(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 867 852 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
19.12.2007 Bulletin 2007/51

(51) Int Cl.:
F02D 9/10 *(2006.01)*

(21) Application number: **07010979.8**

(22) Date of filing: **04.06.2007**

(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 MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **13.06.2006 JP 2006163721**

(71) Applicant: **Keihin Corporation**
Shinjuku-ku, Tokyo (JP)

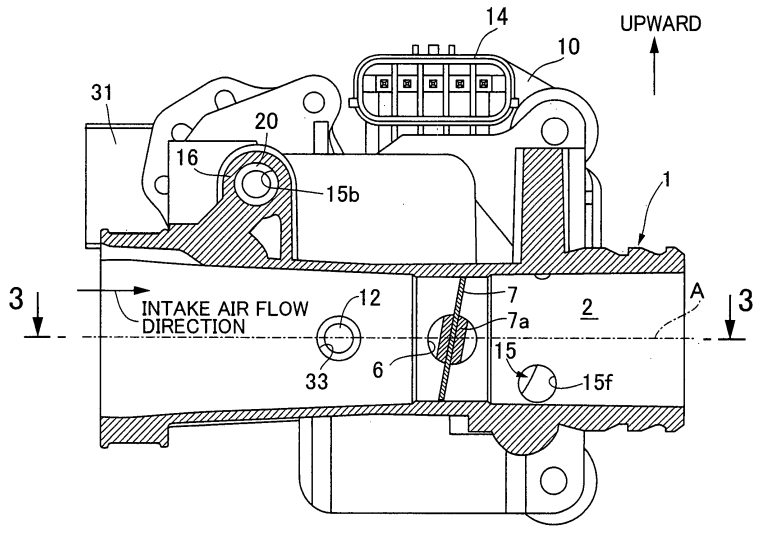
(72) Inventors:
- **Akiyama, Hiroshige**
  Kakuda-shi
  Miyagi (JP)
- **Ishikawa, Hisashi**
  Kakuda-shi
  Miyagi (JP)

(74) Representative: **Prechtel, Jörg et al**
Weickmann & Weickmann,
Patentanwälte,
Postfach 860 820
81635 München (DE)

(54) **Engine intake system**

(57) An engine intake system includes: a bypass (15) bypassing a throttle valve (7) and connected to an intake path (2); and a bypass valve (20) for regulating an opening degree of the bypass (15). A part.of the bypass (15) includes: an inlet port (15a) provided in a throttle body (1) so that the inlet port (15a) is open in the intake path (2) at a position upstream of the throttle valve (7); a valve hole (15b) provided in the throttle body (1) so as to fittingly receive therein the bypass valve (20) ; and an outlet port (15f) provided in the throttle body (1) so that the outlet port (15f) is open in the intake path (2) at a position downstream of the throttle valve (7). The valve hole (15b) is arranged on a side opposite from the outlet port (15f) with the throttle valve (7) interposed therebetween, and at a position above the outlet port (15f) and parallel with the shaft-receiving hole (5, 6) supporting a valve shaft (7a) of the throttle valve (7). Thus, there is provided a small engine intake system in which engine blowback has a difficulty in reaching a bypass valve, and which has an excellent productivity.

FIG.2



EP 1 867 852 A2

Description

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] The present invention relates to an engine intake system comprising: a throttle body including an intake path and a shaft-receiving hole formed therein; a throttle valve supported at a valve shaft thereof in the shaft-receiving hole so as to open and close the intake path; a bypass bypassing the throttle valve and connected to the intake path; a bypass valve for regulating an opening degree of the bypass; an actuator for actuating the bypass valve; and a throttle sensor attached to a sidewall of the throttle body and detecting an opening degree of the throttle valve.

DESCRIPTION OF THE RELATED ART

[0002] Such an engine intake system is already known as disclosed in Japanese Patent Application Laid-Open No. 2003-74444.

[0003] In the conventional engine intake system, a bypass valve for regulating an opening degree of a bypass and an actuator for the bypass valve are attached to a control block bonded to a throttle body. Therefore, it is possible to perform in parallel the assembling of the throttle body side and the assembling of the control block side. Also, the bypass valve provided in the control block is inevitably positioned far away from an outlet port of the bypass which is open in a downstream side of an intake path. Therefore, the conventional system has an advantage that it is difficult for engine blowback to reach the bypass valve.

[0004] However, because the throttle body with the control block connected thereto tends to be large as a whole, the conventional system is not suitable for such a case of a motorcycle where a throttle body is placed in a small space around an engine.

SUMMARY OF THE INVENTION

[0005] The present invention has been achieved in view of the above circumstances, and has an object to provide an engine intake system which is small, in which it is difficult for engine blowback to reach a bypass valve, and a valve hole for fittingly receiving therein the bypass valve can be easily machined, and which has an excellent productivity.

[0006] In order to achieve the above object, according to a first feature of the present invention, there is provided an engine intake system comprising: a throttle body including an intake path and a shaft-receiving hole formed therein; a throttle valve supported at a valve shaft thereof in the shaft-receiving hole so as to open and close the intake path; a bypass bypassing the throttle valve and connected to the intake path; a bypass valve for regulating an opening degree of the bypass; an actuator for actuating the bypass valve; and a throttle sensor attached to a sidewall of the throttle body and detecting an opening degree of the throttle valve, characterized in that at least a part of the bypass comprises: an inlet port provided in the throttle body so that the inlet port is open in the intake path at a position upstream of the throttle valve; a valve hole provided in the throttle body so as to fittingly receive therein the bypass valve; and an outlet port provided in the throttle body so that the outlet port is open in the intake path at a position downstream of the throttle valve; and the valve hole is arranged on a side opposite from the outlet port with the throttle valve interposed therebetween, and at a position above the outlet port and parallel with the shaft-receiving hole.

[0007] With the first feature of the present invention, the bypass valve is fittingly attached in the valve hole formed in the throttle body, and also the actuator for actuating the bypass valve is attached to the throttle body. Therefore, the throttle body with the bypass valve and the actuator can be downsized as a whole, and thus even in such a case of a motorcycle where a space around an engine is small, the throttle body can be easily placed therein.

[0008] Further, the valve hole for fittingly receiving therein the bypass valve is arranged on a side opposite from the outlet port with the throttle valve interposed therebetween, and thus a distance between the valve hole and the outlet port is secured to be large while arranging the valve hole at a high position. Therefore, even if the engine blowback enters the outlet port, the engine blowback does not easily reach the valve hole, thereby preventing moisture and carbon contained in the blowback gas from being frozen and adhering to prevent the bypass valve from being fixed to a position.

[0009] Furthermore, the valve hole is positioned parallel with the shaft-receiving hole for supporting the shaft of the throttle valve, and thus the valve hole can be machined at a time together with the shaft-receiving hole, by a multi-shaft drilling machine, thereby improving the productivity.

[0010] According to a second feature of the present invention, in addition to the first feature, the valve hole is arranged above an axis of the throttle body; and the outlet port is arranged below the axis and parallel with the shaft-receiving hole.

[0011] With the second feature of the present invention, a distance in the vertical direction between the valve hole and the outlet port is further sufficiently secured, thereby effectively preventing the engine blowback from reaching the valve hole. Also, because the outlet hole is arranged parallel with the shaft-receiving hole as in the case of the valve hole, also the outlet port can be machined at a time together with the valve hole and the shaft-receiving hole, by a multi-shaft drilling machine, thereby further improving the productivity.

[0012] According to a third feature of the present invention, in addition to the first or second feature, the inlet

port is arranged so as to be open at an upper portion of an upstream-side end-surface of the throttle body.

[0013] With the third feature of the present invention, the inlet port is open at the upper portion of the upstream-side end-surface of the throttle body to directly face the intake air flow, and thus the inlet port can smoothly receive thereinto the intake air, thereby contributing to stabilization of idling of the engine.

[0014] According to a fourth feature of the present invention, in addition to any of the first to third features, the actuator and a sensor box which holds the throttle sensor are attached to end surfaces of the throttle body, the end faces facing the same direction.

[0015] With the fourth feature of the present invention, the sensor box and the actuator can be easily attached from the same direction to the throttle body without turning the throttle body, thereby improving the productivity.

[0016] The above-mentioned object, other objects, characteristics, and advantages of the present invention will become apparent from a preferred embodiment which will be described in detail below by reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

FIG. 1 is a plan view of an engine intake system according to an embodiment of the present invention.
FIG. 2 is a sectional view taken along a line 2-2 of FIG. 1.
FIG. 3 is a sectional view taken along a line 3-3 of FIG. 3.
FIG. 4 is a view taken in a direction of an arrow 4 in FIG. 1.
FIG. 5 is a sectional view taken along a line 5-5 of FIG. 4.
FIG. 6 is a sectional view taken along a line 6-6 of FIG. 1.
FIG. 7 is a sectional view taken along a line 7-7 of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0018] First, FIGS. 1 to 4 show an intake system of the present invention which is mainly used for an engine of a two-wheeled motor vehicle. The intake system includes a throttle body 1 to be mounted on the engine. The throttle body 1 has an intake path 2 horizontally connected to an intake port (not shown) of the engine in a state in which the throttle body 1 is mounted on the engine. The throttle body 1 has first and second shaft-receiving bosses 3 and 4 formed on its sidewalls which are horizontally opposed to each other so that the bosses 3 and 4 project outward from the sidewalls, respectively. A valve shaft 7a of a butterfly-type throttle valve 7 for opening and closing the intake path 2 is rotatably supported in horizontal shaft-receiving holes 5 and 6 which are provided coaxially with the shaft-receiving bosses 3 and 4. A throttle drum 8 is fixedly attached to one end of the valve shaft 7a projecting outward from the first shaft-receiving boss 3. A return spring 9 for biasing the throttle drum 8 in a closing direction of the throttle valve 7 is mounted on the first shaft-receiving boss 3.

[0019] A sensor box 10 integrally including a coupler 14 is fixedly attached on an end surface of the second shaft-receiving boss 4 by a plurality of screws 35. The sensor box 10 supports therein a throttle sensor 11, an intake-air temperature sensor 12, a boost negative-pressure sensor 13 and other components. The throttle sensor 11 detects a turning angle of the valve shaft 7a as an opening degree of the throttle valve 7. The intake-air temperature sensor 12 passes through a through hole 33 in the sidewall of the throttle body 1 to cause its tip end to face the intake path 2, and detects a temperature of intake air. The boost negative-pressure sensor 13 detects a boost negative-pressure of the engine through a detection hole 34 (see FIG. 7) open in the intake path 2 at a position downstream of the throttle valve 7.

[0020] The throttle body 1 is provided with a bypass 15 which bypasses the throttle valve 7 and is connected to the intake path 2. The bypass 15 comprises: an inlet port 15a (see FIG. 4) open in an upper part of an upstream-side end-surface of the throttle body 1, and extending along the intake path 2; a cylindrical valve hole 15b (see FIG. 5) rising from a downstream end of the inlet port 15a; a fixed measuring hole 15c (see FIG. 5) having a diameter smaller than that of the valve hole 15b, orthogonal to an intermediate part of the valve hole 15b, and extending along the intake path 2; a lateral hole 15d rising from a downstream end of the fixed measuring hole 15c and open in the end surface of the second shaft-receiving boss 4; a groove-shaped intermediate curved path 15e (see FIG. 6) formed between joint surfaces of the second shaft-receiving boss 4 and the sensor box 10, and leading to the lateral hole 15d; and an outlet port 15f (see FIGS. 2 and 3) communicating with the downstream end of the intermediate curved path 15e, and open in the intake path 2 at a position downstream of the throttle valve 7.

[0021] As shown in FIGS. 2 and 5, the valve hole 15b and the fixed measuring hole 15c are formed by drilling in a valve body portion 16 which is integrally formed in the throttle body 1 and adjacent to the second shaft-receiving boss 4. Specifically, the valve hole 15b is bored by drilling from a first end surface 16a of the valve body portion 16 which is parallel with the end surface of the second shaft-receiving boss 4 such that the valve hole 15b is parallel with the shaft-receiving holes 5 and 6; and the fixed measuring hole 15c is bored by drilling from a second end surface 16b which is parallel with the upstream-side end-surface of the second shaft-receiving boss 4 such that the fixed measuring hole 15c extends across the valve hole 15b. When machining the fixed measuring hole 15c, a machining hole 17 is formed in

the second end surface 16a of the valve body portion 16 so as to be coaxial with the fixed measuring hole 15c. The machining hole 17 is airtightly closed by a plug 18 which is press-fitted or screwed into the machining hole 17. In this way, the first and second shaft-receiving holes 5 and 6, and the valve hole 15b which are parallel with one another are machined at a time by a multi-shaft drilling machine.

[0022] The valve hole 15b is arranged close to the second end surface 16b so that a length L1 of the machining hole 17 becomes sufficiently smaller than a length L2 of the fixed measuring hole 15c. With this arrangement, an amount of machining for the machining hole 17 is minimized to extend the durable life of the drill.

[0023] As shown in FIG. 2, the valve hole 15b is arranged on the side opposite from the outlet port 15f of the bypass 15 with the throttle valve 7 interposed therebetween, and at a position above the axis A of the intake path 2. The outlet port 15f is arranged below the axis A of the intake path 2. In this structure, both the valve hole 15b and the outlet port 15f are arranged in parallel with the first and second bearing holes 5 and 6.

[0024] Referring again to FIG. 5, a hollow cylindrical bypass valve 20 is slidably fitted into the valve hole 15b. The bypass valve 20 has, on its sidewall, a movable measuring hole 21 opposed to an upstream end of the fixed measuring hole 15c. Ascending and descending of the bypass valve 20 changes a communication area between the movable measuring hole 21 and the fixed measuring hole 15c, thereby regulating the opening degree of the bypass 15.

[0025] A rotation-preventing means 22 is provided between the bypass valve 20 and the valve body portion 16. The rotation-preventing means 22 allows the bypass valve 20 to move up and down, while holding the movable measuring hole 21 at a position where it faces the fixed measuring hole 15c. The rotation-preventing means 22 comprises a vertical key groove 24 provided in the other sidewall of the bypass valve 20 on the side opposite from the movable measuring hole 21, and a pin-shaped key 23 integrally projectingly provided at a central portion of an inner end surface of the plug 18.

[0026] A mounting hole 25 having a diameter larger than that of the valve hole 15b and coaxial with the valve hole 15b is provided in the valve body portion 16 so as to be open in the first end surface 16a. A stepping motor 27 is mounted in the mounting hole 25 so as to serve as an actuator for opening and closing the bypass valve 20 such that its output shaft 27b projects toward the bypass valve 20. A synthetic resin covering member 28 is mold-coupled to a metallic stator 27a of the stepping motor 27 so as to cover both inner and outer end surfaces and an outer peripheral surface of the stator 27a. Integrally molded in the covering member 28 are a mounting flange 28a protruding from an outer peripheral surface of the covering member 28, and a power-supply coupler 31 for the stepping motor 27 projecting from an outer end surface of the mounting flange 28a. When mounting the stepping motor 27 in the mounting hole 25, the outer peripheral surface of the covering member 28 is fitted to the inner peripheral surface of the mounting hole 25, and a plate-shaped seal member 29 including a lip 29a which closely contacts the outer peripheral surface of the output shaft 27b is interposed between the inner end surface of the covering member 28 and the bottom surface of the mounting hole 25. The mounting flange 28a is fixedly attached on the first end surface 16a of the valve body portion 16 by a plurality of screws 36. At this time, no seal member is interposed between the mounting flange 28a and the first end surface 16a.

[0027] Accordingly, the valve body portion 16 and the second shaft-receiving boss 4 are close to each other, and their end surfaces face in the same direction. Thus, the stepping motor 27 and the sensor box 10 are easily mounted on these end surfaces without changing the orientation of the throttle body 1, thereby contributing to an improvement in efficiency of assembling operation.

[0028] The output shaft 27b of the stepping motor 27 is screwed into a female screw member 30 attached to the central portion of the bypass valve 20. The normal rotation and reverse rotation of the output shaft 27b ascend and descend (open and close) the bypass valve 20. An electronic control unit 32 for controlling power supply to the stepping motor 27 is connected to a terminal in the coupler 31. Detection signals are input to the electronic control unit 32 from the throttle sensor 11, the intake-air temperature sensor 12, the boost negative-pressure sensor 13 and the other components. In accordance with these signals, the electronic control unit 32 controls the operation of the stepping motor 27, and further controls the operation of a fuel injection valve of the engine not shown.

[0029] Next, operation of this embodiment will be described.

[0030] When the engine is operated with the throttle valve 7 fully closed, air taken in and flowing into the intake path 2 is passed through the bypass 15 bypassing the throttle valve 7, that is, the inlet port 15a, valve- hole 15b, fixed measuring hole 15c, intermediate curved path 15e and outlet port 15f, and supplied to the engine. If the engine is in a warm-up operation state at this time, the stepping motor 27 is operated by the electronic control unit 32 in the direction to pull up the bypass valve 20 to regulate the communication area with the fixed measuring hole 15c and the movable measuring hole 21 to be large. Therefore, the amount of intake air is increased and the engine enters a fast idling state. After the warm-up operation, the stepping motor 27 is operated by the control unit 32 in the direction to pull down the bypass valve 20 to reduce the communication area with the fixed measuring hole 15c and the movable measuring hole 21. Therefore, the amount of intake air is decreased and the engine enters a normal idling state.

[0031] The bypass valve 20 moving up and down as described above is prevented from turning by engagement between the vertical key groove 24 provided in its

sidewall and the key 23 fixed on the valve body portion 16. Therefore, it is possible to maintain an appropriate opposed-position relationship between the movable measuring hole 21 of the bypass valve 20 and the fixed measuring hole 15c of the throttle body 1, thereby stabilizing the regulation of the intake air amount.

[0032] Especially because the key 23 is integrally formed with the plug 18 for closing the machining hole 17 which is used for drilling the fixed measuring hole 15c in the valve body portion 16. Thus, it is possible to always easily and accurately maintain a constant positional relationship between the fixed measuring hole 15c and the key 23 in the mass-produced engine intake system, thereby greatly contributing to stabilization of idling characteristics of the engine.

[0033] Also because the plug 18 has the key 23, there is no need to mount a special key on the valve body portion 16. Accordingly, the number of parts and assembling steps are reduced, thereby reducing the cost.

[0034] Further, because the valve body portion 16 forming the valve hole 15b is integrally formed on the throttle body 1, in other words, because the valve hole 15b is bored in the throttle body 1, and because the stepping motor 27 for operating the bypass valve 20 fitted into the valve hole 15b is also mounted on the valve body portion 16, that is, the throttle body 1, it is possible to further reduce the number of parts and assembling steps, and effectively downsizing the entire throttle body 1 equipped with the bypass valve 20 and the stepping motor 27. Therefore, even in such a case of a motorcycle.where a space around an engine is small, the throttle body can be easily placed therein.

[0035] Furthermore, the valve hole 15b, mounting hole 25 and outlet port 15f are arranged in parallel with the first and second shaft-receiving holes 5, 6 of the valve shaft 7a. Therefore, the valve hole 15b, mounting hole 25 and outlet port 15f can be machined at a time by the multi-shaft drilling machine together with the first and second shaft-receiving holes 5, 6, thereby further reducing the number of assembling steps.

[0036] Moreover, the valve hole 15b is arranged on the side opposite from the outlet port 15f of the bypass 15 with the throttle valve 7 interposed therebetween, and at a position above the axis A of the intake path 2; whereas the outlet port 15f is arranged below the axis A of the intake path 2. Therefore, the distance between the valve hole 15b and the outlet port 15f is secured to be large while arranging the valve hole 15b at a high position. Thus, even if the blowback gas enters the outlet port 15f upon engine blowback, the blowback gas does not easily reach the valve hole 15b, thereby preventing moisture and carbon contained in the blowback gas from being frozen and adhering to the bypass valve 20 to prevent the bypass valve 20 from being fixed to a position. Particularly in the throttle body 1, the fuel does not flow into the bypass 15 unlike a carburetor including a bypass, and thus no foreign-material cleaning-action by the fuel occurs around the valve hole 15b. Therefore, it is very important to prevent foreign materials from entering the valve hole 15b.

[0037] On the other hand, the inlet port 15a of the bypass 15 is open in the upper portion of the upstream-side end-surface of the throttle body 1 to directly face the intake air flow, and thus the inlet port 15a smoothly receives thereinto the intake air, thereby contributing to stabilization of idling of the engine.

[0038] The synthetic resin covering member 28 is mold-coupled to the stator 27a of the stepping motor 27 so as to cover both the inner and outer end surfaces and the outer peripheral surface of the stator 27a; and the seal member 29 which closely contacts the outer peripheral surface of the output shaft 27b is interposed between the inner end surface of the covering member 28 and the bottom surface of the mounting hole 25, thereby configuring the stepping motor 27 into a waterproof type to prevent rust development on the outer surface of the stator 27a due to water invasion. That is, the seal member 29, by itself, plays two roles of preventing the water from invading the interior of the stepping motor 27 from the outer peripheral surface of the output shaft 27b, and also preventing the water from invading a space between the inner end portion of the covering member 28 and the stator 27a. Therefore, any seal member for preventing the water invasion into the mounting hole 25 is no longer required, thereby reducing the numbers of parts and assembling steps to reduce the cost.

[0039] Further, the mounting flange 28a for mounting the stepping motor 27 on the valve body portion 16 is integrally formed on the covering member 28. Therefore, any special lid for holding the stepping motor 27 is no longer required, thereby further reducing the numbers of parts and assembling steps to further reduce the cost.

[0040] Furthermore, the power-supply coupler 31 for supplying power to the stepping motor 27 is provided in the covering member 28 such that the coupler 31 projects outward from the mounting flange 28a. Thus, the mounting flange 28a is used for mounting of not only the stepping motor 27 but also the coupler 31, thereby further reducing the numbers of parts and assembling steps.

[0041] The present invention is not limited to the above- described embodiment, and various changes in design can be made without departing from the subject matter of the present invention. For example, the flange 28a may be replaced by a holding plate which is a member separate from the covering member 28.

[0042] An engine intake system includes: a bypass (15) bypassing a throttle valve (7) and connected to an intake path (2); and a bypass valve (20) for regulating an opening degree of the bypass (15). A part of the bypass (15) includes: an inlet port (15a) provided in a throttle body (1) so that the inlet port (15a) is open in the intake path (2) at a position upstream of the throttle valve (7); a valve hole (15b) provided in the throttle body (1) so as to fittingly receive therein the bypass valve (20); and an outlet port (15f) provided in the throttle body (1) so that the outlet port (15f) is open in the intake path (2) at a

position downstream of the throttle valve (7). The valve hole (15b) is arranged on a side opposite from the outlet port (15f) with the throttle valve (7) interposed therebetween, and at a position above the outlet port (15f) and parallel with the shaft-receiving hole (5, 6) supporting a valve shaft (7a) of the throttle valve (7). Thus, there is provided a small engine intake system in which engine blowback has a difficulty in reaching a bypass valve, and which has an excellent productivity.

Claims

1. An engine intake system comprising:

a throttle body (1) including an intake path (2) and a shaft-receiving hole (5, 6) formed therein;
a throttle valve (7) supported at a valve shaft (7a) thereof in the shaft-receiving hole (5, 6) so as to open and close the intake path (2);
a bypass (15) bypassing the throttle valve (7) and connected to the intake path (2);
a bypass valve (20) for regulating an opening degree of the bypass (15);
an actuator (27) for actuating the bypass valve (20); and
a throttle sensor (11) attached to a sidewall of the throttle body (1) and detecting an opening degree of the throttle valve (7),
characterized in that at least a part of the bypass (15) comprises: an inlet port (15a) provided in the throttle body (1) so that the inlet port (15a) is open in the intake path (2) at a position upstream of the throttle valve (7); a valve hole (15b) provided in the throttle body (1) so as to fittingly receive therein the bypass valve (20); and an outlet port (15f) provided in the throttle body (1) so that the outlet port (15f) is open in the intake path (2) at a position downstream of the throttle valve (7); and
the valve hole (15b) is arranged on a side opposite from the outlet port (15f) with the throttle valve (7) interposed therebetween, and at a position above the outlet port (15f) and parallel with the shaft-receiving hole (5, 6).

2. The engine intake system according to claim 1, **characterized in that** the valve hole (15b) is arranged above an axis (A) of the throttle body (1); and the outlet port (15f) is arranged below the axis (A) and parallel with the shaft-receiving hole (5, 6)

3. The engine intake system according to claim 1 or 2, **characterized in that** the inlet port (15a) is arranged so as to be open at an upper portion of an upstream-side end-surface of the throttle body (1).

4. The engine intake system according to any of claims 1 to 3, the actuator (27) and a sensor box (10) which holds the throttle sensor (11) are attached to end surfaces of the throttle body (1), the end faces facing the same direction.

FIG.1

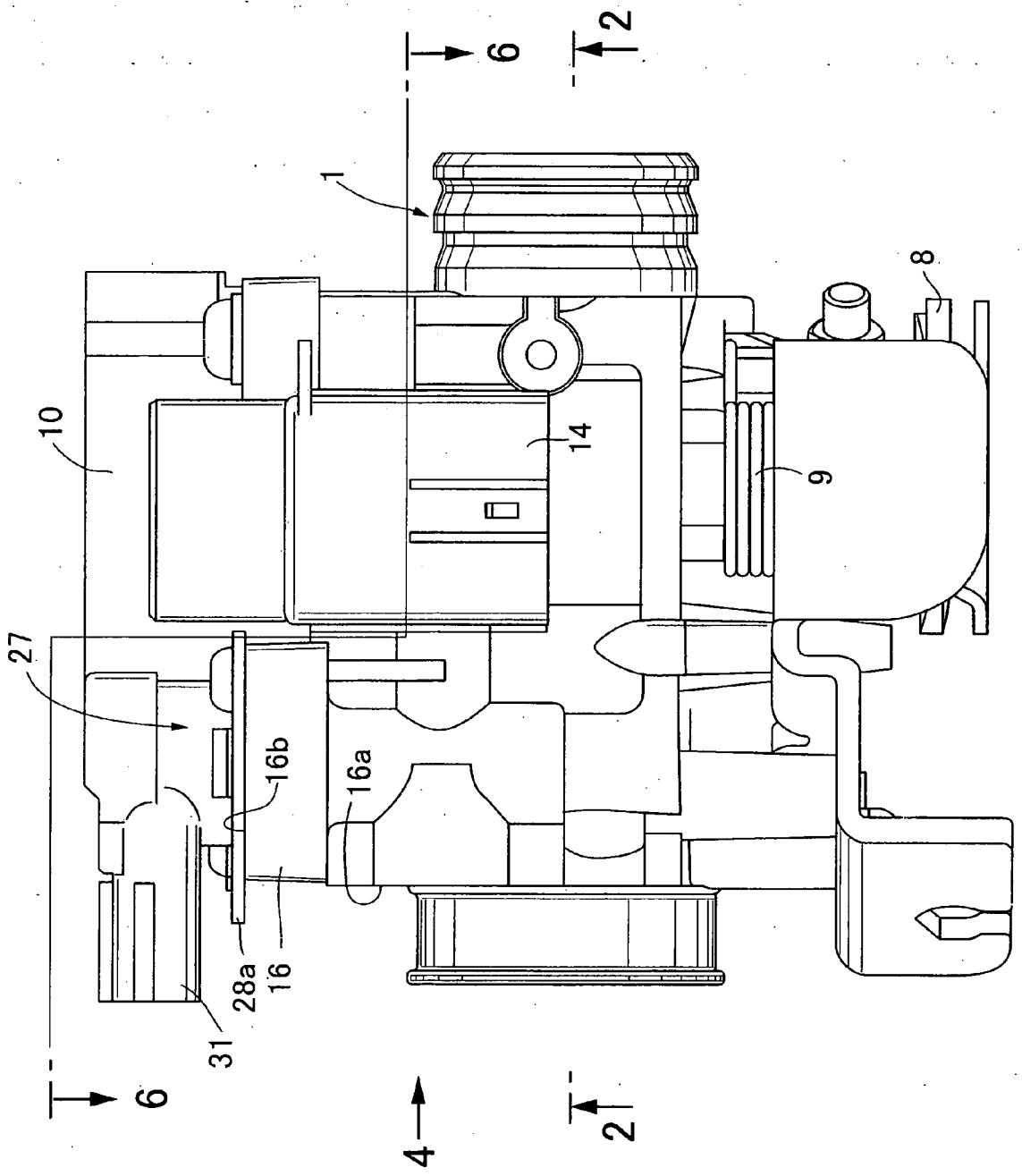


FIG.2

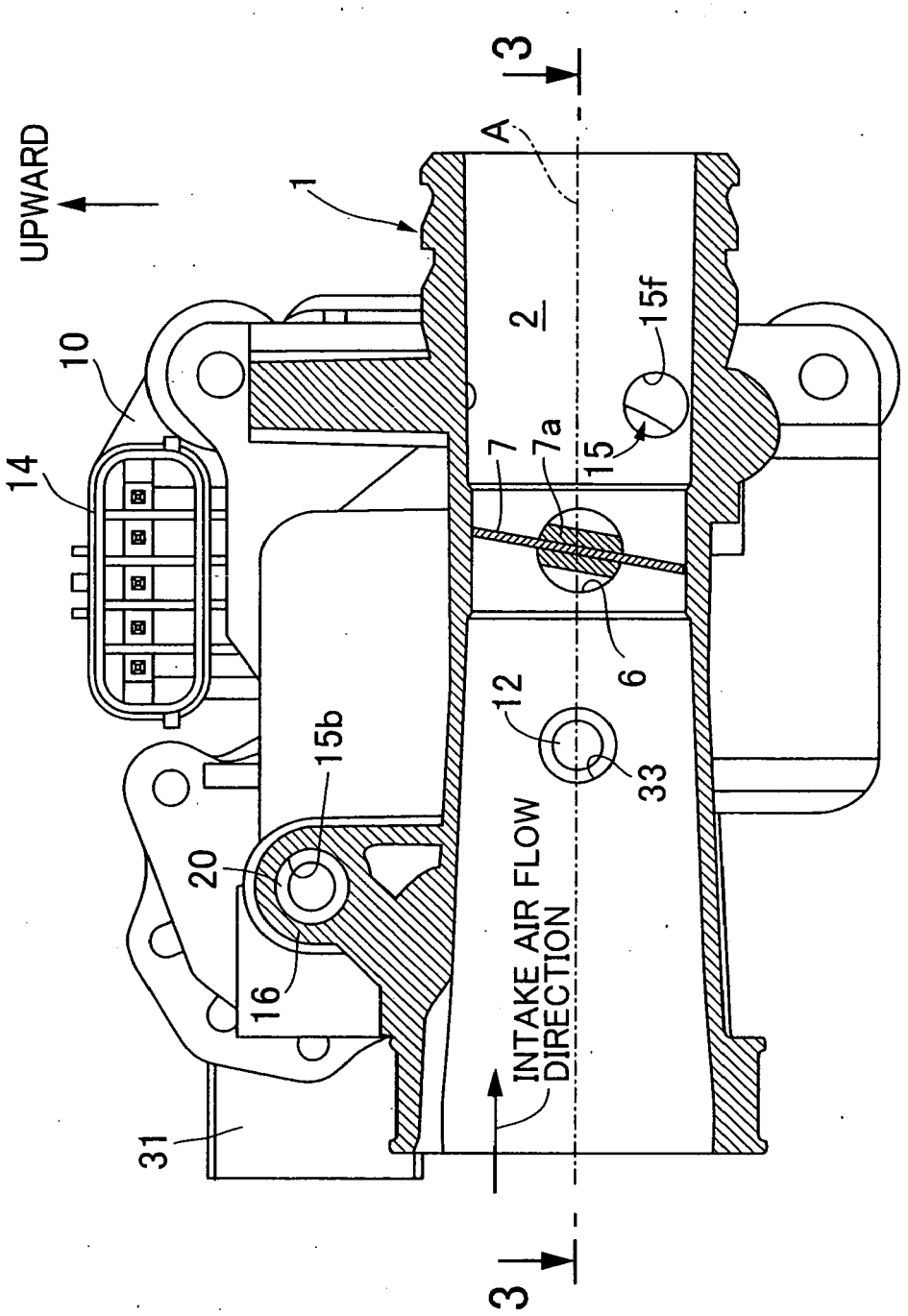

UPWARD
1
A
3
3
2
10
14
7
7a
15
15f
6
12
33
15b
20
16
31
INTAKE AIR FLOW DIRECTION

FIG.3

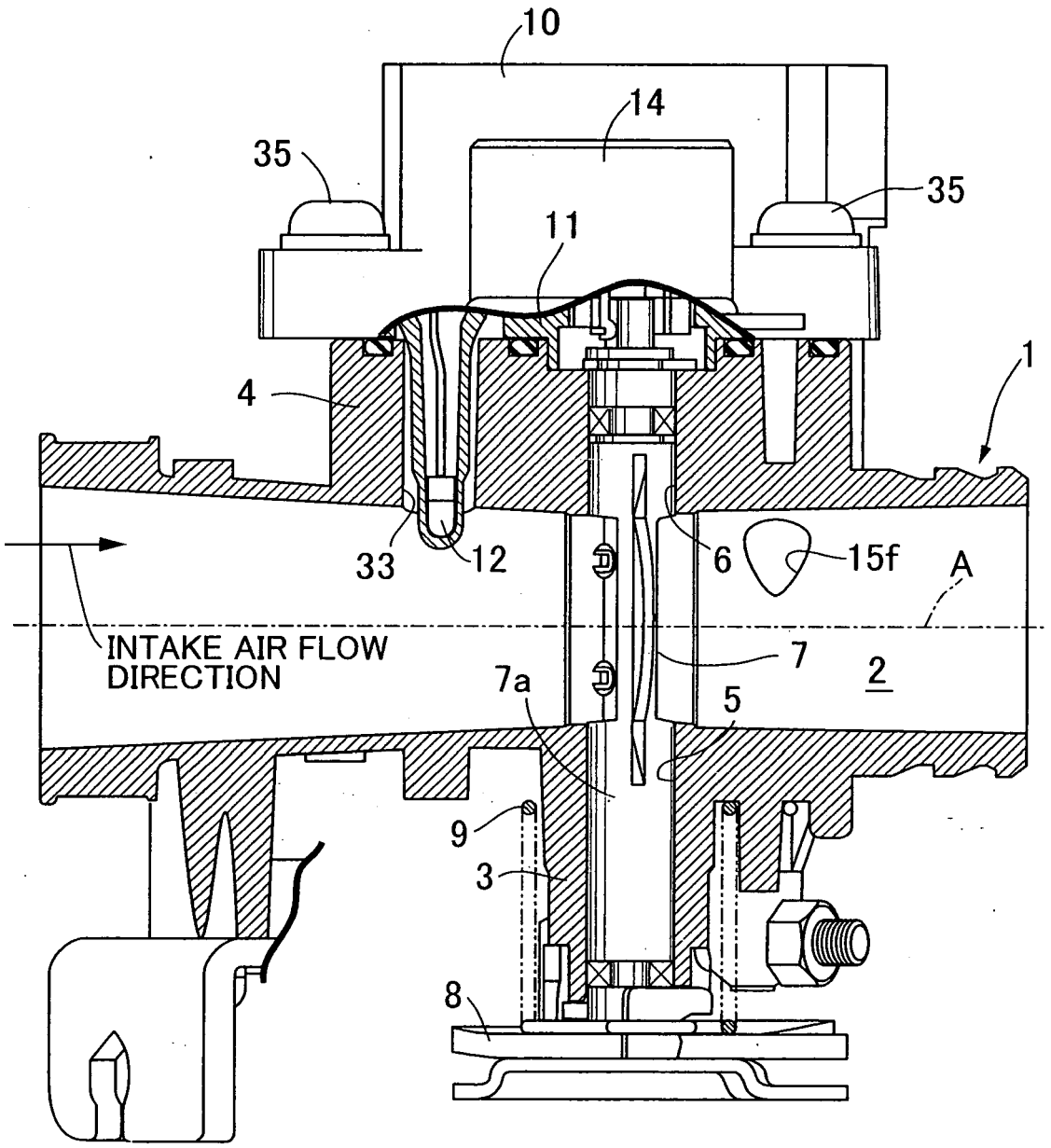

10
14
35
35
11
1
4
33
12
6
15f
A
INTAKE AIR FLOW
DIRECTION
7
2
7a
5
9
3
8

FIG.4

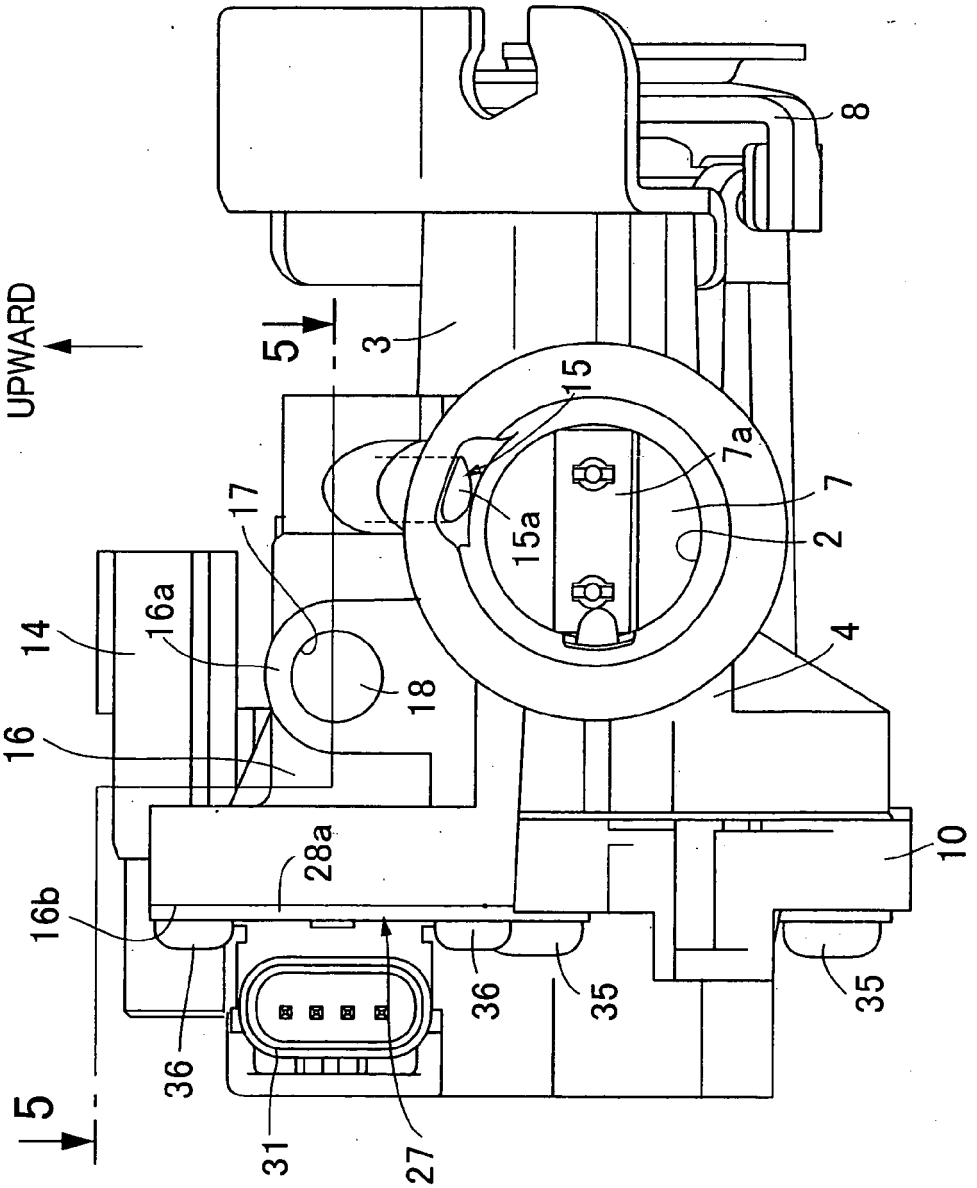

UPWARD
5
5
3
8
15
7a
7
2
15a
17
16a
14
18
4
16
10
28a
16b
36
36
35
35
31
27

FIG.5

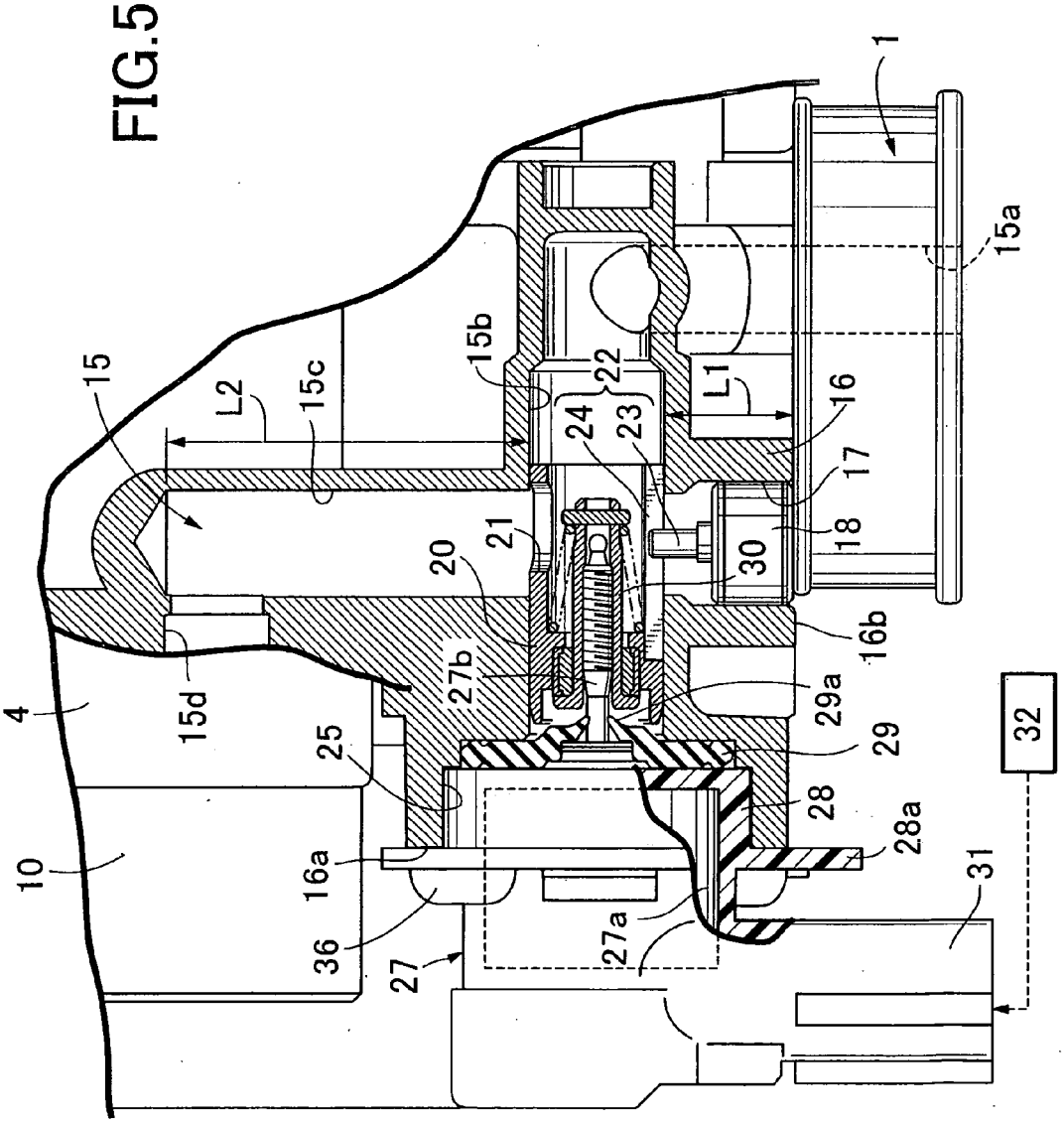

1
15a
15b
15
L2
15c
22
L1
16
24
23
17
18
30
21
20
16b
27b
29a
15d
4
25
29
32
28
10
16a
28a
31
36
27a
27

FIG.6

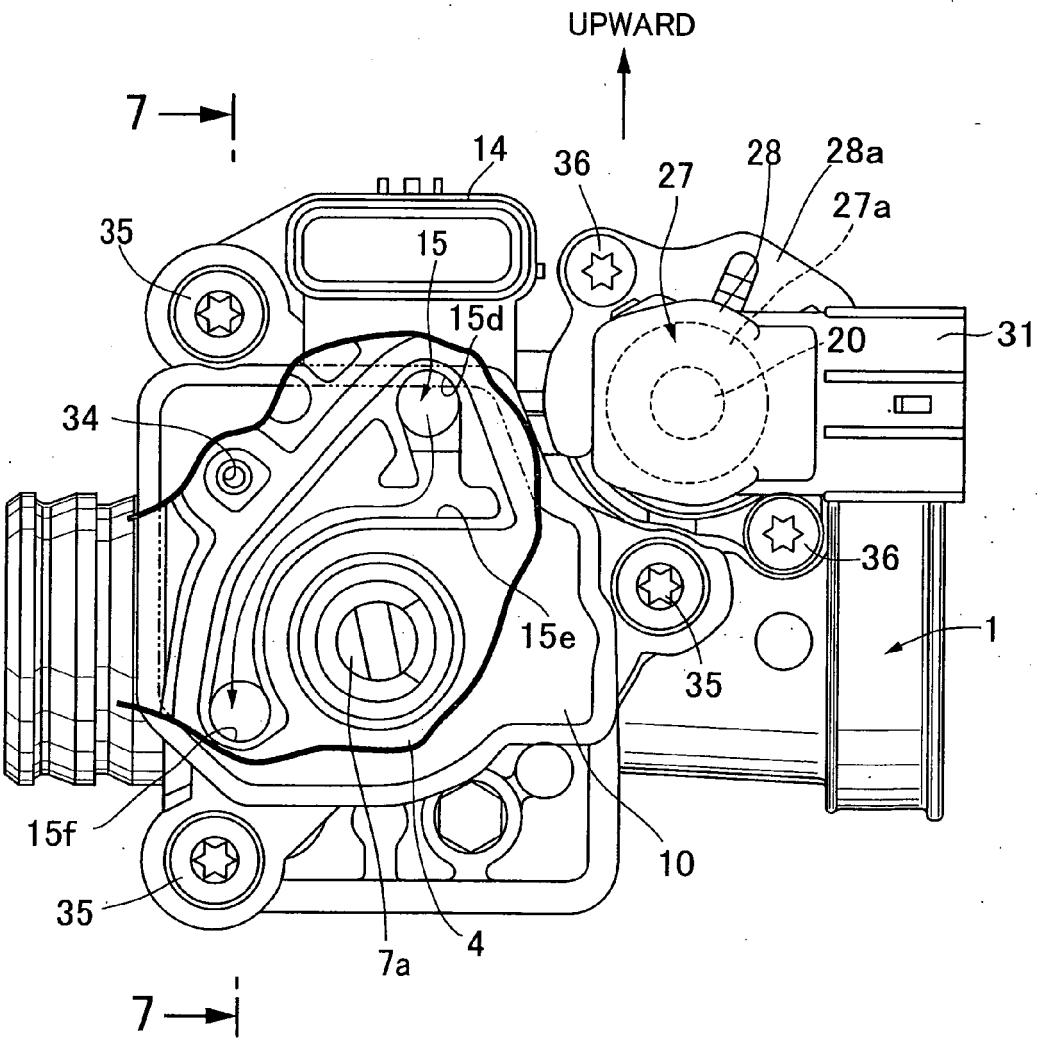
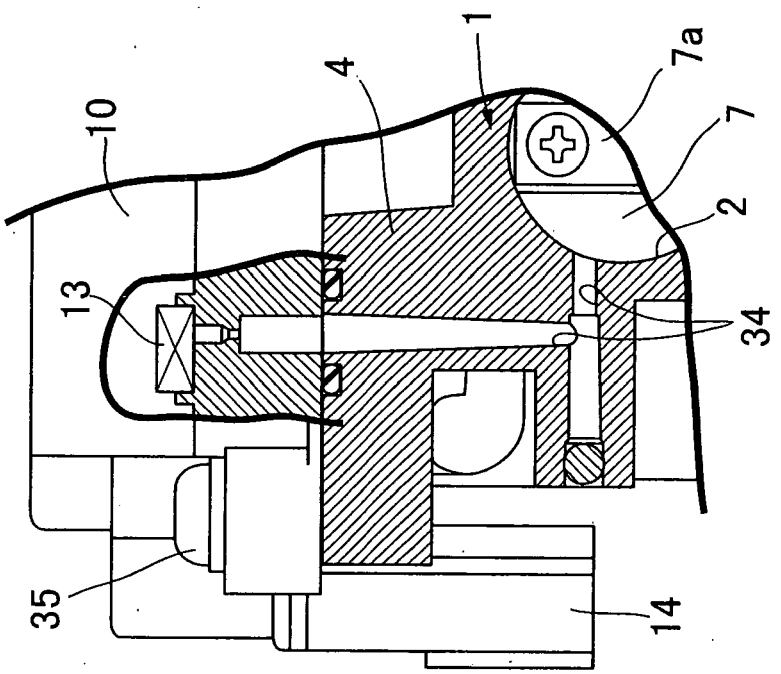

UPWARD
7
7
14
36
27
28
28a
27a
35
15
15d
20
31
34
36
1
15e
35
15f
10
35
7a
4

FIG.7



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2003074444 A **[0002]**