

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 686 245 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.08.2006 Bulletin 2006/31

(51) Int Cl.:
F01M 13/02 (2006.01)

(21) Application number: **06250260.4**

(22) Date of filing: **18.01.2006**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
SK TR**
Designated Extension States:
AL BA HR MK YU

(72) Inventor: **Horibe, Takehiro**
Ichinomiya-shi, Aichi-ken (JP)

(74) Representative: **Roberts, Mark Peter**
J.A. Kemp & Co.,
14 South Square,
Gray's Inn
London WC1R 5JJ (GB)

(30) Priority: **26.01.2005 JP 2005018990**

(71) Applicant: **AICHI MACHINE INDUSTRY CO., LTD.**
Nagoya-shi,
Aichi-ken (JP)

(54) Blowby gas passage construction

(57) A blowby gas passage construction of an internal combustion engine is provided, wherein no outside pipeline is required for the engine, moisture included in the blowby gas may be prevented from freezing, and numbers of parts may be reduced so that the engine may be made into a compact type. In the internal portion of a cylinder head cover 1 mounted on a cylinder head, a blowby gas inside passage is formed so as to lead the blowby gas into the intake ports of the cylinder head. A

rear end wall 1a of the cylinder head cover 1 is provided on the surface thereof with a blowby gas introductory port 3a that communicates with the blowby gas inside passage and a discharge port 2a for discharging the blowby gas out of a positive crankcase ventilation (PCV) valve 2. Also, on the rear end wall 1a is attached a rear cover 10 for covering the blowby gas introductory port 3a and the discharge port 2a and for making communication between both the ports 3a and 2a.

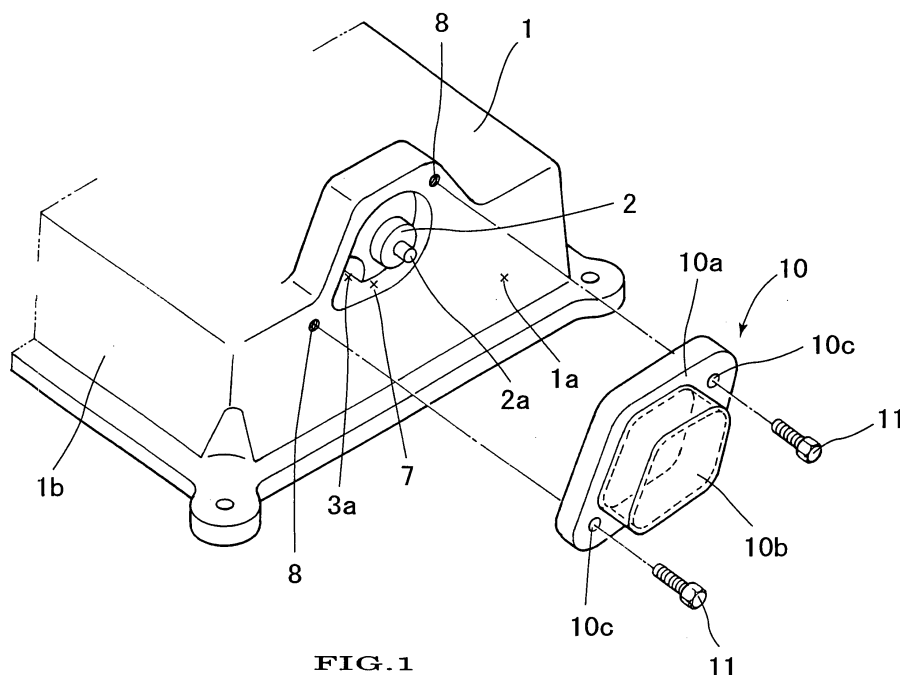


FIG. 1

EP 1 686 245 A2

Description

FIELD OF THE INVENTION

[0001] The present invention relates to the construction of a blowby gas passage in an internal combustion engine.

BACKGROUND OF THE INVENTION

[0002] In an internal combustion engine of the prior art, as disclosed in the following Patent document 1, a positive crankcase ventilation (PCV) valve, which is provided in the outlet of an oil separator on a cylinder head cover, and an intake manifold are connected by a hose composing a blowby gas passage, wherein blowby gas is circulated through the hose located outside the engine.

[0003] Concerning the hose, there is used a double-tube hose comprising an external and an internal tube as disclosed in the following Patent document 2.

Patent document 1: Japanese Patent Publication No.H08-93436

Patent document 2: Japanese Utility Model Publication No.H05-30410

[0004] In the construction as disclosed in Patent document 1, a hose composing the blowby gas passage is plumbed outside the engine, so that in a very low temperature area such as a cold district there is a drawback that the blowby gas is cooled down inside the hose, and the moisture in the blowby gas is frozen to block the blowby gas passage.

[0005] Even in case that a doubled-tube hose such as disclosed in Patent document 2 is used, there is a problem that the moisture in the blowby gas is frozen during flowing within the outside tube in contact with the open air.

[0006] Further, in the prior art construction, there is a problem that the degree of freedom for arrangement of engine parts is insufficient, because it is obliged to arrange the engine parts considering the arrangement of the outside hose and keeping away from the periphery of the hose.

[0007] Further, in the prior art of FIG.9, a blowby gas passage is extending to intake ports 6, 6 of a cylinder head 5, a part of the passage being included within a cylinder head cover 1. In this construction, a doubled-tube hose 52 connects a connector 51 and a PCV valve 2 projecting out of a rear end wall 1a of the cylinder head cover 1. The doubled-tube hose 52 needs a space to keep bending angle, so that the arrangement of parts around the periphery of the hose is difficult. This is a factor of obstructing an engine to be made in a compact type.

SUMMARY OF THE INVENTION

[0008] The present invention is worked out in view of

the above-described problems in the prior art. It is an object of the present invention to provide a blowby gas passage construction that is capable of preventing the moisture in blowby gas from freezing and capable of reducing numbers of engine parts to make an engine in a compact type.

[0009] Another object of the present invention is to provide a blowby gas passage construction having the advantage that an outside pipeline of an engine becomes useless, and thereby the engine can be designed into a compact type, and the degree of freedom for arrangement of parts is improved.

[0010] A further object of the present invention is to provide a blowby gas passage construction including a rear cover composing a blowby gas passage, inside of which the blowby gas is warmed up to prevent the moisture in the blowby gas from freezing.

[0011] A further object of the present invention is to provide a blowby gas passage construction including a deep recess formed in a rear end wall of a cylinder head cover, inside of which recess the blowby gas is warmed up to prevent the moisture in the blowby gas from freezing.

[0012] A still further object of the present invention is to provide a blowby gas passage construction including a blowby gas introductory port positioned below the level of a discharge port in a recess, wherein the oil and moisture in the blowby gas are hard to accumulate in the recess, prevented from becoming sludge by oxidization and degradation to block the discharge port.

[0013] The subject matter of the present invention is that a blowby gas passage construction comprises a cylinder head cover mounted on a cylinder head of an engine, which cylinder head cover has an internal portion wherein a blowby gas inside passage is formed for leading the blowby gas into the intake ports of the cylinder head, and has a rear end wall provided on the surface thereof with a blowby gas introductory port communicating with the blowby gas inside passage and a discharge port for discharging the blowby gas out of a PCV valve; and a rear cover attached to the rear end wall for covering the blowby gas introductory port and the discharge port and for making communication between both the ports.

[0014] The second subject matter is that in the above blowby gas passage construction the blowby gas introductory port and the discharge port are provided within a recess formed in the wall surface of the cylinder head cover, both the ports are positioned under the wall surface, and the rear cover is made in a flat board for covering the recess.

[0015] The third subject matter is that in the above blowby gas passage construction the blowby gas introductory port is positioned below the level of the discharge port.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] In the drawings:

FIG.1 is an exploded view in perspective of the rear end portion of a cylinder head cover and the elements of a rear cover in accordance with the first embodiment;

FIG.2 is a front view of the rear cover of FIG.1 in attached condition;

FIG.3 is a cross-sectional view taken on line X-X of FIG.2;

FIG.4 is a cross-sectional view taken on line Y-Y of FIG.2;

FIG.5 is a cross-sectional view taken on line Z-Z of FIG.2;

FIG.6 is a cross-sectional view taken on line W-W of FIG.3;

FIG.7 is an exploded view in perspective of a cylinder head cover and a rear cover in accordance with the second embodiment as a modified form;

FIG.8 is an exploded view in perspective of a cylinder head cover and a rear cover in accordance with the third embodiment as another modified form; and

FIG.9 is an exploded view in perspective of a conventional construction of a cylinder head cover inside of which is formed a blowby gas inside passage.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0017] Hereinafter, an embodiment of the present invention will be described with reference to the drawings.

[0018] Referring to FIG.1, there is shown a rear end portion of a cylinder head cover 1 in accordance with the first embodiment of the present invention. Within the cylinder head cover 1 is formed a blowby gas inside passage 3 (not shown), in the same way as shown in FIG.9. Referring to FIG.9, the cylinder head cover 1 that is mounted on a cylinder head 5 is provided with flange portions 1c, 1c which are fixed by bolts to mounting flange surfaces 5a, 5a of the cylinder head 5. The blowby gas inside passage 3 is formed within the cylinder head cover 1 along a side wall 1b in the direction of a row of cylinders. The blowby gas inside passage 3 communicates with introductory passages 4, 4 provided vertically in the flange portions 1c, 1c.

[0019] Further, in the mounting flange surfaces 5a, 5a of the cylinder head 5 are formed introductory passages 4, 4 communicating with the introductory passages 4, 4 of the cylinder head cover 1. Each of the introductory passages 4, 4 communicates with each of intake ports 6, 6 of the cylinders in the cylinder head 5.

[0020] As shown enlarged in FIG.1, in the rear end wall 1a of the cylinder head cover 1 is hollowed out a shallow recess 7, in which is provided a discharge port 2a of a PCV valve 2, the tip end of which slightly projects from the surface of the rear end wall 1a. Also, in the recess 7 is provided a blowby gas introductory port 3a at a position below the level of the discharge port 2a, which port 3a communicates with the blowby gas inside passage 3 (not shown) that is formed in the cylinder head cover 1.

[0021] On the outside surface of the rear end wall 1a

is attached a rear cover 10 for covering the recess 7. Around the periphery of the rear cover 10 is formed a flange portion 10a with through holes 10c, 10c for a screw 11 respectively. Also, the rear cover 10 is integrally formed with a cover-inside passage portion 10b on the inside of the flange portion 10a. The cover-inside passage portion 10b has a shape agreeing with that of the recess 7 and projects outward, of which the hollow inside is a communication space S. Incidentally, the rear end wall 1a is provided with screw holes 8, 8 in the periphery of the recess 7 to attach the rear cover 10 by screws 11, 11.

[0022] FIG.2 is a front view of the rear cover 10 fixed by screw 11 to the rear end wall 1a of the cylinder head cover 1; FIG.3 is a section taken on line X-X in FIG.2; FIG.4 is a section taken on line Y-Y in FIG.2; FIG.5 is a section taken on line Z-Z in FIG.2; and FIG.6 is a section taken on line W-W in FIG.3.

[0023] In the bottom portion of the cylinder head cover 1 is disposed a baffle plate 12 (in FIG.4 and 5), over which is formed a vapor-liquid separation chamber 13 (in FIG. 5 and 6) in the position possible to communicate with the PCV valve 2.

[0024] The vapor-liquid separation chamber 13 is provided for purpose of separating oil out of blowby gas. Blowby gas (unburned gas) generated in a crankcase includes engine oil in mist, vapor or liquid condition. When the blowby gas is introduced into an intake side of an engine, the blowby gas including oil adheres to the inside of the intake passage and is carbonized to become carbon by heat generated in the engine. To avoid such a problem, the oil is separated in the vapor-liquid separation chamber 13.

[0025] The blowby gas, in which the oil is removed in the vapor-liquid separation chamber 13, is blown out of the discharge port 2a of PCV valve 2 into the communication space S within the rear cover 10. Further, the blowby gas is introduced from the blowby gas introductory port 3a into the blowby gas inside passage 3, and then from the introductory passage 4 into the intake port 6.

[0026] In case the rear cover 10 is made of aluminum or made of synthetic resin that has the adiabatic effect, the inside of the communication space S is warmed by heat of an engine. Besides, in the communication space S, the distance between the discharge port 2a and the blowby gas introductory port 3a is very short, so that the time is short that the flow of blowby gas keeps in contact with the side of the open air. As a result, the moisture in the blowby gas is prevented from freezing. Moreover, since the blowby gas flows through the blowby gas inside passage 3 in the cylinder head cover 1 that is warmed up by heat of the engine, the moisture in the blowby gas is prevented from freezing. Therefore, it can be avoided that the blowby gas passage is obstructed.

[0027] In particular, the rear cover 10 made of aluminum is warmed by generation of heat in an engine, so that the inside of the communication space S can be well warmed up.

[0028] Since the blowby gas introductory port 3a is positioned below the level of the discharge port 2a, it is avoided that the discharge port 2a of PCV valve 2 is obstructed by oil and moisture in the blowby gas accumulated in the communication space S. That is, the oil and moisture in the blowby gas are drained away from the blowby gas introductory port 3a positioned at a lower level to the lower course smoothly. As a result, the oil and moisture in the blowby gas are difficult to accumulate in the communication space S.

[0029] Referring to FIG.7, an exploded view of a variation according to this invention, the rear end wall 1a of the cylinder head cover 1 is directly provided with a PCV valve 2 and a discharge port 2a which are projecting outward from the surface of the rear end wall 1a. Also, the rear end wall 1a is provided with a blowby gas introductory port 3a. The rear cover 10 comprises a flange portion 10a and a cover-inside passage portion 10b inside of which is formed a communication space S with sufficient depth for covering the PCV valve 2, the discharge port 2a and the blowby gas introductory port 3a.

[0030] This type of cylinder head cover 1 in FIG.7 is easy to manufacture because of its simple construction that there is no need to form a recess 7 in the rear end wall 1a.

[0031] Referring to FIG.8, an exploded view of another variation according to this invention, there is an inverse relationship with the case of FIG.7. Namely, the rear end wall 1a of the cylinder head cover 1 is provided with a deep recess 7, in which are formed a discharge port 2a of PCV valve 2 that is not projecting outside of the recess 7. Further, in the bottom of the recess 7 is provided a blowby gas introductory port 3a.

[0032] Accordingly, in the construction of the cylinder head cover 1 in FIG.8 the discharge port 2a does not project out of the surface of the rear end wall 1a. Therefore, it becomes possible to favorably form a communication space S within the recess 7 by covering it with a board rear cover 10 attached to the rear end surface 1a. As a result, it becomes possible to simplify the shape of the rear cover 10. Moreover, the inside of the recess 7 is favorably warmed up by the heat of the cylinder head cover 1 during engine operation, so that the moisture in the blowby gas is more surely prevented from freezing.

[0033] Besides, it becomes possible to make the whole of the cylinder head cover 1 in a smaller size corresponding to the reduction of the outwardly projected length of the rear cover 10. Further, the conventional outside pipeline such as blowby gas hose becomes useless and does not project outward, so that other engine parts become easy to arrangement, numbers of parts are capable of reducing to make the engine in a compact type, and the degree of freedom for parts arrangement is improved.

[0034] Having described the invention in detail and by reference to the preferred embodiment thereof, it will be apparent that other modifications and variations are possible without departing from the scope of the invention defined in the appended claims.

Claims

1. A blowby gas passage construction in an internal combustion engine, comprising:

a cylinder head cover mounted on a cylinder head of the engine;
 said cylinder head cover having an internal portion wherein a blowby gas inside passage is formed for leading the blowby gas into the intake ports of said cylinder head;
 said cylinder head cover having a rear end wall provided on the surface thereof with a blowby gas introductory port communicating with said blowby gas inside passage and a discharge port for discharging the blowby gas out of a positive crankcase ventilation valve; and
 a rear cover attached to said rear end wall for covering said blowby gas introductory port and said discharge port and for making communication between both said ports.

2. A blowby gas passage construction as claimed in claim 1, wherein said blowby gas introductory port and said discharge port are provided within a recess formed in said wall surface of said cylinder head cover, both said ports are positioned under said wall surface, and said rear cover is made in a flat board for covering said recess.

3. A blowby gas passage construction as claimed in claim 1 or 2, wherein said blowby gas introductory port is positioned below the level of said discharge port.

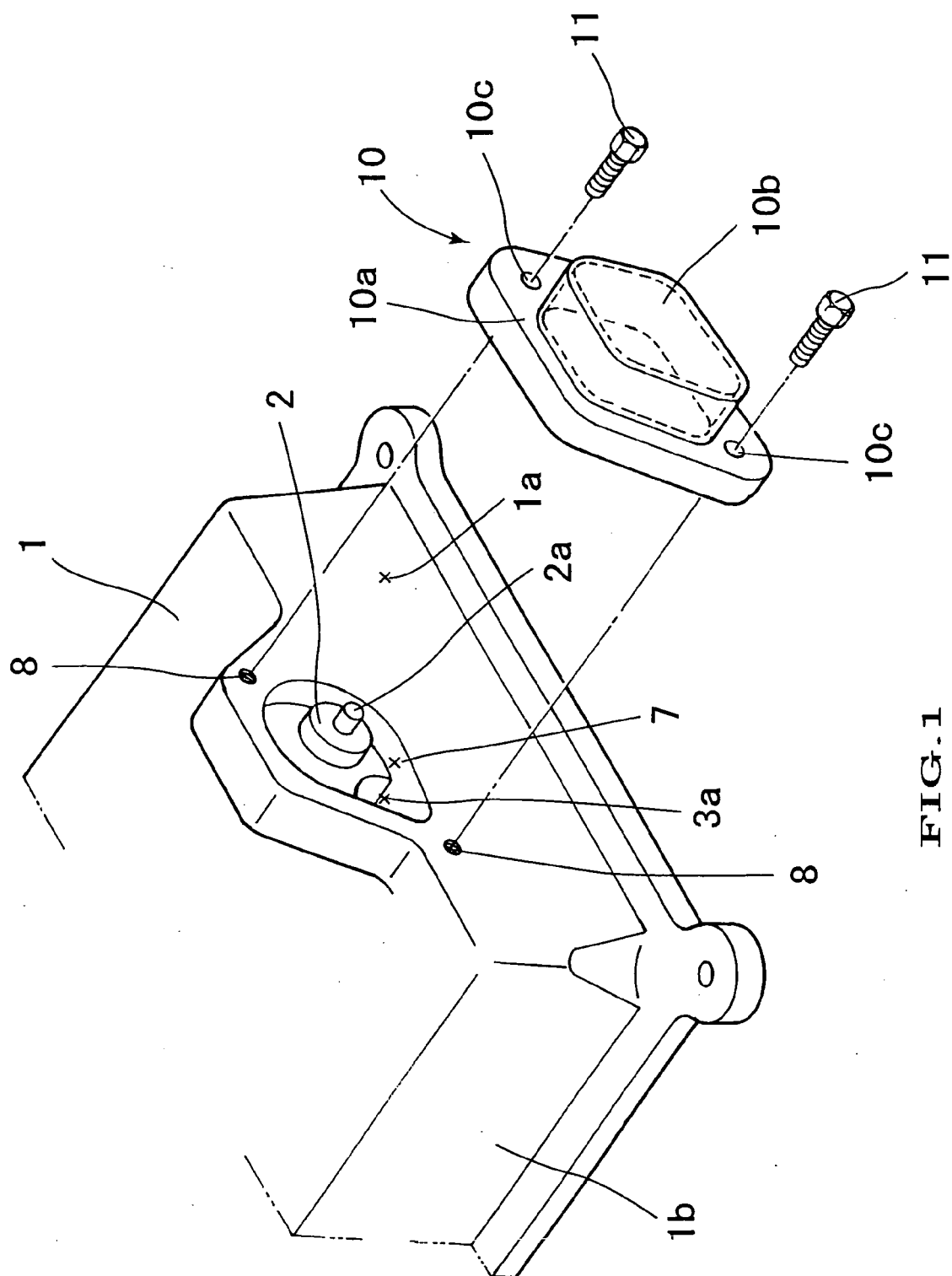


FIG. 1

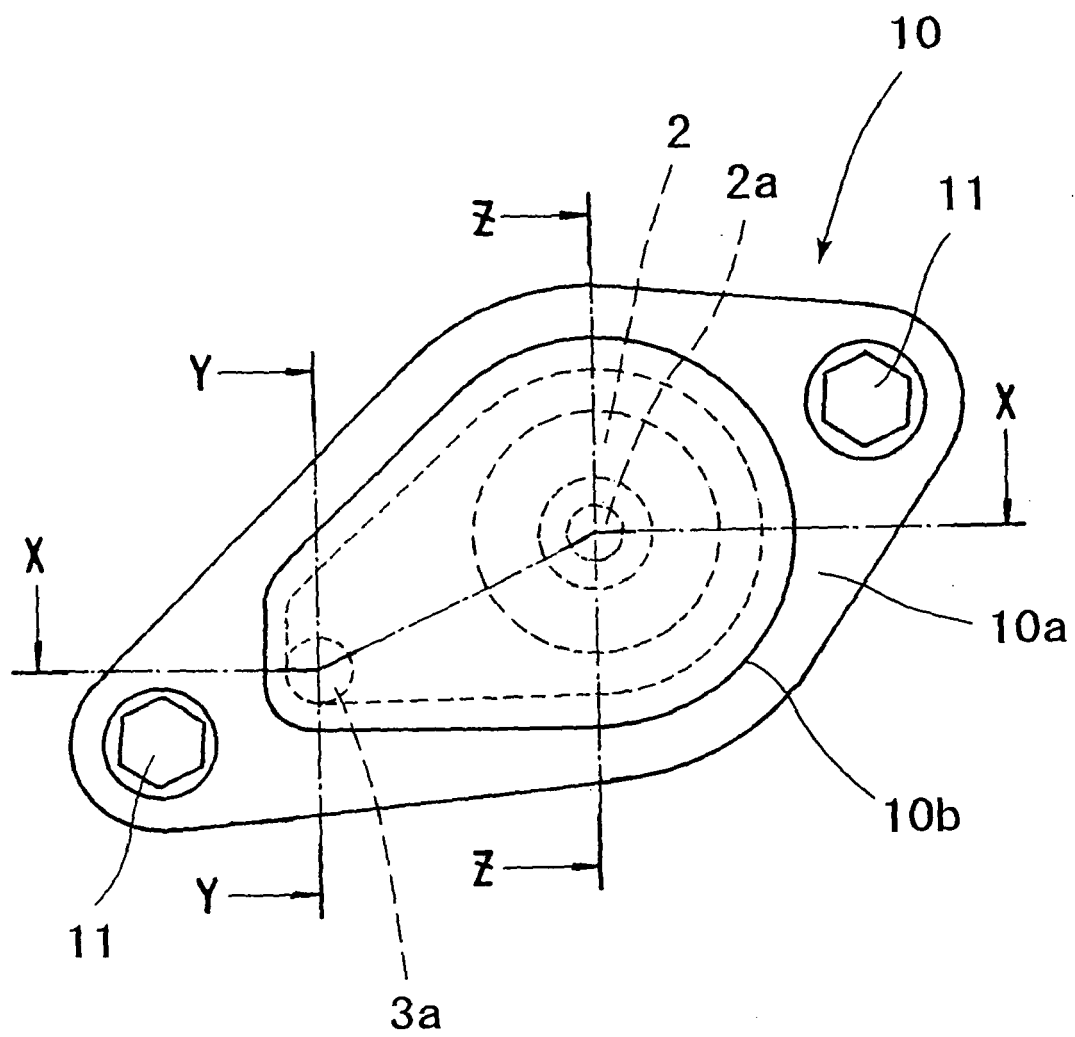


FIG. 2

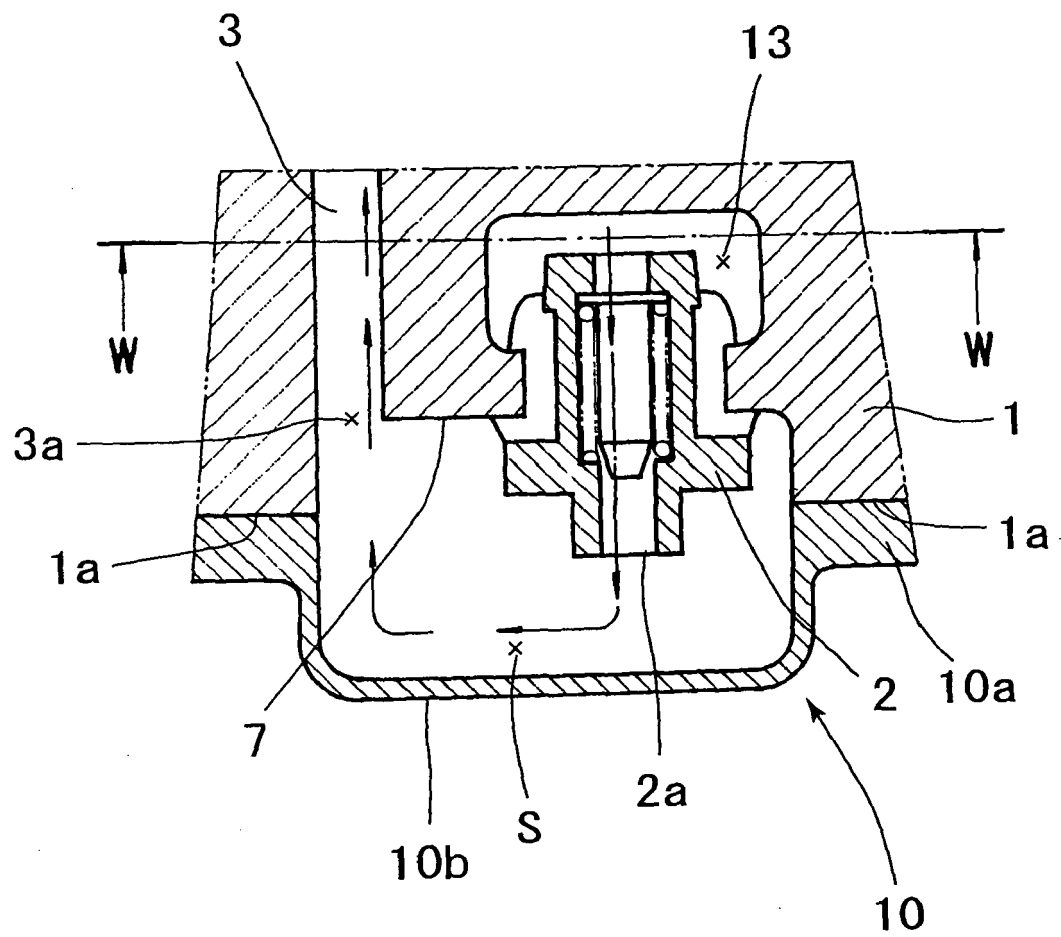


FIG.3

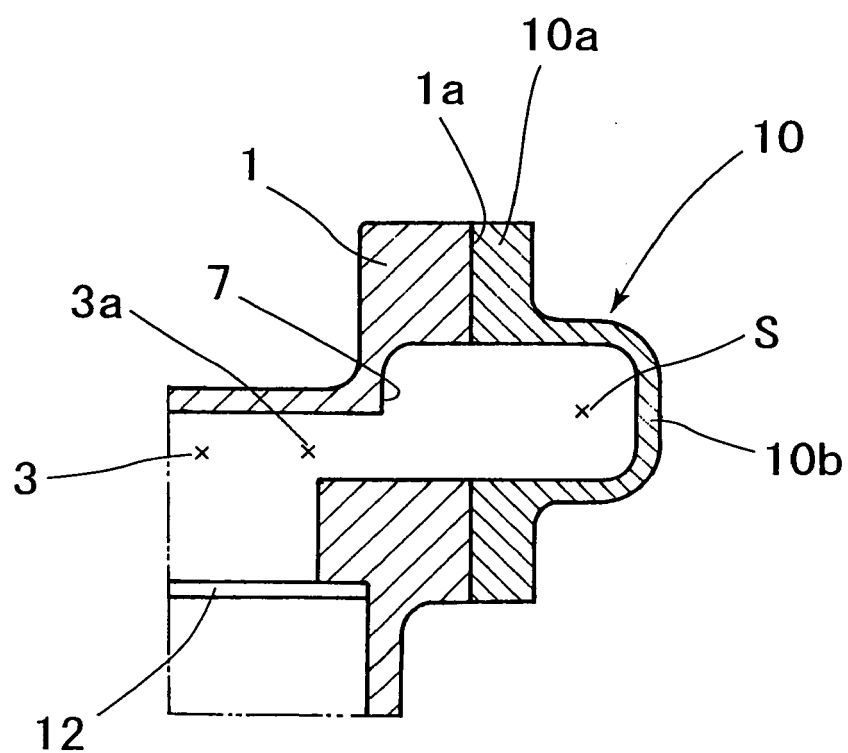


FIG. 4

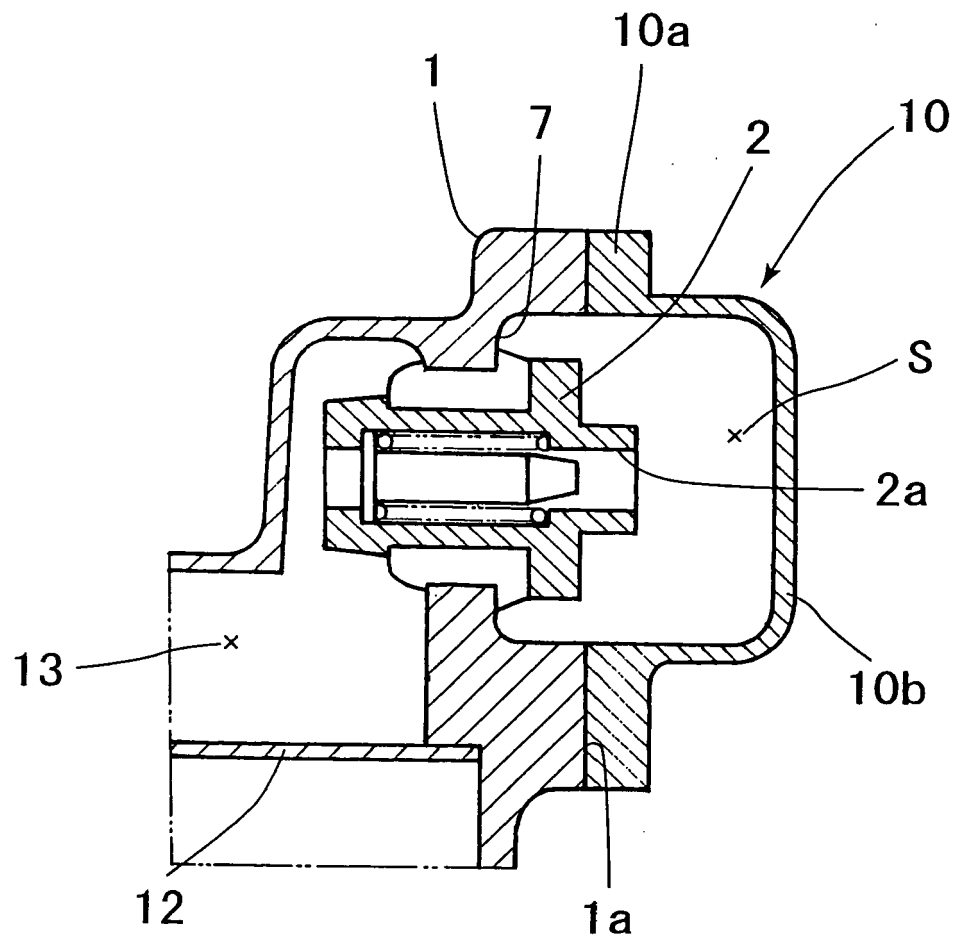


FIG. 5

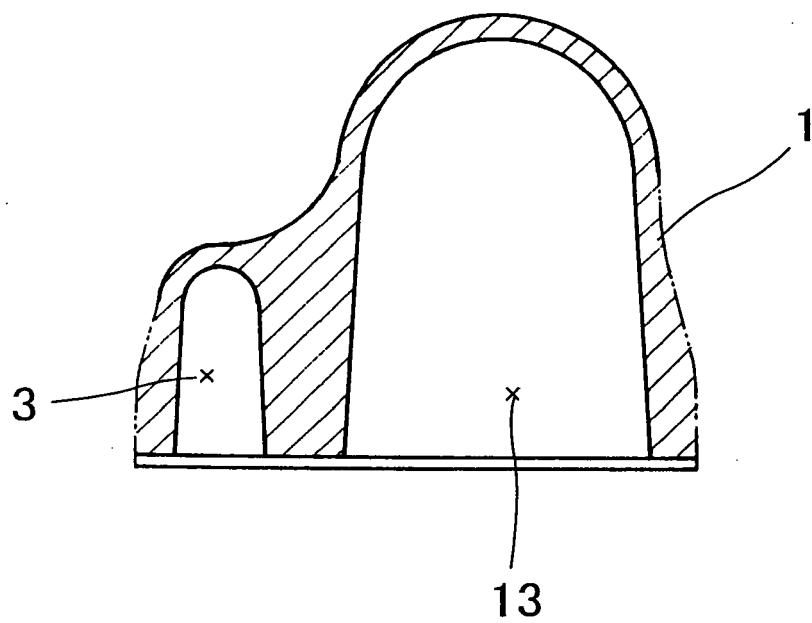


FIG.6

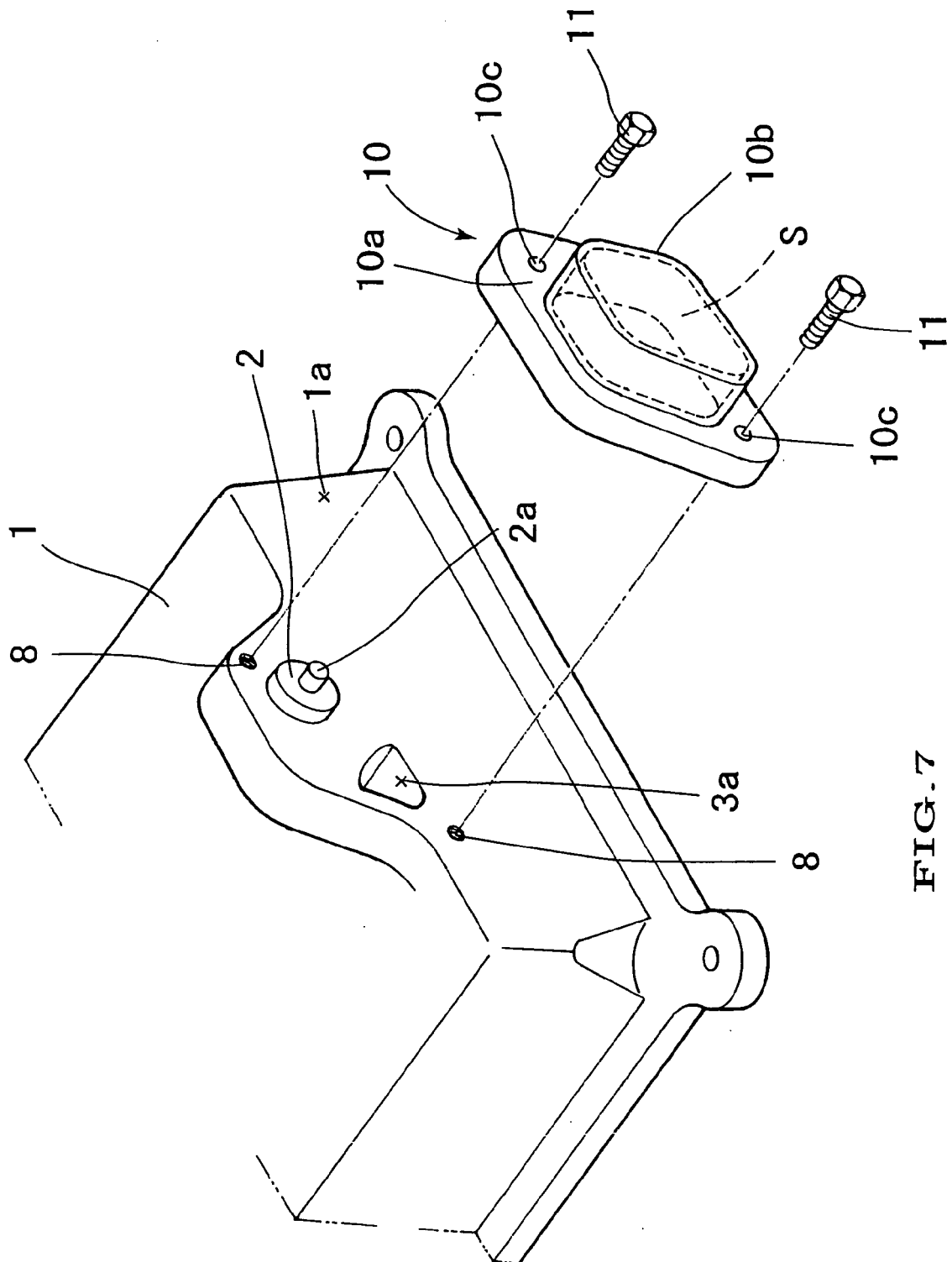


FIG. 7

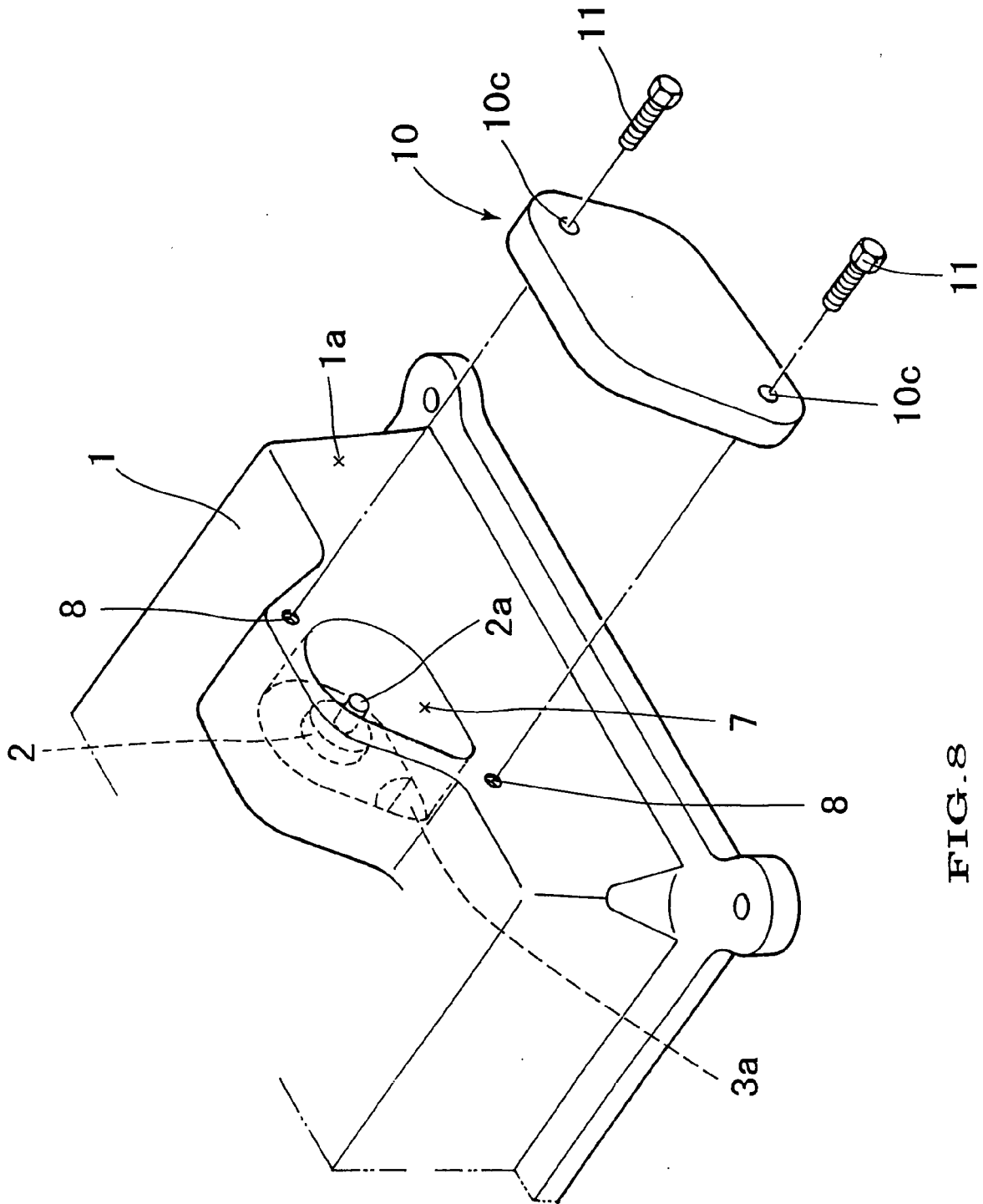


FIG. 8

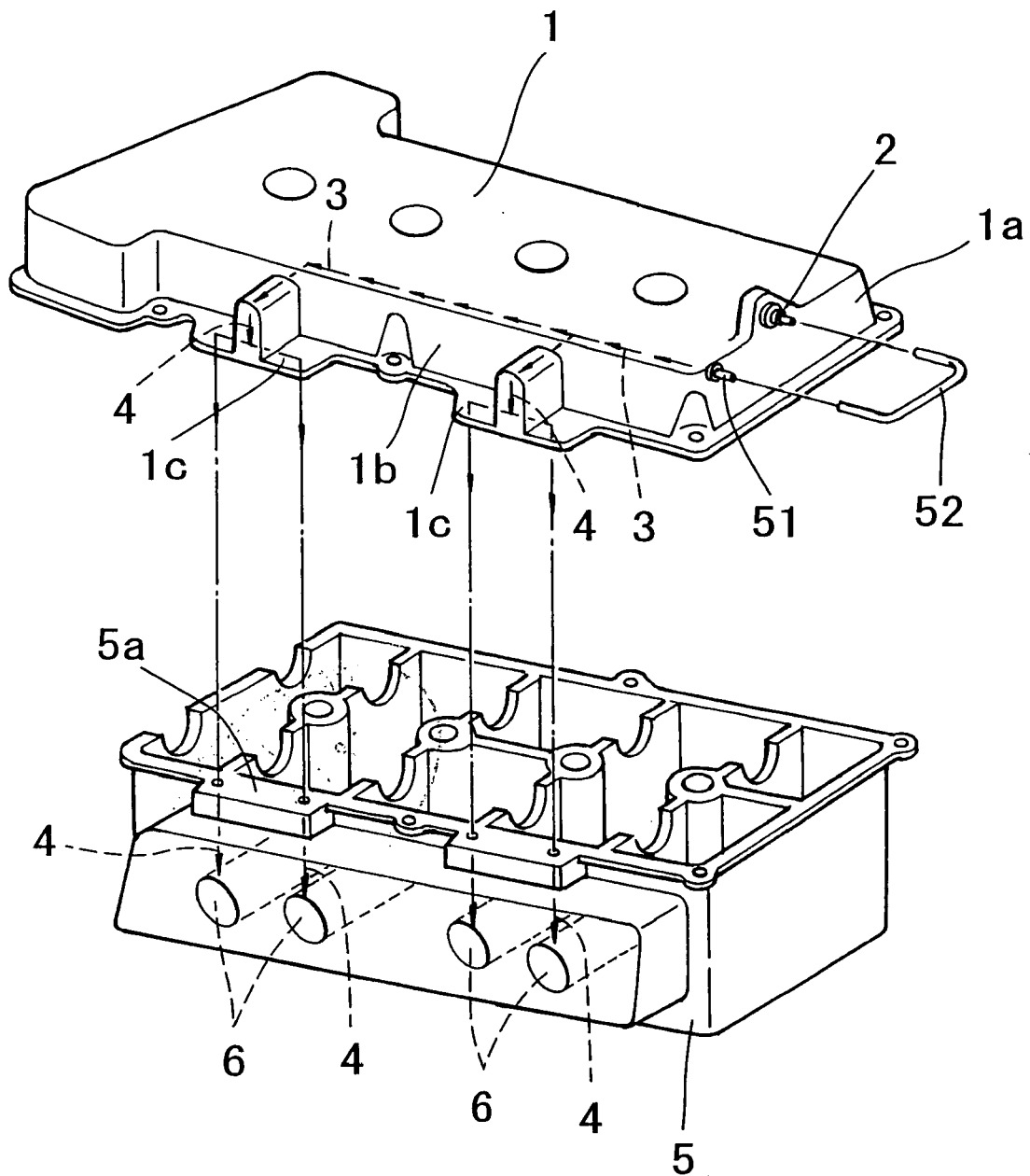


FIG. 9