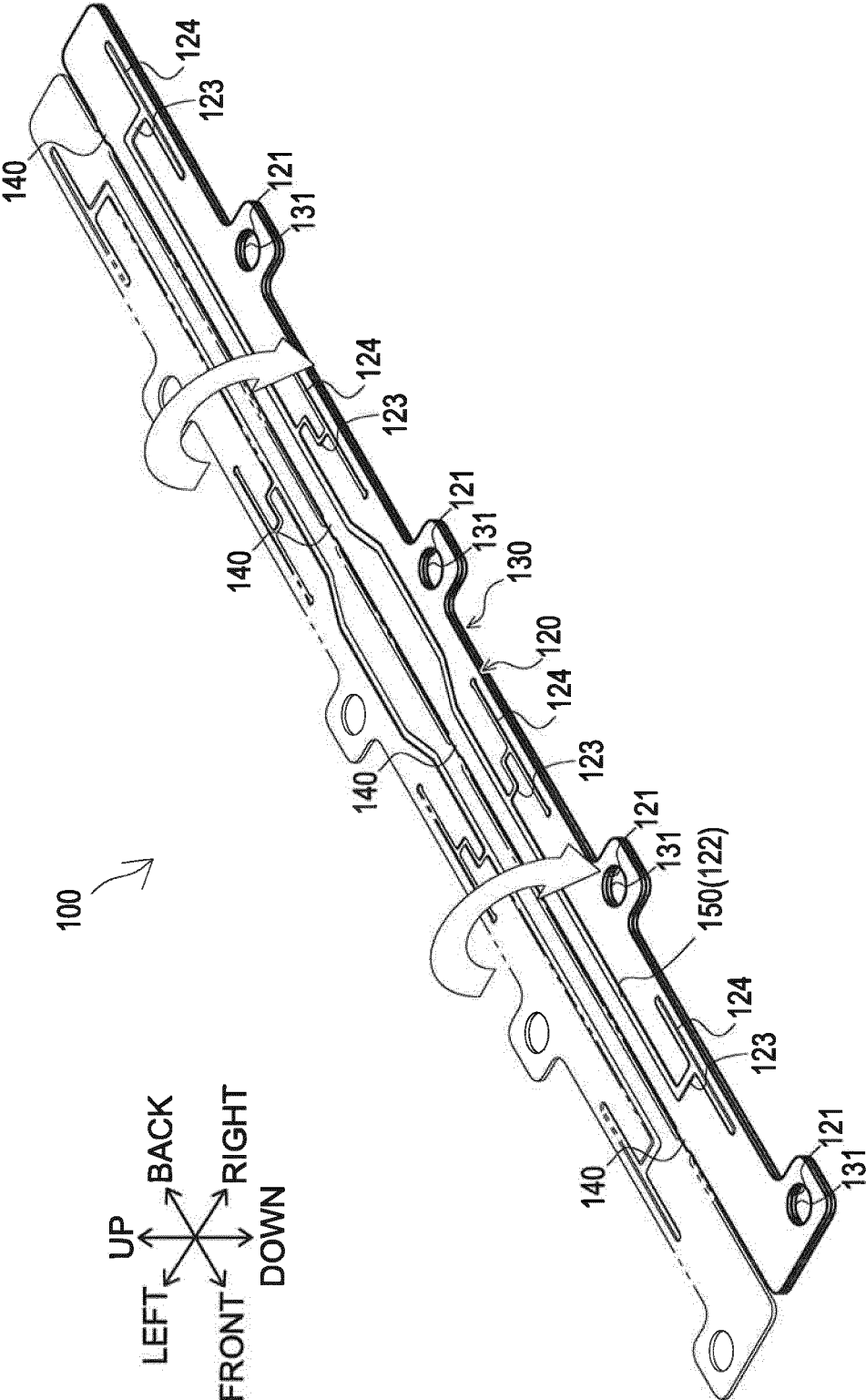


Fig. 9

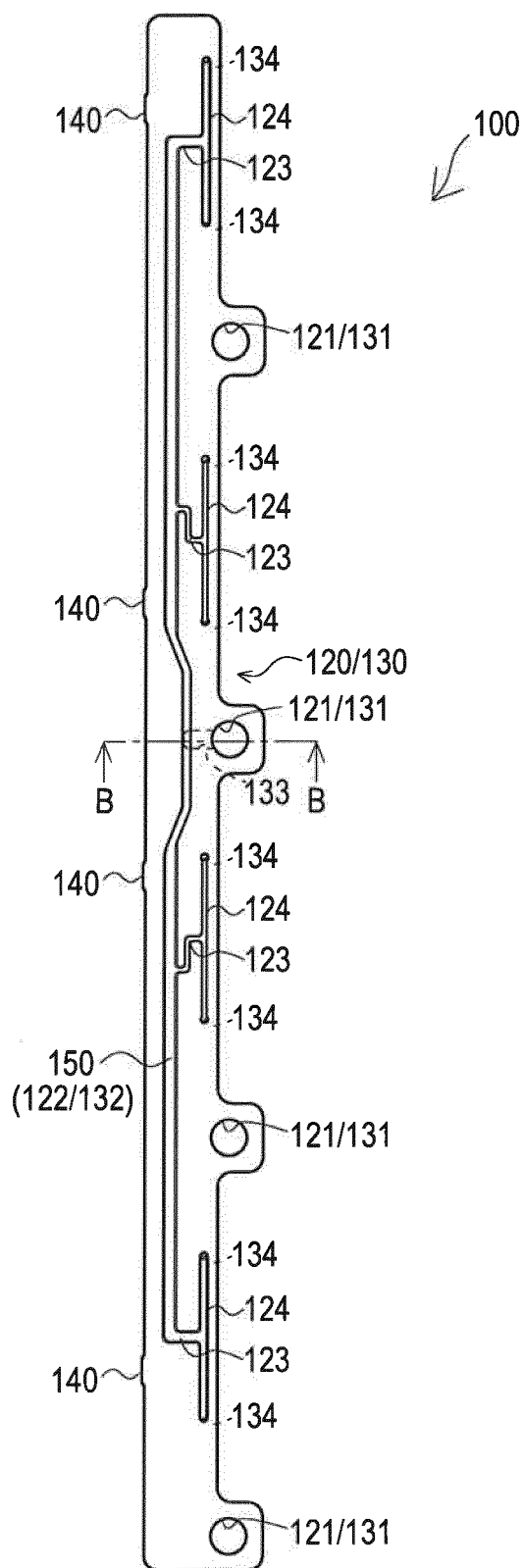
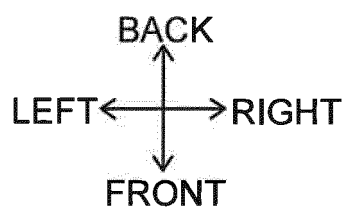


Fig. 10

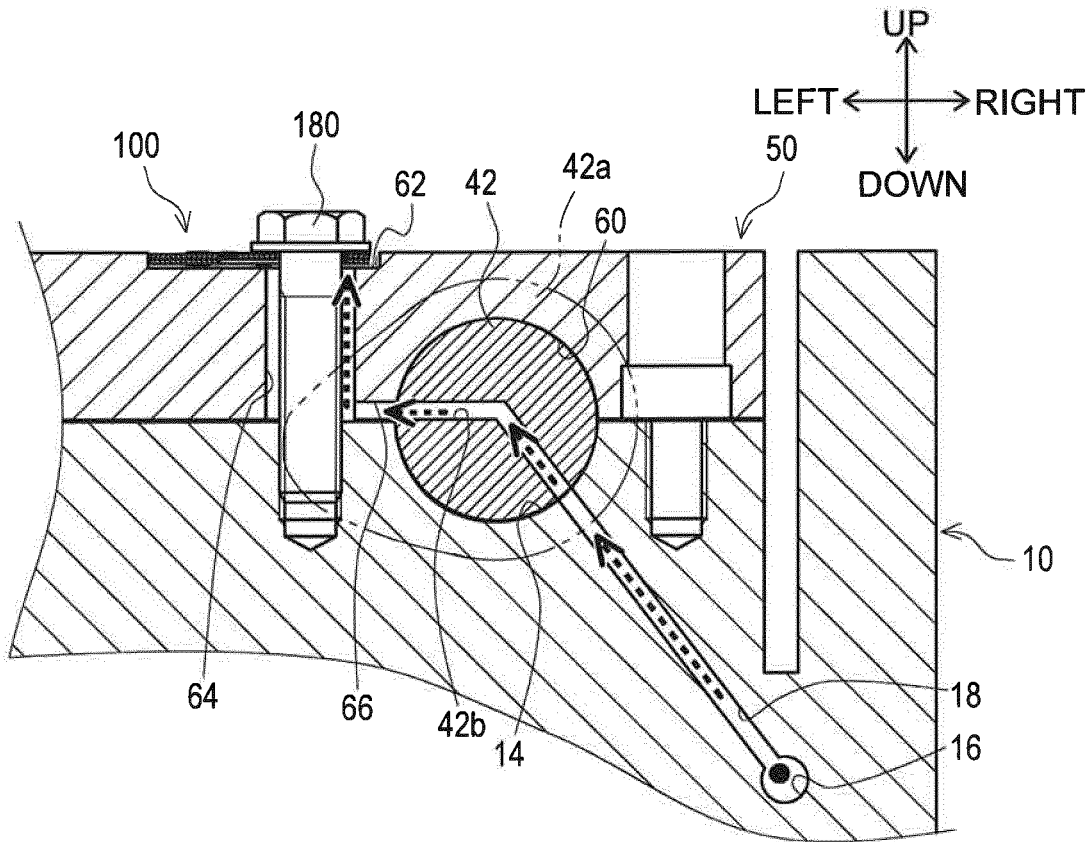
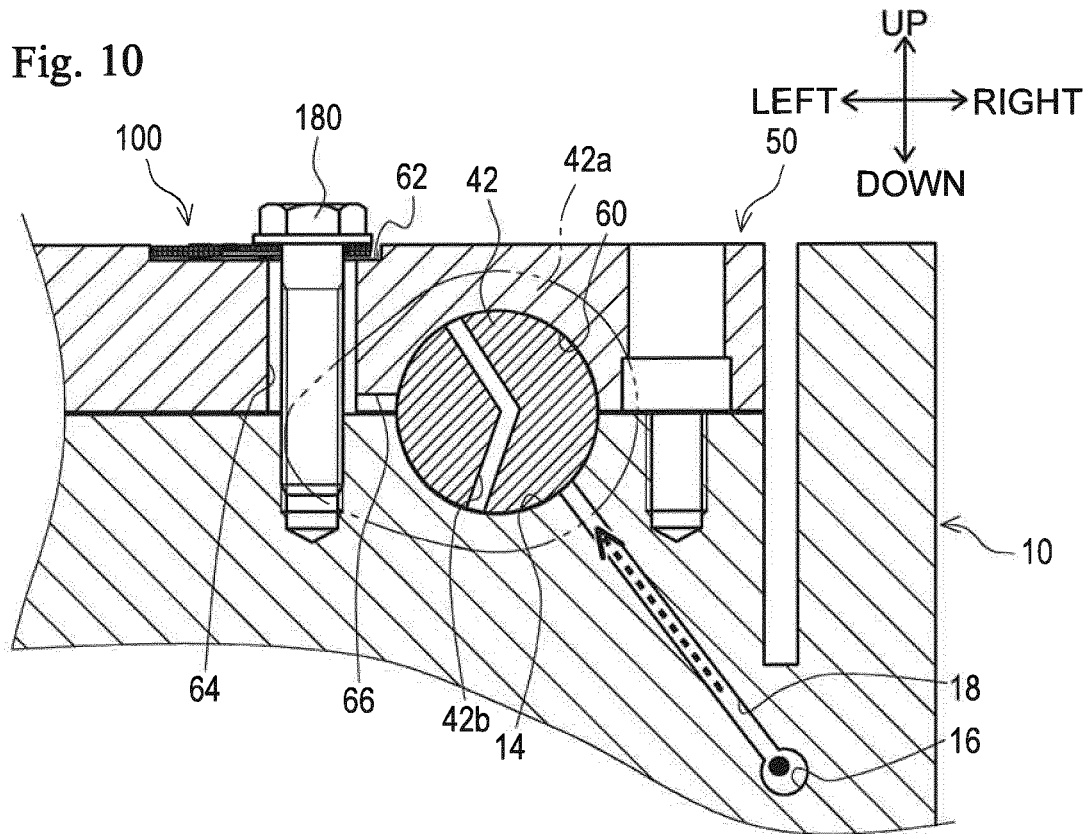


Fig. 11

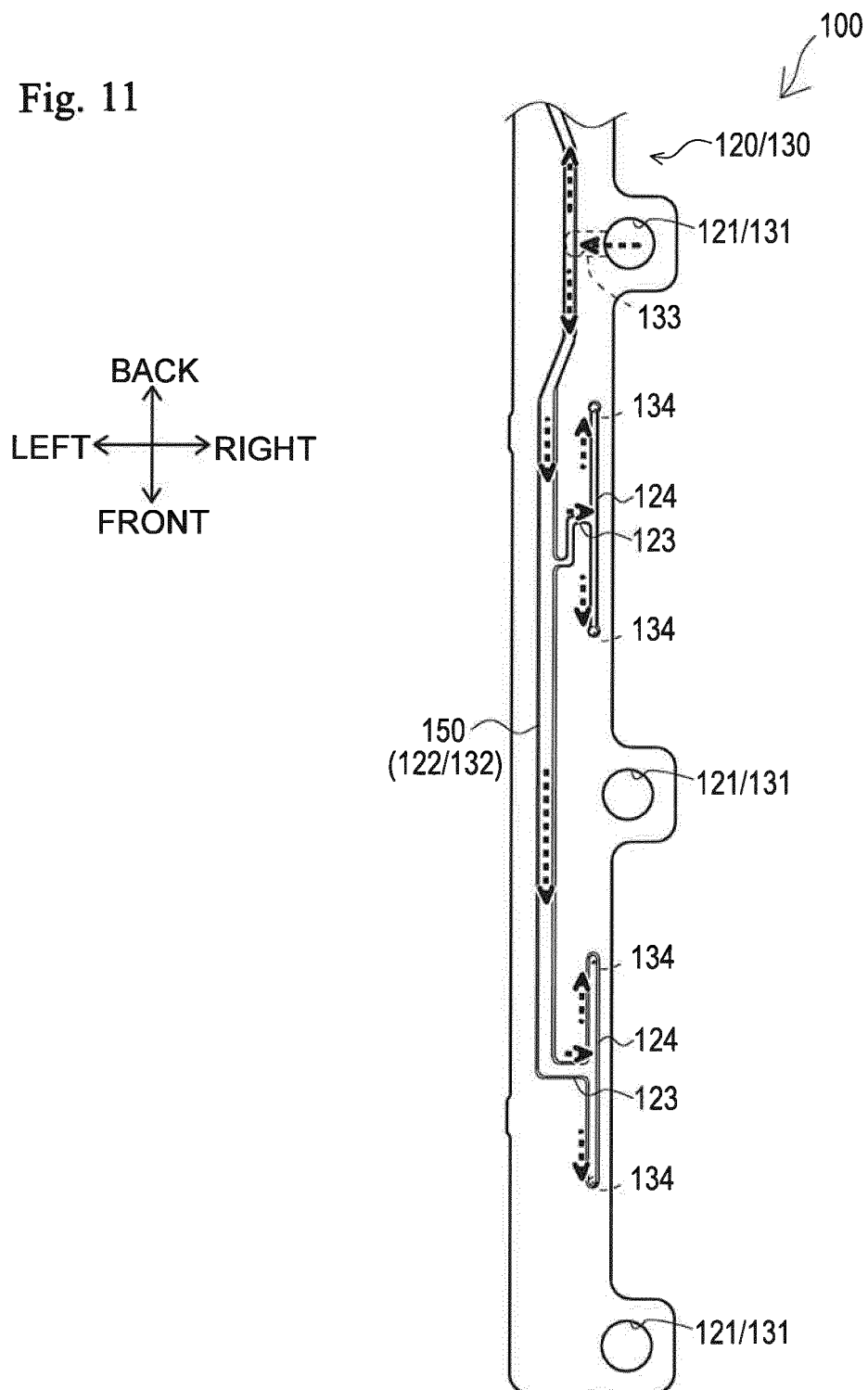
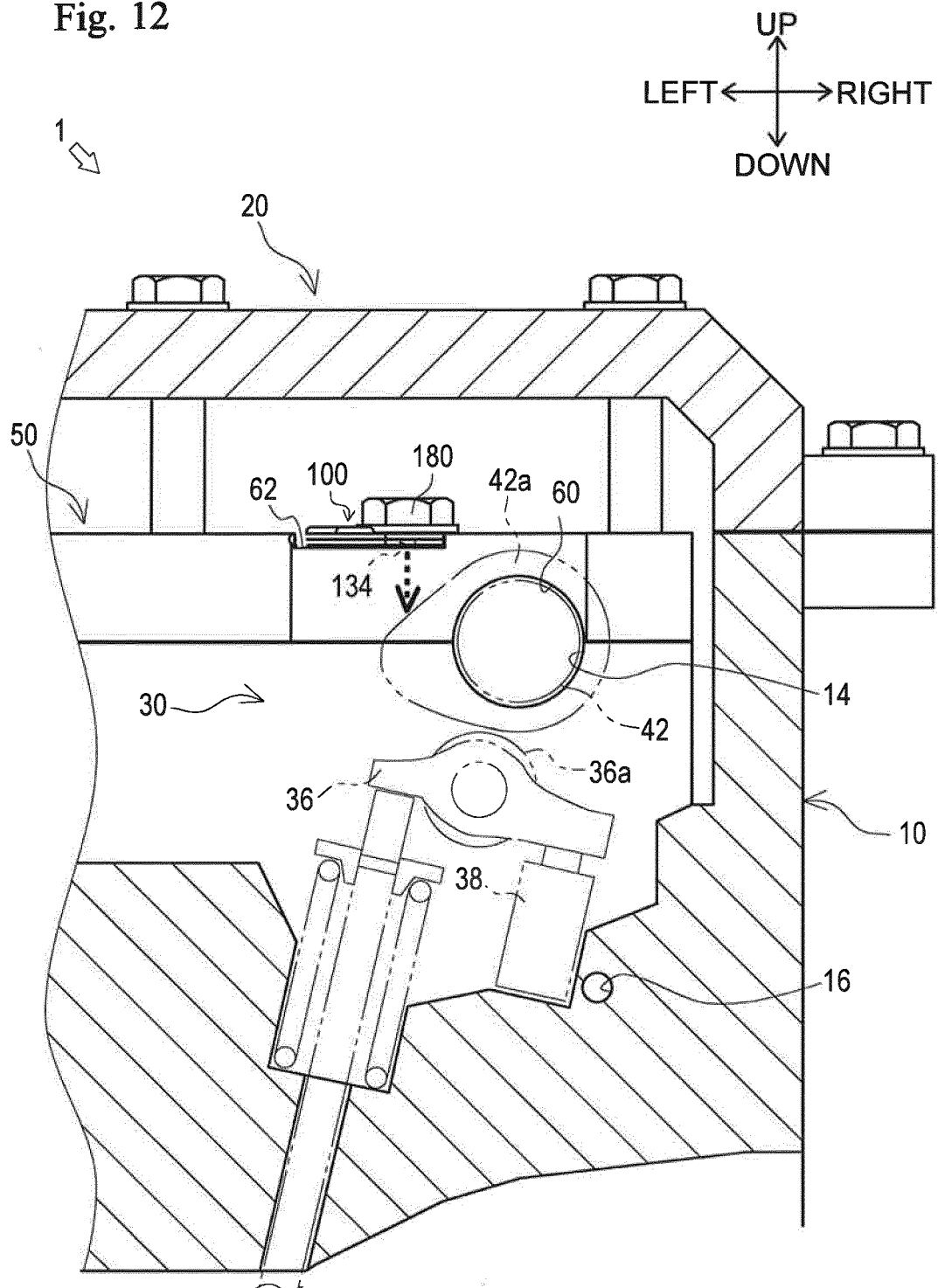
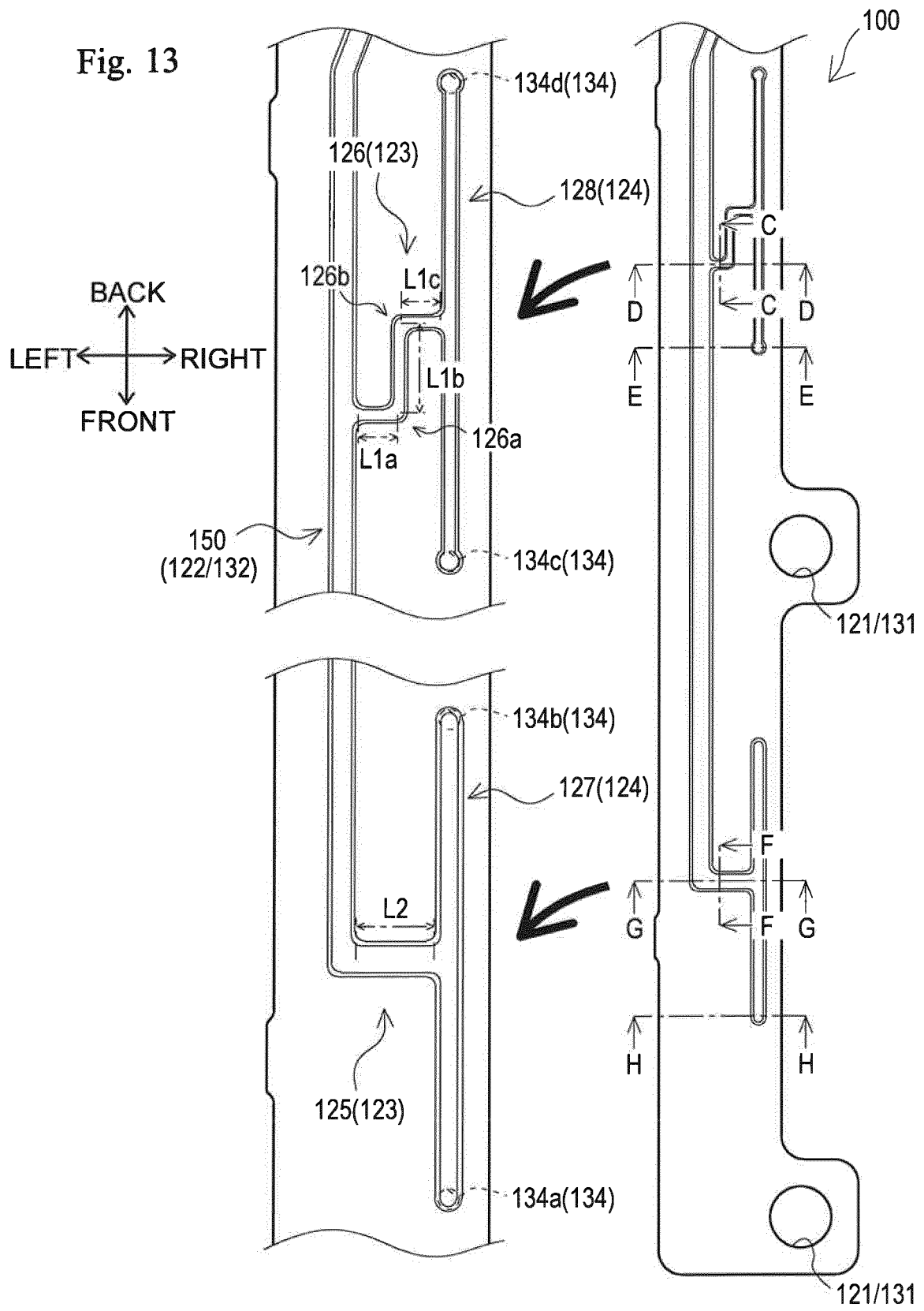


Fig. 12





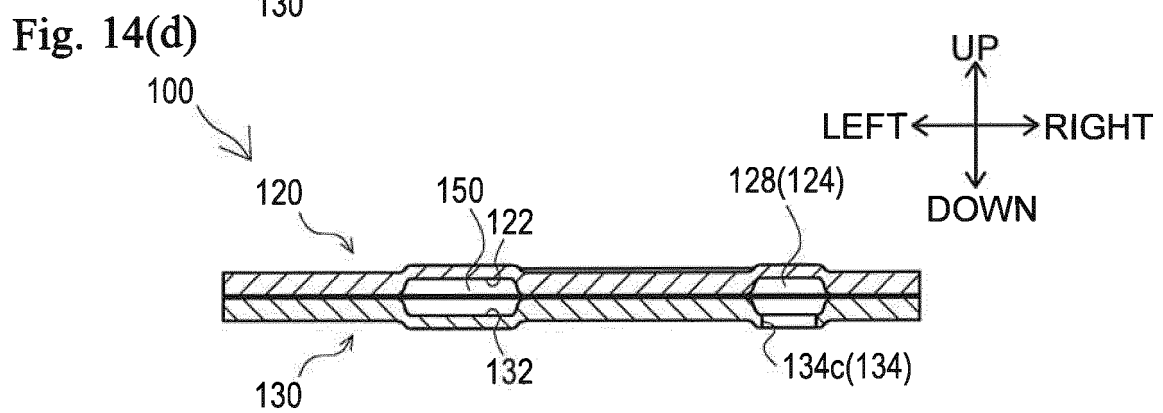
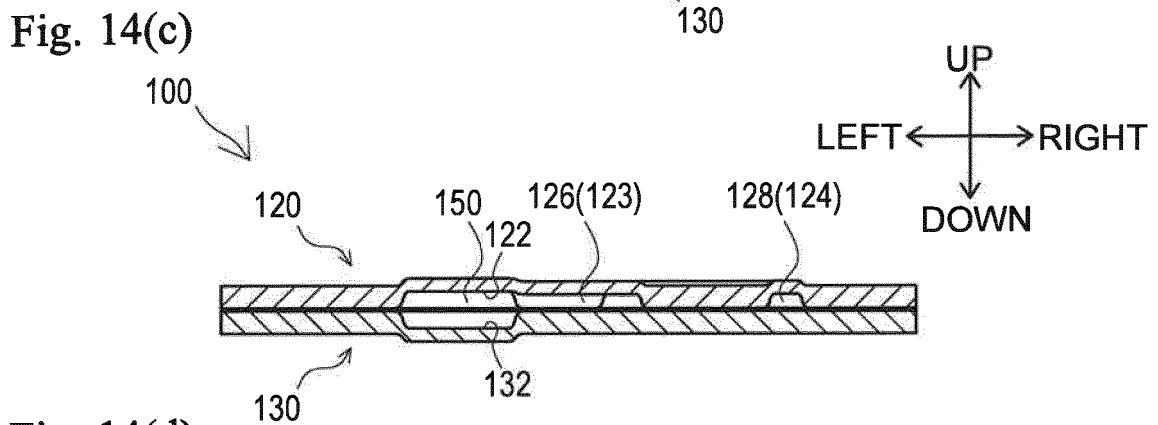
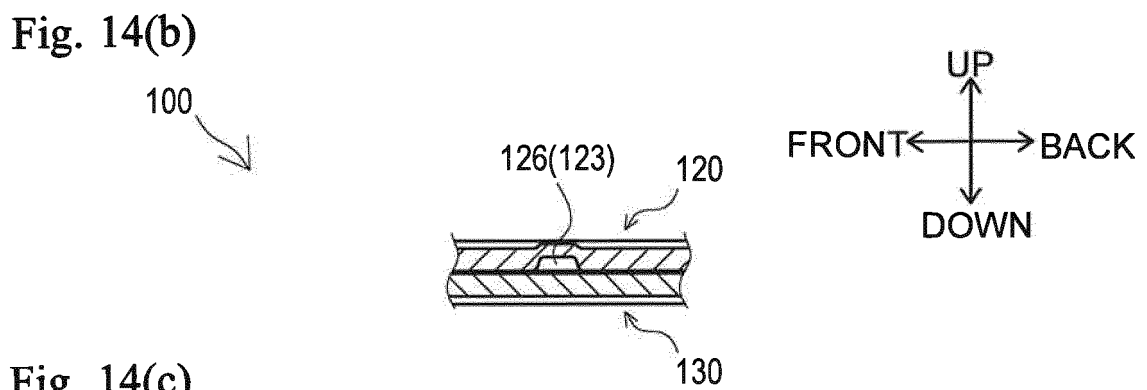
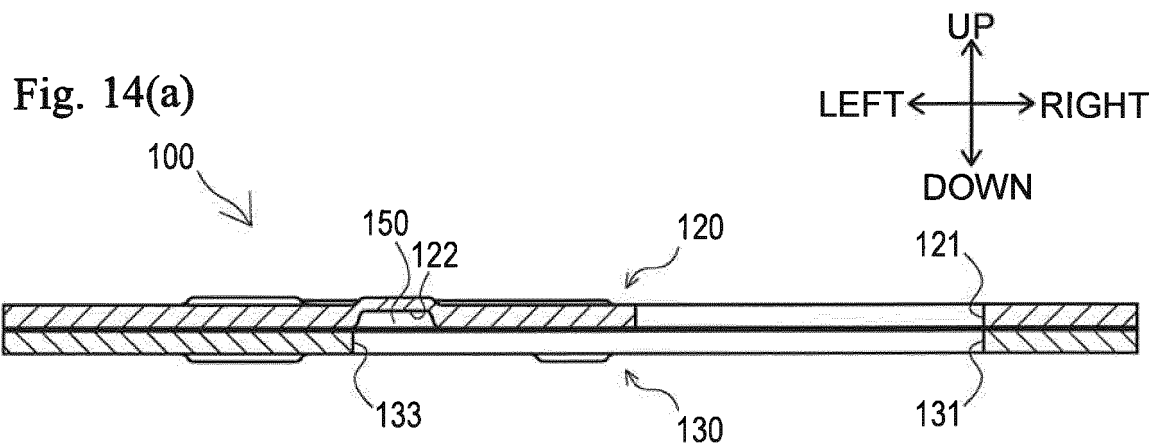


Fig. 15(a)

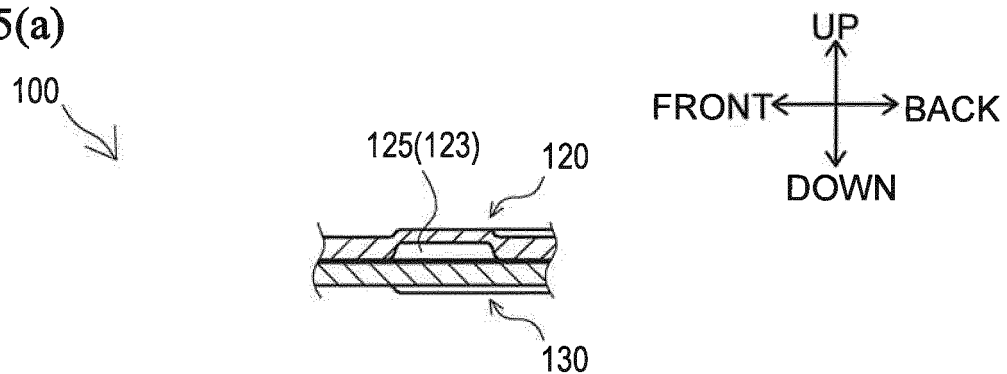


Fig. 15(b)

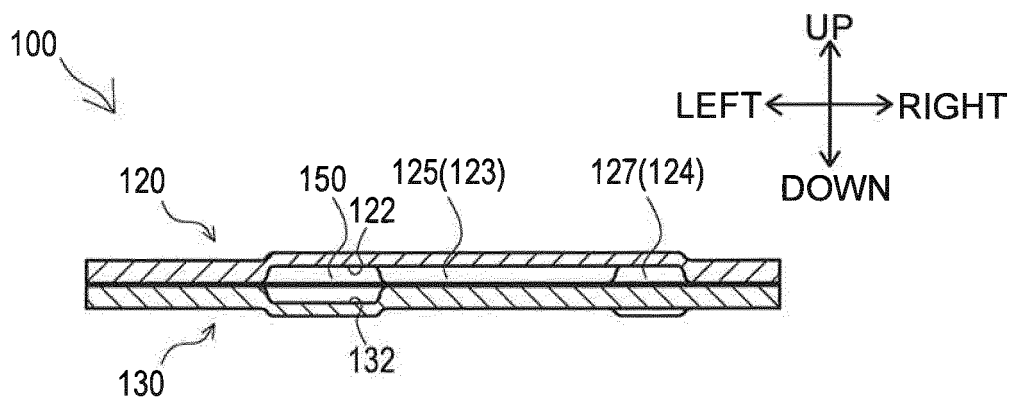
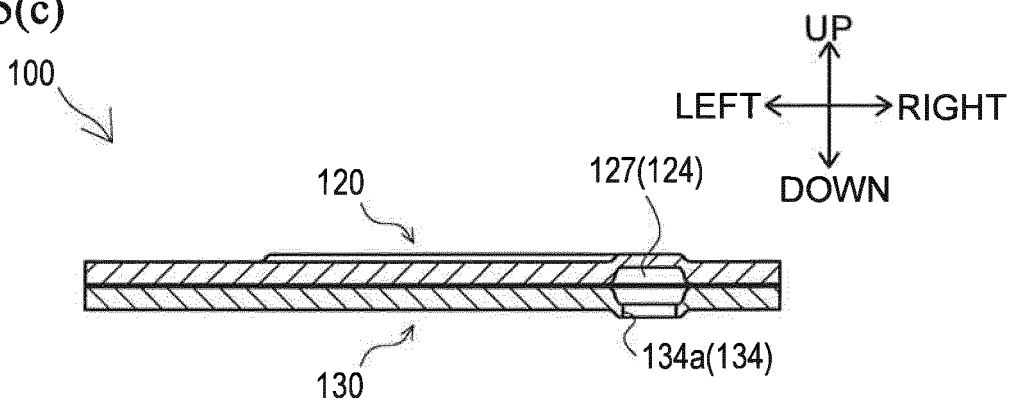


Fig. 15(c)



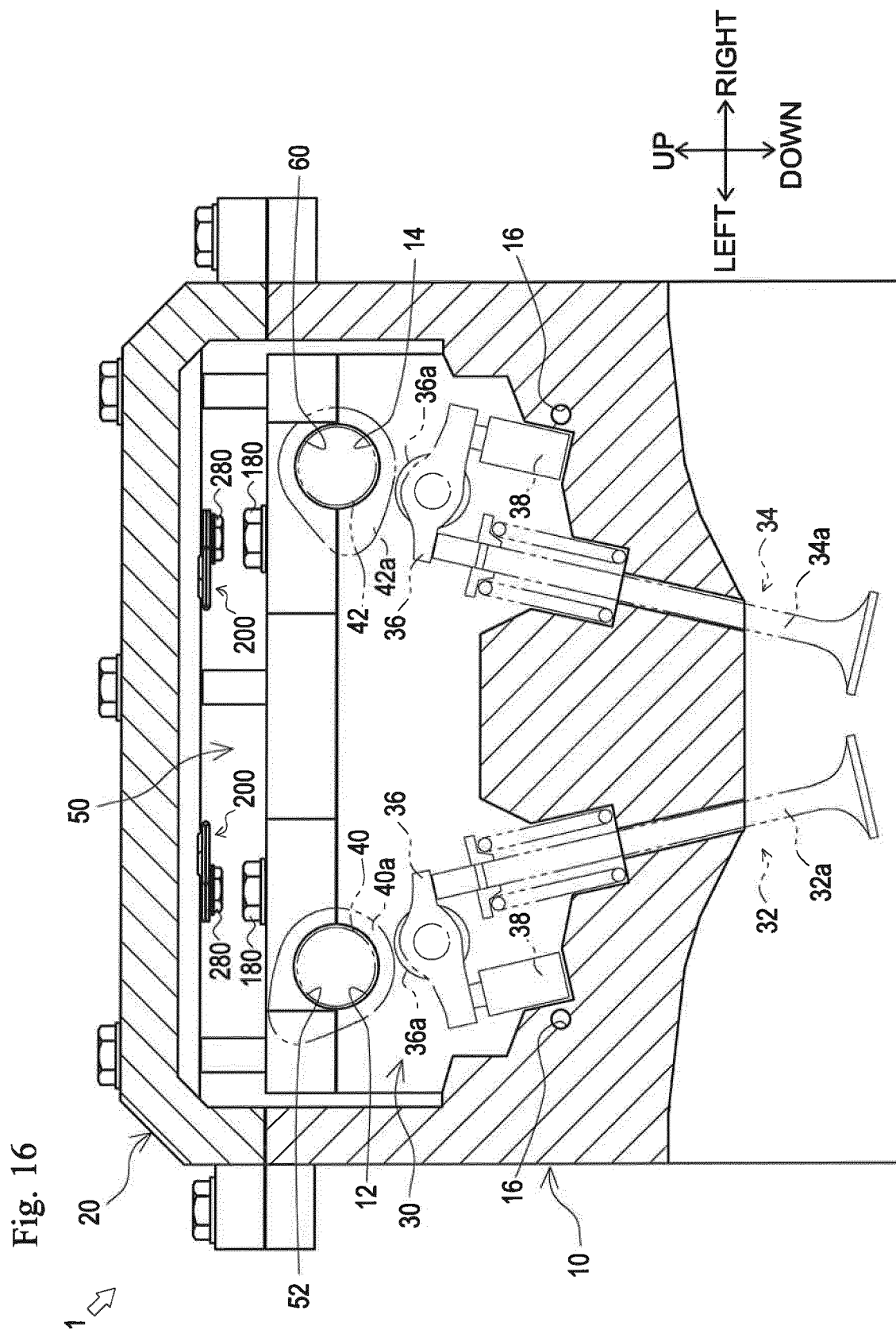


Fig. 17

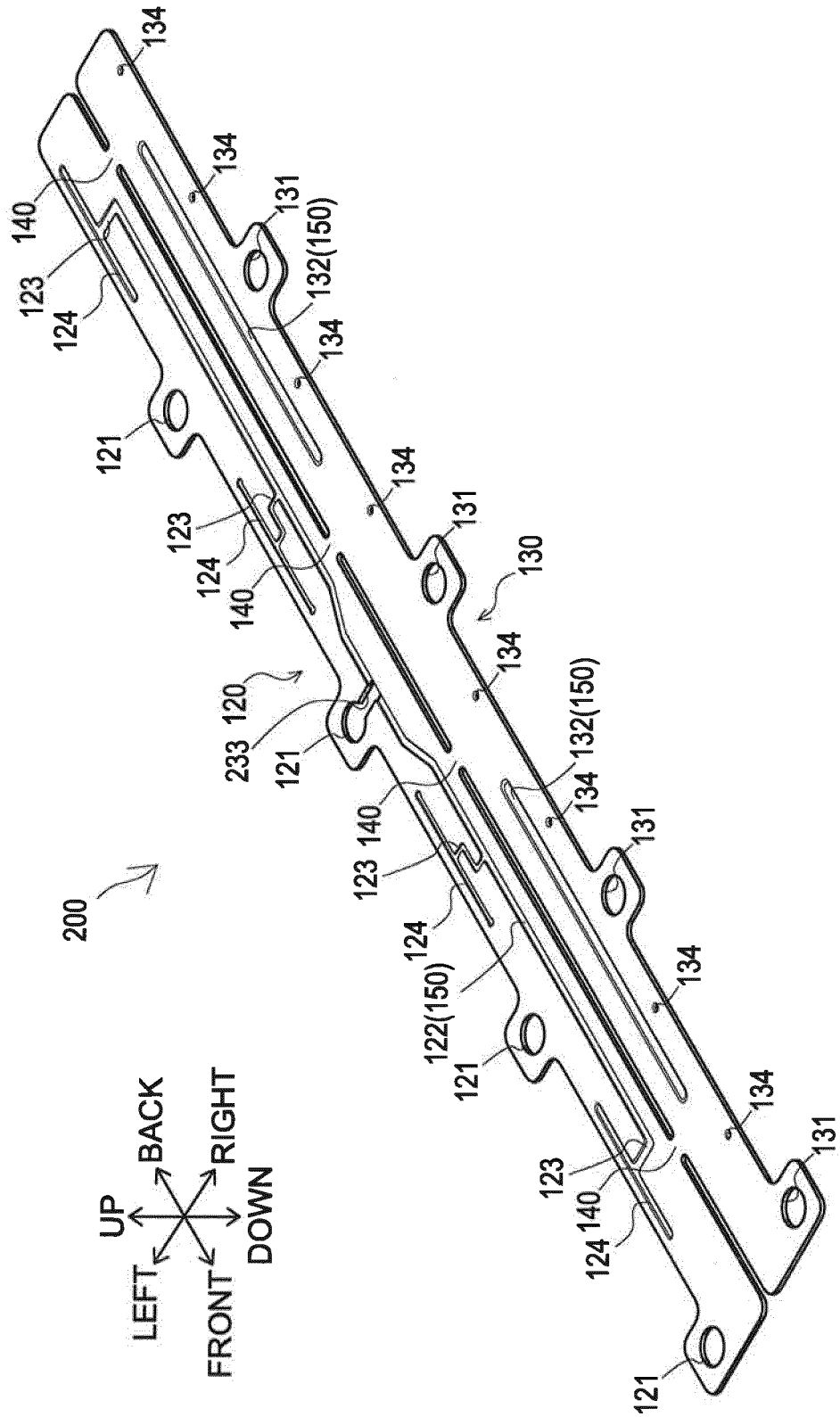


Fig. 18

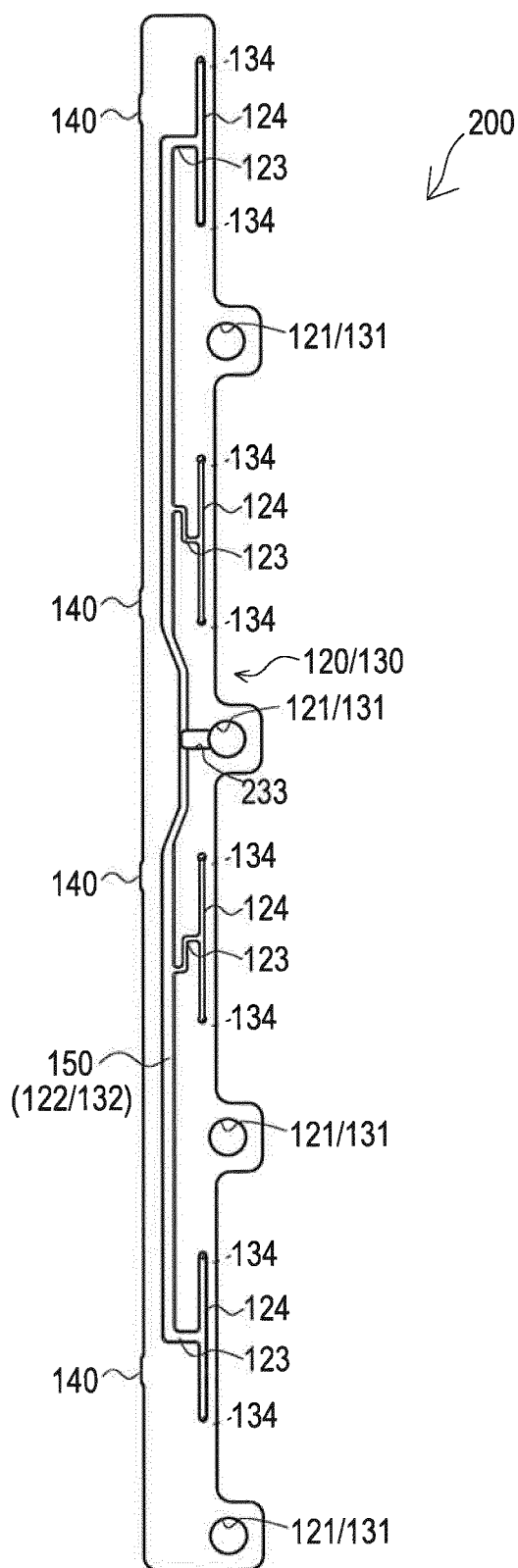
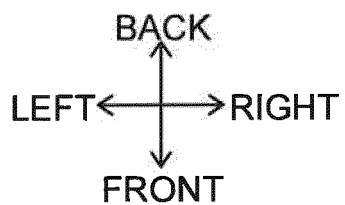


Fig. 19

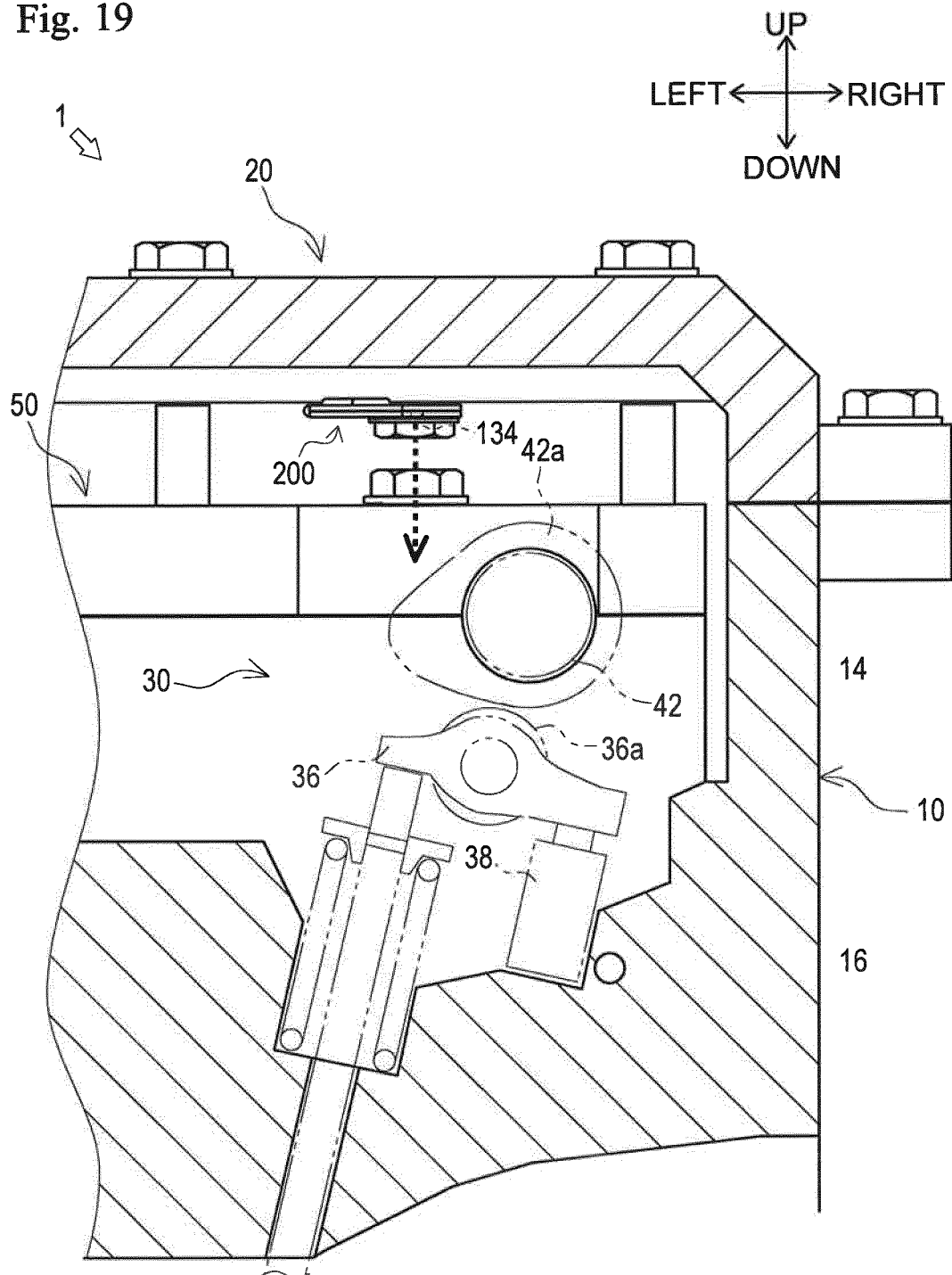


Fig. 20

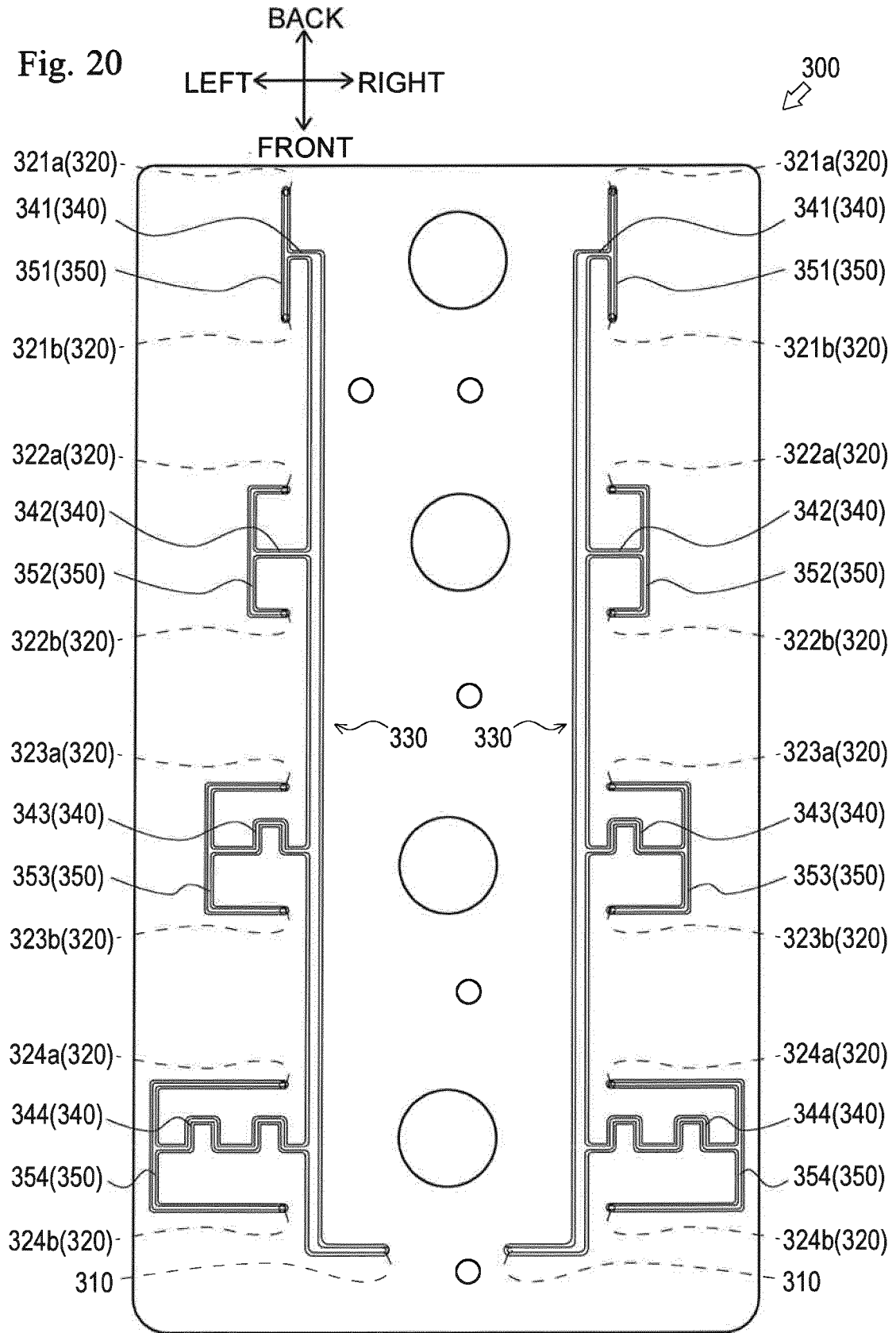
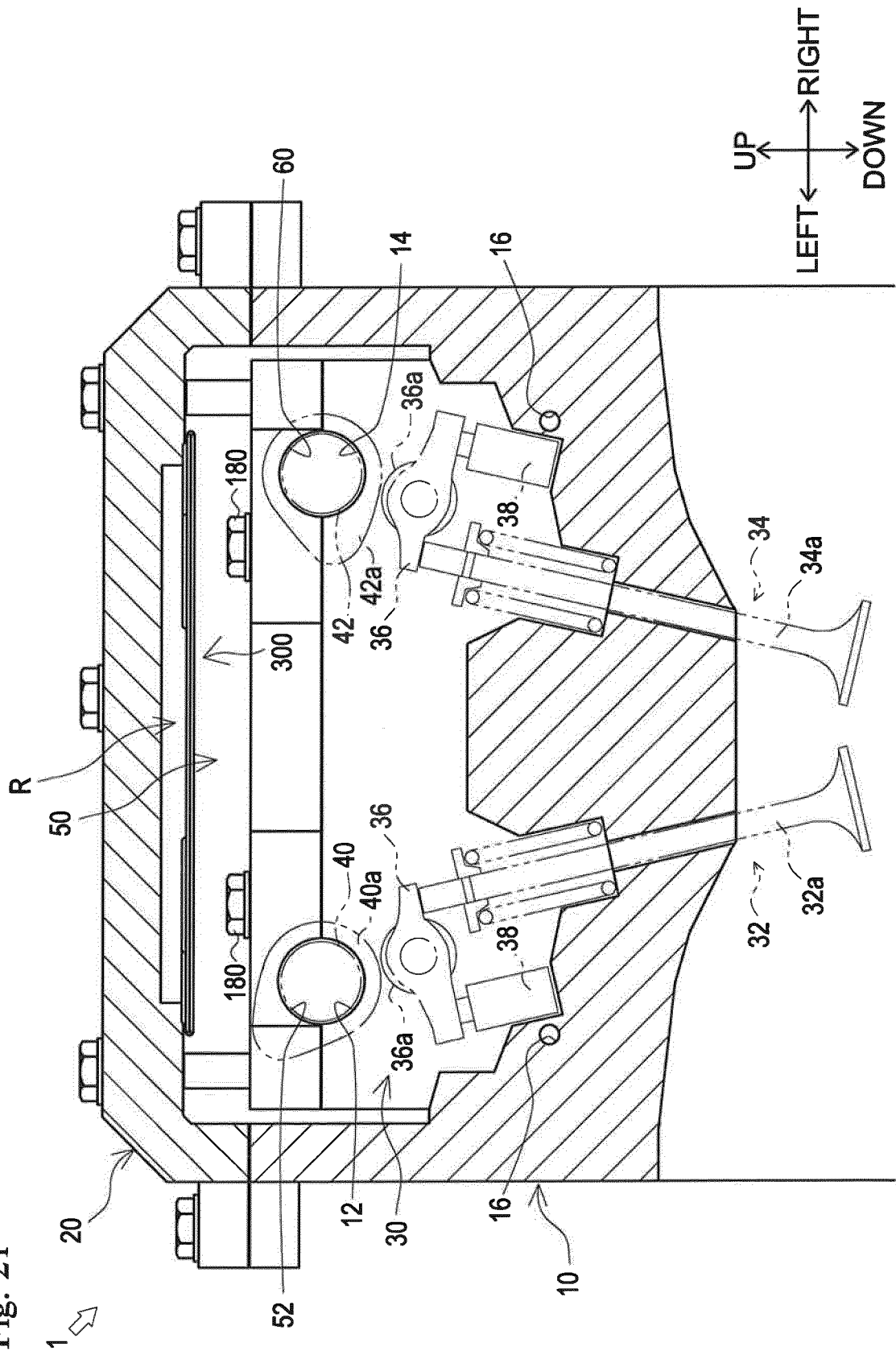


Fig. 21



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/060372

A. CLASSIFICATION OF SUBJECT MATTER

F01M1/08(2006.01)i, F01M9/10(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F01M1/08, F01M9/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2015

Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2014-066214 A (Taiho Kogyo Co., Ltd.), 17 April 2014 (17.04.2014), paragraphs [0010], [0030], [0038], [0060], [0062], [0064], [0070] to [0071], [0104], [0108]; fig. 1 to 3, 18, 21 & WO 2014/050716 A1 paragraphs [0010], [0030], [0038], [0060], [0062], [0064], [0070] to [0071], [0104], [0108]; fig. 1 to 3, 18, 21	1 2-5
Y	JP 2005-163703 A (Toyota Motor Corp.), 23 June 2005 (23.06.2005), paragraphs [0016] to [0022], [0027]; fig. 1 to 2 (Family: none)	2-5

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search
26 June 2015 (26.06.15)Date of mailing of the international search report
07 July 2015 (07.07.15)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/060372

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2001-032705 A (Honda Motor Co., Ltd.), 06 February 2001 (06.02.2001), paragraphs [0021], [0047] to [0048], [0051]; fig. 1, 4 to 6 (Family: none)	1, 5

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REFERENCES CITED IN THE DESCRIPTION

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