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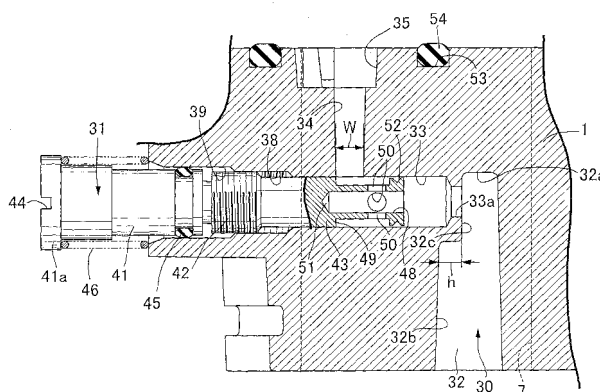
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(54) **AIR INTAKE CONTROL DEVICE FOR ENGINE**

(57) In an air intake control device for an engine in which a throttle body (1) having an air intake path (7) is provided with a bypass (30) communicating with the air intake path (7) while bypassing a throttle valve (8), and the bypass (30) is provided with valve means (31) for opening and closing the bypass (30), an inlet of the bypass (30) is formed of a concave groove (32) formed in an inner surface of the air intake path (7) so as to start from an upstream end of the throttle body (1) and termi-

nate as a dead-end before reaching the throttle valve (8), and a different path (33) of the bypass (30) leading to the concave groove (32) has an opening in a step portion (32c) raised from an inner surface (32b) of the concave groove (32) by one step. With this configuration, the inlet of the bypass does not cause any air intake resistance during outputting operation of the engine, and, even when water drops flow along an inner surface of the air intake path, the water drops can be prevented from entering the bypass.

FIG.8



Description

TECHNICAL FIELD

[0001] The present invention relates to an improvement of an air intake control device for an engine in which a throttle body having an air intake path opened and closed by a throttle valve is provided with a bypass communicating with the air intake path while bypassing the throttle valve, and the bypass is provided with valve means for opening and closing the bypass.

BACKGROUND ART

[0002] Such an air intake control device for an engine has already been known as disclosed in Patent Documents 1 and 2.

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0003]

Patent Document 1: Japanese Utility Model Application Laid-open No. 59-88236

Patent Document 2: Japanese Utility Model Application Laid-open No. 63-151965

DISCLOSURE OF INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] In a conventional air intake control device for an engine, an inlet of a bypass is formed in a pipe shape to protrude from an inner surface of an air intake path. Accordingly, in the load operation of such an engine with a throttle valve being released, the protruding inlet of the bypass causes air intake resistance, which adversely affects the output performance of the engine. To address this problem, it is conceivable to open the inlet of the bypass directly in the inner surface of the air intake path without forming the inlet in a protruding manner. In such a case, however, if water drops occurring due to dew condensation or the like flow along the inner surface of the air intake path, the water drops may enter the bypass.

[0005] The present invention has been made in view of the above-described circumstances, and an object thereof is to provide an air intake control device for an engine which can prevent, even when water drops flow along an inner surface of an air intake path, the water drops from entering a bypass, without causing a situation of an inlet of the bypass causing an air intake resistance, during an outputting operation of the engine.

MEANS FOR SOLVING THE PROBLEMS

[0006] In order to attain the above object, according to

a first aspect of the present invention, there is provided an air intake control device for an engine in which a throttle body having an air intake path opened and closed by a throttle valve is provided with a bypass communicating with the air intake path while bypassing the throttle valve, and the bypass is provided with valve means for opening and closing the bypass, **characterized in that** an inlet of the bypass is formed of a concave groove which is formed in an inner surface of the air intake path so as to start from an upstream end of the throttle body and terminate as a dead-end before reaching the throttle valve, and a different path of the bypass leading to the concave groove is opened in a step portion raised by one step from an inner surface of the concave groove. Here, the above-described valve means corresponds to an idle adjustment valve 31 of an embodiment of the present invention, which will be described later; and the above-described different path corresponds to a valve hole 33.

[0007] Furthermore, according to a second aspect of the present invention, in addition to the first aspect, an opening portion of the different path that is open to the step portion is arranged to be spaced from a peripheral edge of the step portion.

[0008] Moreover, according to a third aspect of the present invention, in addition to the first or second aspect, the step portion is formed to be continuous with a ceiling surface and a dead-end portion of the concave groove.

[0009] Furthermore, according to a fourth aspect of the present invention, in addition to any one of the first to third aspects, the air intake path is formed in a drum portion of the throttle body to be eccentric with respect to a center of an outer shape of the drum portion in a direction orthogonal to a valve stem of the throttle valve, and the concave groove is formed in a thick-wall portion of the drum portion, the thick-wall portion being located on a side opposite to the side on which the air intake path is eccentrically located.

[0010] Moreover, according to a fifth aspect of the present invention, in addition to the first aspect, the valve means is an idle adjustment valve for opening and closing the bypass to adjust the amount of idle intake air for the engine flowing the bypass, the throttle body has a screw hole, a valve hole coaxially continuous to an inner end of the screw hole, and a measurement hole opened in an inner surface of the valve hole, the bypass is formed such that one of the valve hole and the measurement hole communicates with a portion, upstream of the throttle valve, of the air intake path and the other communicates with a portion, downstream of the throttle valve, of the air intake path, the idle adjustment valve includes a screw shaft screwed into the screw hole and an adjustment valve stem continuously provided to a tip end of the screw shaft and rotatably and slidably fitted to the valve hole, the adjustment valve stem has a blind hole having an opening in an end surface of the adjustment valve stem and communicating with the valve hole, an annular measurement groove surrounding an outer periphery of the adjustment valve stem and communicating with the

measurement hole, and a plurality of through-holes causing an axial-direction intermediate portion of the blind hole to communicate with the measurement groove, a width of communication of the measurement groove with the measurement hole is adjustable by adjusting advance and retreat of the adjustment valve stem in an axial direction of the adjustment valve stem, and a dead-end portion, further than the through-holes, of the blind hole is used as a foreign-subject pool.

[0011] Furthermore, according to a sixth aspect of the present invention, in addition to the fifth aspect, the through holes are shifted from the measurement hole in the axial direction of the adjustment valve stem regardless of which adjustment position the adjustment valve stem is in.

[0012] Moreover, according to a seventh aspect of the present invention, in addition to the fifth or sixth aspect, the through-holes the number of which is four are arranged in a peripheral direction of the adjustment valve stem at equal intervals.

EFFECTS OF THE INVENTION

[0013] According to the first aspect of the present invention, the inlet of the bypass has the concave groove depressing from the inner surface of the air intake path. The concave groove prevents reduction in the channel area of the air intake path, and does not interrupt the flow of the intake air flowing straight on along the air intake path during the load operation of the engine. This configuration can reduce air intake resistance of the engine, and contribute to improving the output of the engine.

[0014] Moreover, the different path of the bypass leading to the concave groove is opened in the step portion raised from the inner surface of the concave groove by one step. Accordingly, even if there exist water drops flowing along the inner surface of the concave groove, the water drops flowing along the periphery of the step portion due to the inertia of the flow while avoiding the opening portion in the different path. Accordingly, it is possible to prevent the water drops from flowing downstream the bypass.

[0015] According to the second aspect of the present invention, the opening portion of the different path that is open to the step portion is formed to be spaced from the peripheral edge of the step portion. With this configuration, water drops flowing along the periphery of the step portion is further unlikely to enter the different path, and thus the water drops are prevented from flowing downstream the bypass more reliably.

[0016] According to the third aspect of the present invention, die-cutting of the air intake path and the concave groove in molding the throttle body can be performed without being interrupted by the step portion.

[0017] According to the fourth aspect of the present invention, a sufficient channel area can be secured for the concave groove without reducing the strength of the throttle body, and the other portions of the bypass leading

to the concave groove can be easily formed without being interrupted by the valve stem.

[0018] According to the fifth aspect of the present invention, when foreign subjects flow into the valve hole together with the idle intake air, the idle intake air flows into the annular measurement groove by changing the course at a right angle from the blind hole to the through-holes while the foreign subjects that have flowed into the blind hole flow straight on due to the inertia of the flow, are pooled in the foreign-substance pool closer to the dead-end of the blind hole, and are thus separated from the idle intake air. This configuration can prevent attachment of the foreign subjects to the measurement portion, which are the measurement groove and the measurement hole, and the amount of the idle intake air once adjusted by the idle adjustment valve can be kept stable for a long time.

[0019] According to the sixth aspect of the present invention, even if foreign subjects flow into the measurement groove through the through-holes together with idle intake air, since the through-holes and the measurement hole are always shifted from each other along the axial direction of the valve stem, the idle intake air that has flowed into the measurement groove through the through-holes changes the course at the right angle immediately and then flows toward the measurement hole while the foreign subjects that have passed through the through-holes collide against the inner peripheral surface of the valve hole due to the inertia, fall to the bottom of the valve hole, and are thus separated from the idle intake air. This configuration can further prevent attachment of the foreign subjects to the measurement portion, which are the measurement groove and the measurement hole.

[0020] According to the seventh aspect of the present invention, four through-holes are arranged in the peripheral direction of the valve stem at equal intervals. This arrangement allows the amount of the idle intake air to vary smoothly in relation to the changes of the rotation angle of the idle adjustment valve. Consequently, the amount of the idle intake air can be adjusted easily and precisely. Furthermore, the four through-holes can be formed by simply performing hole processing in two directions, which provides excellent processability.

BRIEF DESCRIPTION OF DRAWINGS

[0021]

[FIG. 1] FIG. 1 is a longitudinal side view of an air intake control device of a two-wheeled motor vehicle engine according to an embodiment of the present invention (a cross-sectional view taken along a line 1-1 in FIG. 3). (First Embodiment)

[FIG. 2] FIG. 2 is a view taken in the direction of an arrow 2-2 in FIG. 1. (First Embodiment)

[FIG. 3] FIG. 3 is a cross-sectional view taken along a line 3-3 in FIG. 1. (First Embodiment)

[FIG. 4] FIG. 4 is a cross-sectional view taken along

a line 4-4 in FIG. 2. (First Embodiment)
 [FIG. 5] FIG. 5 is a cross-sectional view taken along a line 5-5 in FIG. 2. (First Embodiment)
 [FIG. 6] FIG. 6 is a cross-sectional view taken along a line 6-6 in FIG. 2. (First Embodiment)
 [FIG. 7] FIG. 7 is an enlarged cross-sectional view taken along a line 7-7 in FIG. 2 (in a state of adjusting an idle intake air amount to be the minimum). (First Embodiment)
 [FIG. 8] FIG. 8 is a view for explaining an operation corresponding to FIG. 7 (in a state of adjusting the idle intake air amount to be the maximum). (First Embodiment)
 [FIG. 9] FIG. 9 is a cross-sectional view taken along a line 9-9 in FIG. 3. (First Embodiment)
 [FIG. 10] FIG. 10 is a graph showing a relation between a rotation angle of an idle adjustment valve and an idle intake air amount. (First Embodiment)

EXPLANATION OF REFERENCE NUMERALS AND SYMBOLS

[0022]

1	throttle body
1a	drum portion
7	air intake path
8	throttle valve
8a	valve stem
30	bypass
31	valve means (idle adjustment valve)
32	concave groove
32a	dead-end portion
32b	inner surface
32c	step portion
33	different path of bypass (valve hole)
33a	opening portion
36	thick-wall portion
34	measurement hole
38	screw hole
42	screw shaft
43	adjustment valve stem
48	blind hole
49	measurement groove
50	through-hole
51	foreign-subject pool
w	communication width

MODE FOR CARRYING OUT THE INVENTION

[0023] An embodiment of the present invention will be described below based on a preferable example of the present invention shown in the accompanying drawings.

FIRST EMBODIMENT

[0024] First, in FIG. 1 to FIG. 4, a throttle body 1 is formed by die casting using a light alloy as a material,

and includes a drum portion 1a and a flange portion 1b projecting from the outer periphery of the drum portion 1a at one end portion of the drum portion 1a. The flange portion 1b is in a substantially square form when seen from the front (see FIG. 3). Paired first and second fastening bosses 2 and 2' are formed respectively at upper and lower corner portions on one diagonal of the flange portion 1b, and are connected to a connection flange portion of an air intake pipe 5 of an engine by paired fastening bolts 3 and 3'. Moreover, an inlet tube 6 connected to an air cleaner is connected to the outer periphery of the drum portion 1a so as to be fitted around the outer periphery.

[0025] The throttle body 1 includes a cylindrical air intake path 7, which communicates the inlet tube 6 and the air intake pipe 5, the air intake path 7 being formed eccentrically with respect to the center of the outer shape of the drum portion 1a of the throttle body 1 so as to be positioned lower than the center in a direction orthogonal to a valve stem 8a. The valve stem 8a of a butterfly-shaped throttle valve 8 for opening and closing the air intake path 7 is rotatably supported by paired first and second bearing bosses 9 and 9' formed in the throttle body 1. Each of the first and second bearing bosses 9 and 9' is formed so that one semicircle portion of the boss would be integrated with the drum portion 1a while the other semicircle portion of the boss would be integrated with the flange portion 1b. As to the first and second bearing bosses 9 and 9', it is preferable that one side-surface of each of the bosses 9 and 9' be arranged to be substantially flush with a corresponding end surface of the flange portion 1b, as shown in the drawings.

[0026] Thus, the first and second bearing bosses 9 and 9' are formed so as to extend over the drum portion 1a and the flange portion 1b. This allows the throttle valve 8 to be arranged near a downstream end of the air intake path 7, which makes it possible to downsize the throttle body 1, especially to downsize significantly the throttle body 1 in an axial direction of the throttle body 1.

[0027] As shown in FIG. 2 to FIG. 4, a throttle drum 10 is fixed to one end portion of the above-described valve stem 8a, and an operation wire 11 (see FIG. 4) for operating the throttle valve 8 to open and close is connected to the throttle drum 10.

[0028] The first fastening boss 2 provided on the upper side is disposed so as to partially overlap with the drum portion 1a when seen in a plan view, and a stay boss 15 is provided so as to be integrally connected to an outer side of the first fastening boss 2. A guide tube stay 13 for supporting an end portion of a guide tube 12 of the above-described operation wire 11 is fixed to an end surface of the stay boss 15 with a screw 16, the end surface being on the side of the drum portion 1a. In addition, a positioning pin 18 provided so as to protrude from the end surface, on the side of the drum portion 1a, of the stay boss 15, is fitted to a positioning hole 17 provided downwardly adjacent to the screw 16 and pierced in the guide tube stay 13. With this fitting, the guide tube stay

13 is prevented from rotating around the screw 16. This enables the single screw 16 to fix the guide tube stay 13 to the stay boss 15. A tip end portion of the positioning pin 18 penetrates the positioning hole 17 and then protrudes from an outer surface of the guide tube stay 13. A stopper arm 10a is integrally formed to the throttle drum 10, so as to be in contact with the tip end portion of the positioning pin 18 to control a fully-opened position of the throttle valve 8. In other words, the positioning pin 18 serves also as a stopper pin for controlling the fully-opened position of the throttle valve 8. Accordingly, no dedicated stopper pin is required, which allows simplification of the configuration.

[0029] Moreover, a full-closing-stopper boss 20 is integrally formed to the flange portion 1b, at a position opposite of the first bearing boss 9 to the stay boss 15, and a full-closing-stopper bolt 21 for controlling a fully-closed position of the throttle valve 8 by stopping the above-described stopper arm 10a, is screwed to the full-closing-stopper boss 20.

[0030] With the above-described configuration, the first and second fastening bosses 2 and 2', the holes in the stay boss 15, the positioning pin 18 and the hole in the full-closing-stopper boss 20 are arranged to be parallel with the air intake path 7. This makes it possible to perform molding and drilling for the air intake path 7, the first and second fastening bosses 2 and 2', the stay boss 15, the positioning pin 18 and the full-closing-stopper boss 20, all at once, which provides excellent processibility.

[0031] A space 22 is formed around the first bearing boss 9 so as to space the stay boss 15 and the full-closing-stopper boss 20 from the first bearing boss 9. With this space 22, a torsion coil type return spring 23 for biasing the throttle drum 10 in a closing direction of the throttle valve 8, is disposed on the outer periphery of the bearing boss 9.

[0032] In this way, the stay boss 15, the first bearing boss 9, the return spring 23 and the full-closing-stopper boss 20 can be aligned on one side of the flange portion 1b, which contributes to downsizing of the throttle body 1. In this respect, especially since the stay boss 15 is integrally provided on the outer side of the first fastening boss 2 arranged so as to partially overlap with the drum portion 1a in a plan view, a portion, protruding from the one side of the flange portion 1b, of the stay boss 15 can be reduced in length as much as possible. In association with this, a portion, protruding from the flange portion 1b, of the full-closing-stopper boss 20 vertically arranged with the stay boss 15 can also be reduced in length, which can further contribute to the downsizing of the throttle body 1.

[0033] As shown in FIG. 1 and FIG. 3, a casing 25 for a throttle sensor 25 for detecting an opening degree of the throttle valve 8 is fitted around the outer periphery of the second bearing boss 9'. Meanwhile, a sensor-supporting boss 27 is integrally formed to the flange portion 1b so as to be aligned with the second fastening boss 2'

while interposing the second bearing boss 9 together with the second fastening boss 2', and the casing 25 is fastened to the sensor-supporting boss 27 with a fastening bolt 28. The above-described sensor-supporting boss 27 is arranged in parallel with the second bearing boss 9. With this arrangement, molding and drilling can be performed for the second bearing boss 9 and the sensor-supporting boss 27 all at once, which provides excellent processibility.

[0034] In this way, the second fastening boss 2', the second bearing boss 9' and the sensor-supporting boss 27 can be aligned on the other side of the flange portion 1b. With this configuration, in combination with the configuration that the stay boss 15, the first bearing boss 9, the return spring 23 and the full-closing-stopper boss 20 are aligned on the one side of the flange portion 1b, the entire throttle body 1 can be downsized significantly.

[0035] In FIG. 2, FIG. 3 and FIG. 5 to FIG. 8, a bypass 30 communicating with the air intake path 7 while bypassing the throttle valve 8 is formed to the throttle body 1. This bypass 30 is provided to pass intake air for idling (referred to as idle intake air, below) to the engine. An idle adjustment valve 31 for adjusting the amount of the idle intake air is screwed to the throttle body 1. The bypass 30 and the idle adjustment valve 31 will be described below in detail.

[0036] The bypass 30 includes: a concave groove 32 formed on an upper surface of the air intake path 7 between an upstream end of the throttle body 1 and a portion before reaching the throttle valve 8 (see FIG. 2, FIG. 5 and FIG. 6); a cylindrical valve hole 33 extending from the concave groove 32 in such a direction to be bent at a right angle with the concave groove 32 (see FIG. 7); a measurement hole 34 extending from an intermediate portion of the valve hole 33 toward a downstream end of the throttle body 1; and a cut-out portion 35 formed in an end surface, connected to the air intake pipe 5, of the flange portion 1b of the throttle body 1, to cause the measurement hole 34 to communicate with a downstream end portion of the air intake path 7 (see FIG. 3).

[0037] The concave groove 32 is formed in a thick-wall portion 36 formed in an upper portion of the drum portion 1a, by forming the air intake path 7 eccentrically with respect to the center of the outer shape of the drum portion 1a of the throttle body 1 so as to be positioned lower than the center in the direction orthogonal to the valve stem 8a as described above. In this way, a sufficient channel area can be secured for the concave groove 32 without reducing the strength of the throttle body 1, and the other portion of the bypass 30 leading to the concave groove 32 can be formed easily without being interrupted by the valve stem 8a.

[0038] A screw hole 38 and a guide hole 39, becoming larger in diameter sequentially and gradually, are coaxially provided to an outer end side of the valve hole 33, and the guide hole 39 is opened in an outer surface of the throttle body 1. The guide hole 39, the screw hole 38 and the valve hole 33 are formed in parallel with the sec-

ond bearing boss 9' similarly as the sensor-supporting boss 27 is. Consequently, molding and drilling can be performed for the above-described holes, the sensor-supporting boss 27 and the second bearing boss 9' all at once, which provides excellent processibility.

[0039] As shown in FIG. 1, FIG. 5 and FIG. 6, the concave groove 32 has a dead-end portion 32a on a downstream side of the concave groove 32, and the valve hole 33 is disposed so as to extend from a portion before the dead-end portion 32a in such a direction to be bent at a right angle with the dead-end portion 32a. Moreover, an opening portion 33a of the valve hole 33 to the concave groove 32 is narrowed, and is formed in a step portion 32c, which is raised from an inner surface 32b of the concave groove 32 by a step h. Further, the opening portion 33a is disposed so as to be spaced from the peripheral edge of the step portion 32c.

[0040] The above-described step portion 33c is formed so as to be continuous with a ceiling surface of the concave groove 32 and the dead-end portion 32a. With this configuration, die cutting of the air intake path 7 and the concave groove 32 can be performed without being interrupted by the step portion 32c, in molding the throttle body 1.

[0041] Meanwhile, the idle adjustment valve 31 includes a main shaft 41, a screw shaft 42 and an adjustment valve stem 43 that are integrally and coaxially connected to each other so as to become smaller in diameter sequentially and gradually. The main shaft 41 has an enlarged head portion 41a with a tool-insertion groove 44 at an outer end, and an O-ring 45 is attached to an outer periphery of the main shaft 41. The adjustment valve stem 43 is rotationally and slidably fitted to the valve hole 33, the screw shaft 42 is screwed to the screw hole 38, the main shaft 41 is rotationally and slidably fitted to the guide hole 39 with the O-ring 45, and a coil spring 46 for preventing the idle adjustment valve 31 from rotating is provided in a compressed manner between the outer surface of the throttle body 1 and the enlarged head portion 41a.

[0042] The adjustment valve stem 43 has: a blind hole 48 opened in an end surface of the adjustment valve stem 43 to communicate with the valve hole 33; an annular measurement groove 49 formed on an outer periphery of the adjustment valve stem 43 to communicate with the measurement hole 34; and multiple through-holes 50, 50 ... formed in a manner that an axial-direction intermediate portion of the blind hole 48 would communicate with the measurement groove 49. The groove width of the measurement groove 49 is set to be sufficiently larger than the internal diameter of the measurement hole 34. In addition, a blind portion defined closer to the dead-end of the blind hole 48 than the through-holes 50, 50 ... serves as a foreign-subject pool 51.

[0043] The measurement hole 34 and the through-holes 50, 50 ... are provided to always offset each other in the axial direction of the adjustment valve stem 43 regardless of which adjustment position the adjustment

valve stem 43 is in.

[0044] As shown in FIG. 1, the number of the multiple through-holes 50, 50 ... is preferably four arranged at equal intervals in a peripheral direction of the adjustment valve stem 43. One or multiple annular grooves 52 (see FIG. 6) to serve as a labyrinth seal are formed on an outer peripheral surface of a tip end portion of the adjustment valve stem 43.

[0045] With this configuration, when the engine is idling with the throttle valve 8 fully closed, air flowed into the air intake path 7 passes the bypass 30, i.e. the concave groove 32, the valve hole 33, the blind hole 48, the multiple through-holes 50, 50 ..., the measurement groove 49 and the cut-out portion 35 in this order, then flows downstream the air intake path 7, passes the air intake pipe 5 and is then supplied to the engine as idle intake air. The amount of the idle intake air can be performed by increasing and decreasing a communication width w of the measurement groove 49 and the measurement hole 34 through adjustment in which the adjustment valve stem 43 is caused to advance or retreat by screwing or unscrewing the idle adjustment valve 31. Specifically, the amount of the idle intake air can be reduced when the communication width w is reduced as shown in FIG. 7, and can be increased when the communication width w is increased as shown in FIG. 8.

[0046] In such adjustment of the amount of the idle intake air, when the positions of the through-holes 50, 50 ... in the peripheral direction of the adjustment valve stem 43 change, the distance between the measurement hole 34 and the through-hole 50 that is the closest to the measurement hole 34 changes even if the offset amount of the through-holes 50, 50 ... and the measurement hole 34 in the axial direction of the adjustment valve stem 43 is kept constant. This change causes some variations in the amount of the idle intake air. In view of this, variations in the amount of the idle intake air in relation to the rotation angle of the idle adjustment valve 31 were actually investigated in: a case (A) where two through-holes 50 are formed at equal intervals in the peripheral direction of the adjustment valve stem 43; and a case (B) where four through-holes 50 are formed at equal intervals. Through this investigation, the results shown in FIG. 10 were obtained. As apparent from the results, the amount of the idle intake air varies smoothly in the case (B), and hence the amount of the idle intake air can be adjusted easily and precisely. Moreover, in the case (B), the four through-holes 50 can be formed simply by subjecting the adjustment valve stem 43 to hole processing in two directions, which provides excellent processibility. These advantages show that adopting (B) is preferable.

[0047] Incidentally, in some cases, water drops occurring due to dew condensation or the like attach to an inner surface of the concave groove 32, and flow through the concave groove 32 together with the idle intake air. In these cases, the valve hole 33 communicating with the concave groove 32 is positioned in the direction to be bent substantially at a right angle with a portion before

the dead-end portion 32a of the concave groove 32. Moreover, the opening portion 33a of the valve hole 33 to the concave groove 32 is formed in the step portion 32c, which is raised from the inner surface 32b of the concave groove 32 by one step, and the opening portion 33a is formed to be away from the peripheral edge of the step portion 33a. With this configuration, the water drops flowing on the inner surface 32b of the concave groove 32 flow along the periphery of the step portion 32c as shown by an arrow a in FIG. 5 and an arrow b in FIG. 6, due to the inertia of the flow, while avoiding the opening portion 33a. In this way, the water drops are prevented from entering the valve hole 33.

[0048] If foreign subjects including water drops and minute dusts happen to flow into the valve hole 33 together with idle intake air, the idle intake air flows into the annular measurement groove 49 by changing the course at the right angle at the blind hole 48 to the through-holes 50, 50', while the foreign subjects that have entered the blind hole 48 flow straight on due to the inertia of the flow, are pooled in the foreign-subject pool 51 positioned close to the dead-end of the blind hole 48, and are thus separated from the idle intake air.

[0049] Further, even if foreign subjects happen to flow to the measurement groove 49 through the through-holes 50, 50' together with the idle intake air, the through-holes 50, 50' and the measurement hole 34 always offset each other in the axial direction of the adjustment valve stem 43 regardless of which adjustment position the adjustment valve stem 43 is in. With this configuration, the idle intake air that has flowed into the measurement groove 49 through the through-holes 50, 50' immediately changes the course at a right angle and heads for the measurement hole 34, while the foreign subjects passing through the through-holes 50, 50' collide against an inner peripheral surface of the valve hole 33 due to the inertia and fall down to a bottom portion of the valve hole 33, and are thus separated from the idle intake air.

[0050] With this configuration, attachment of foreign subjects to the measurement portion, which are the measurement groove 49 and the measurement hole 34, can be prevented, and the idle intake air amount adjusted once by the idle adjustment valve 31 can be kept stable for a long time.

[0051] As the throttle valve 8 is opened gradually to accelerate the engine, the intake air that has flowed into the air intake path 7 flows straight on through the air intake path 7 with the flow amount being controlled by regulating the opening degree of the throttle valve 8, and is supplied to the engine. Since the inlet of the bypass 30 has the concave groove 32 forming a depression in an inner surface of the air intake path 7, the channel area of the air intake path 7 is not reduced, and the flow of the intake air flowing straight on through the air intake path 7 is not interrupted. This configuration can reduce the air intake resistance of the engine and contribute to improvement of the output of the engine.

[0052] Moreover, even if water drops flow along the inner surface 32b of the concave groove 32 during the load operation of the engine, the water drops can be prevented from entering the opening portion 33a of the valve hole 33 by the step portion 32c similarly at the time of idling described above.

[0053] Referring to FIG. 3 and FIG. 7 again, the flange portion 1b has the cut-out portion 35, which is in a cut-out shape and to be a downstream end portion of the bypass 30, in the end surface facing the air intake pipe 5 at a position corresponding to an upper oblique portion of the air intake path 7, and a sealing groove 53 having a waterdrop form is formed in the end surface of the flange portion 1b to surround the cut-out portion 35 and the air intake path 7. The O-ring 54 to come in close contact with the end surface of the air intake pipe 5 is attached to the sealing groove 53 when the first and second fastening bosses 2 and 2' of the flange portion 1b are fastened to the air intake pipe 5 with the fastening bolts 3 and 3'. Here, the fastening bosses 2 and 2' respectively protrude slightly from the surface in which the sealing groove 53 of the flange portion 1b is formed. Moreover, the cut-out portion 35 is positioned on one side of a straight line 55 joining the centers of the first and second fastening bosses 2 and 2' across the air intake path 7, and an arc-shaped contact seating 56 (see FIG. 3 and FIG. 9), which is slightly protruding from the surface in which the sealing groove 53 of the flange portion 1b is formed, is formed to be along a part of the outer peripheral edge of the sealing groove 53. The contact seating 56 and the seating surfaces 2a and 2a' are finished to be on the same level after the throttle body 1 is casted.

[0054] Since the three portions, i.e. the seating surfaces 2a and 2a' and the contact seating 56, come in contact with the end surface of the air intake pipe 5 in the above-described fastening, the compressive deformation amount of the O-ring 54 can be regulated accurately, and the sealing function of the O-ring 54 can be maintained for a long time. Moreover, the processing only needs to be performed on the three portions, i.e. the seating surfaces 2a and 2a' of the first and second fastening bosses 2 and 2' and the contact seating 56, in finishing the surface to be in contact with the air intake pipe 5 of the flange portion 1b to be on the same level. This finishing can improve the processing efficiency and extend the life of processing tools. Further, the cut-out portion 35 and the contact seating 56 are arranged on the opposite sides of the straight line 55 joining the centers of the two fastening bosses 2 and 2'. This arrangement can distribute the portions having complex shapes and improve the run characteristics in the die casting.

[0055] The present invention is not limited to the above-described embodiment, and may be modified in a variety of ways as long as the modifications do not depart from the gist of the present invention. For example, the sealing groove 53 may be formed in an end surface, facing the flange portion 1b, of the air intake pipe 5. More-

over, although the present invention is applied to the horizontal type throttle body 1 including the air intake path 7 arranged horizontally in the above-described embodiment, the present invention is also applicable to a vertical type throttle body including the air intake path 7 arranged in a vertical direction. Further, instead of the manual idle adjustment valve 31, an electric or wax-type automatic valve may be provided to the bypass. Furthermore, in contrast with the above-described embodiment, the valve hole 33 and the measurement hole 34 may be formed to communicate with a downstream portion and an upstream portion of the air intake path 7 in the bypass 30, respectively.

Claims

1. An air intake control device for an engine in which a throttle body (1) having an air intake path (7) opened and closed by a throttle valve (8) is provided with a bypass (30) communicating with the air intake path (7) while bypassing the throttle valve (8), and the bypass (30) is provided with valve means (31) for opening and closing the bypass (30),
characterized in that
an inlet of the bypass (30) is formed of a concave groove (32) which is formed in an inner surface of the air intake path (7) so as to start from an upstream end of the throttle body (1) and terminate as a dead-end before reaching the throttle valve (8), and a different path (33) of the bypass (30) leading to the concave groove (32) is opened in a step portion (32c) raised by one step from an inner surface (32b) of the concave groove (32).
2. The air intake control device for an engine according to claim 1, wherein an opening portion (33a) of the different path (33) that is open to the step portion (32c) is arranged to be spaced from a peripheral edge of the step portion (32c).
3. The air intake control device for an engine according to claim 1 or 2, wherein the step portion (33c) is formed to be continuous with a ceiling surface and a dead-end portion (32a) of the concave groove (32).
4. The air intake control device for an engine according to any one of claims 1 to 3, wherein the air intake path (7) is formed in a drum portion (1a) of the throttle body (1) to be eccentric with respect to a center of an outer shape of the drum portion (1a) in a direction orthogonal to a valve stem (8a) of the throttle valve (8), and the concave groove (32) is formed in a thick-wall portion (36) of the drum portion (1a), the thick-wall portion (36) being located on a side opposite to the side on which the air intake path (7) is eccentrically located.

5. The air intake control device for an engine according to claim 1, wherein the valve means is an idle adjustment valve (31) for opening and closing the bypass (30) to adjust the amount of idle intake air for the engine flowing the bypass (30), the throttle body (1) has a screw hole (38), a valve hole (33) coaxially continuous to an inner end of the screw hole (38), and a measurement hole (34) opened in an inner surface of the valve hole (33), the bypass (30) is formed such that one of the valve hole (33) and the measurement hole (34) communicates with a portion, upstream of the throttle valve (8), of the air intake path (7) and the other communicates with a portion, downstream of the throttle valve (8), of the air intake path (7), the idle adjustment valve (31) includes a screw shaft (42) screwed into the screw hole (38) and an adjustment valve stem (43) continuously provided to a tip end of the screw shaft (42) and rotatably and slidably fitted to the valve hole (33), the adjustment valve stem (43) has a blind hole (48) having an opening in an end surface of the adjustment valve stem (43) and communicating with the valve hole (33), an annular measurement groove (49) surrounding an outer periphery of the adjustment valve stem (43) and communicating with the measurement hole (34), and a plurality of through-holes (50) causing an axial-direction intermediate portion of the blind hole (48) to communicate with the measurement groove (49), a width (w) of communication of the measurement groove (49) with the measurement hole (34) is adjustable by adjusting advance and retreat of the adjustment valve stem (43) in an axial direction of the adjustment valve stem (43), and a dead-end portion, further than the through-holes (50), of the blind hole (48) is used as a foreign-subject pool (51).
6. The air intake control device for an engine according to claim 5, wherein the through holes (50) are shifted from the measurement hole (34) in the axial direction of the adjustment valve stem (43) regardless of which adjustment position the adjustment valve stem (43) is in.
7. The air intake control device for an engine according to claim 5 or 6, wherein the through-holes (50) the number of which is four are arranged in a peripheral direction of the adjustment valve stem (43) at equal intervals.

FIG.1

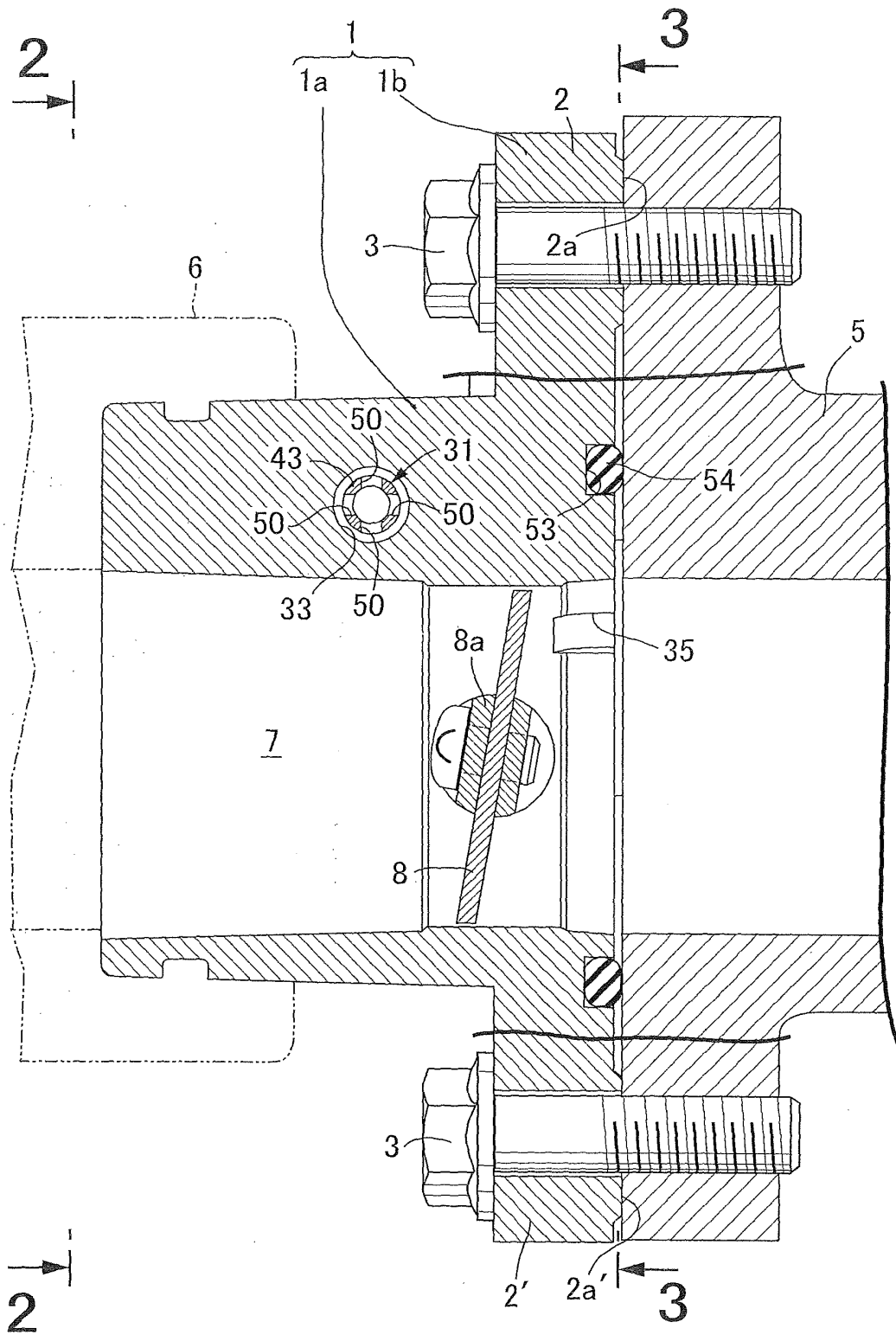


FIG.2

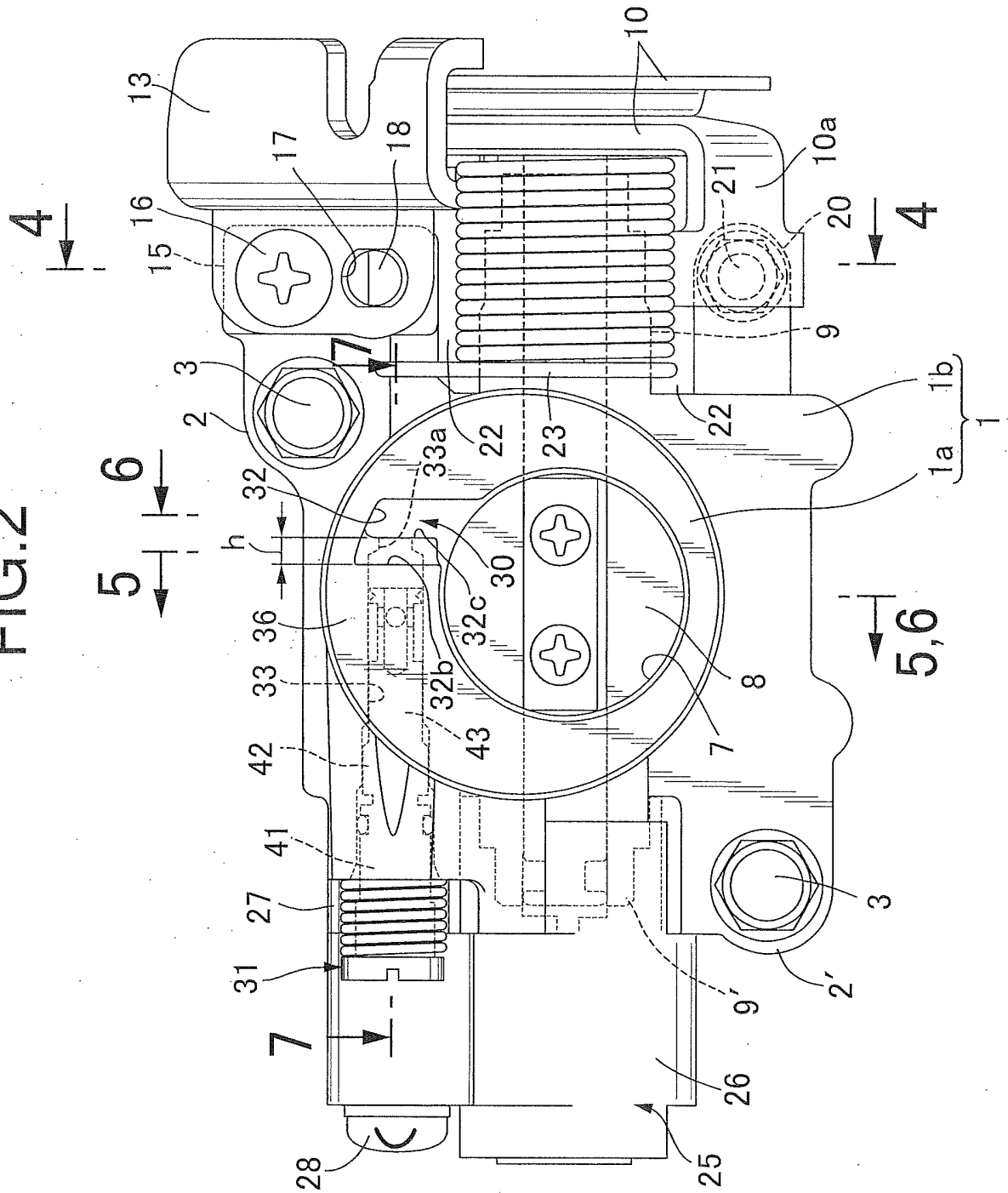


FIG.3

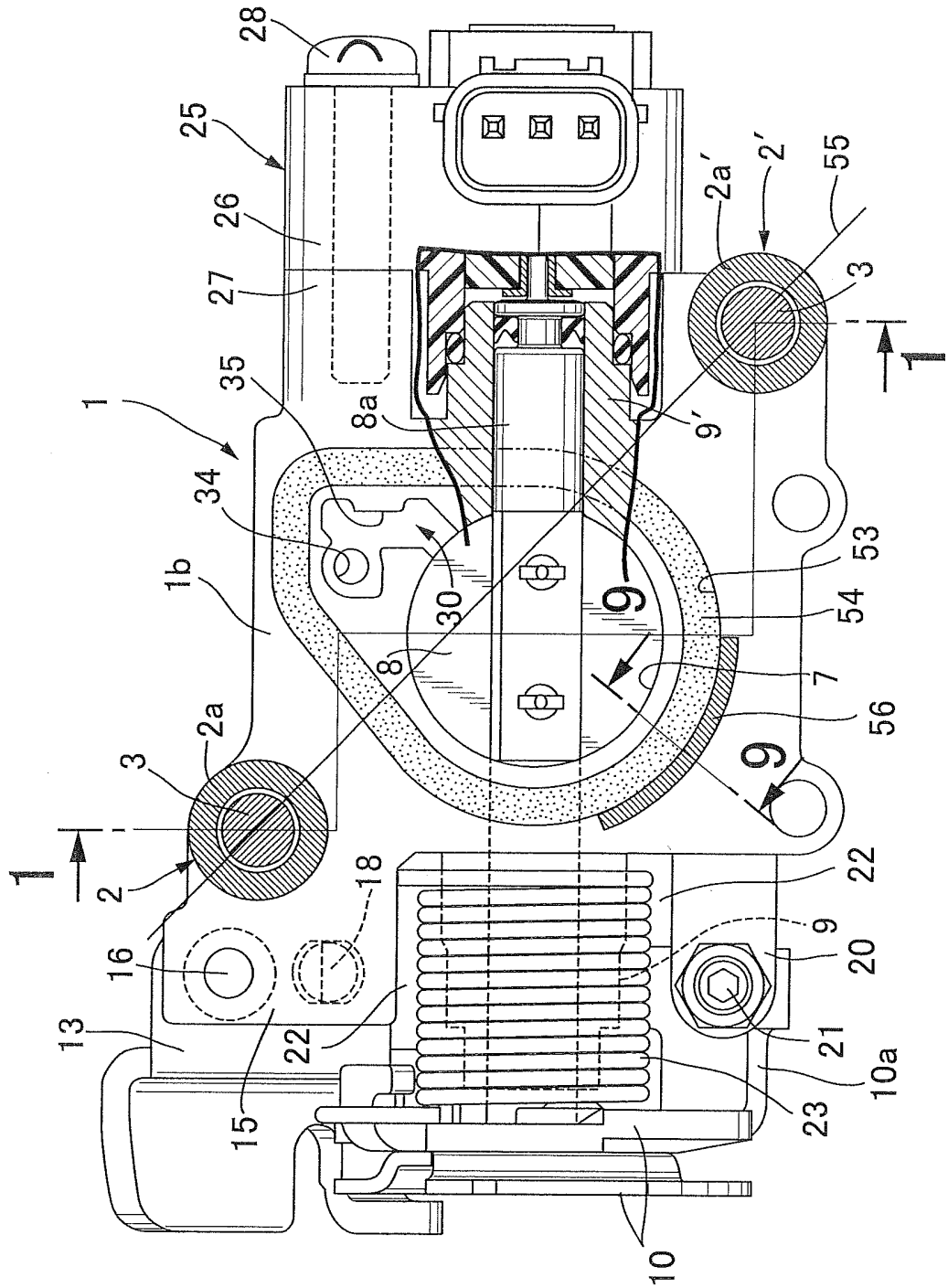


FIG.4

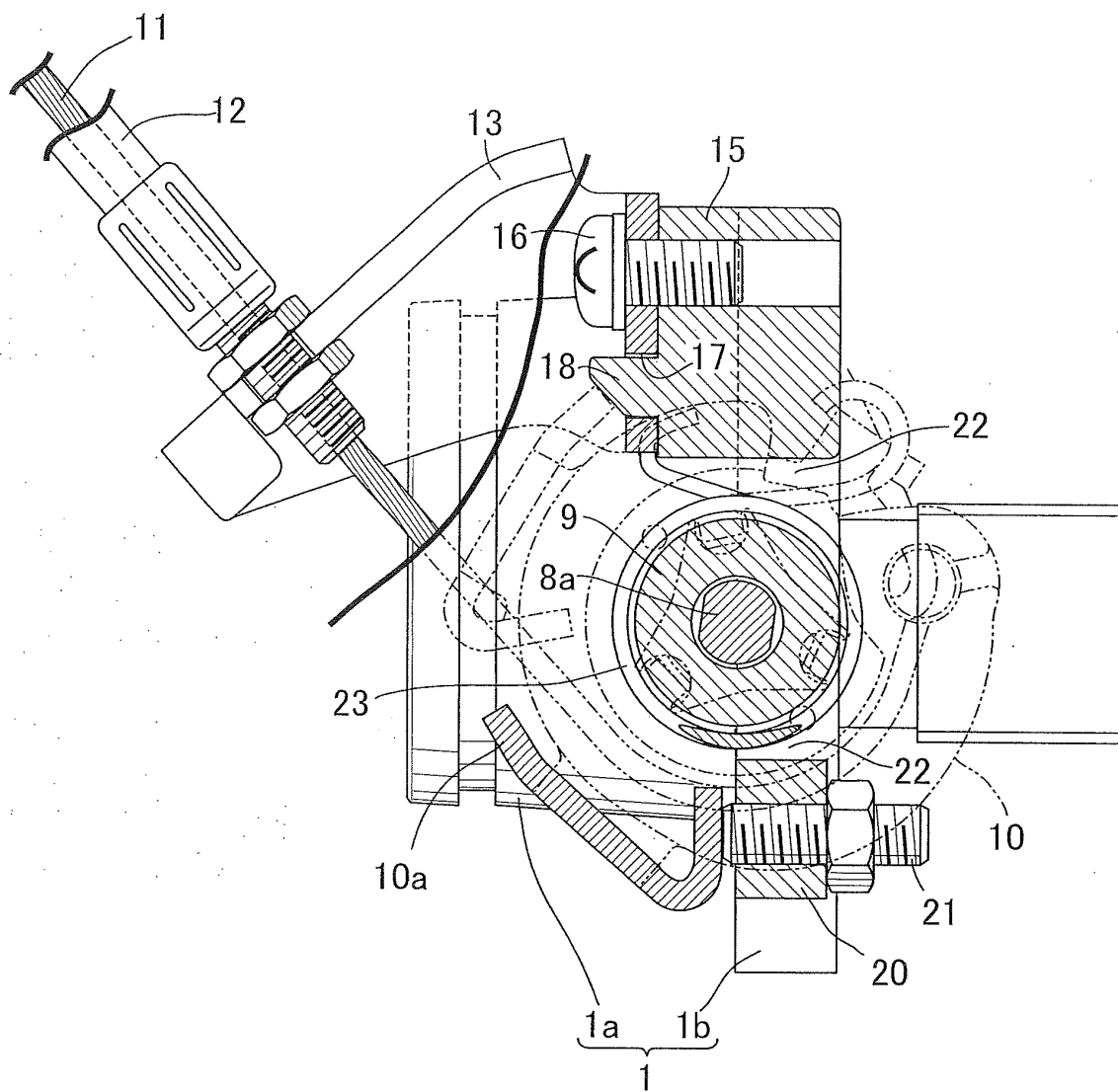


FIG.5

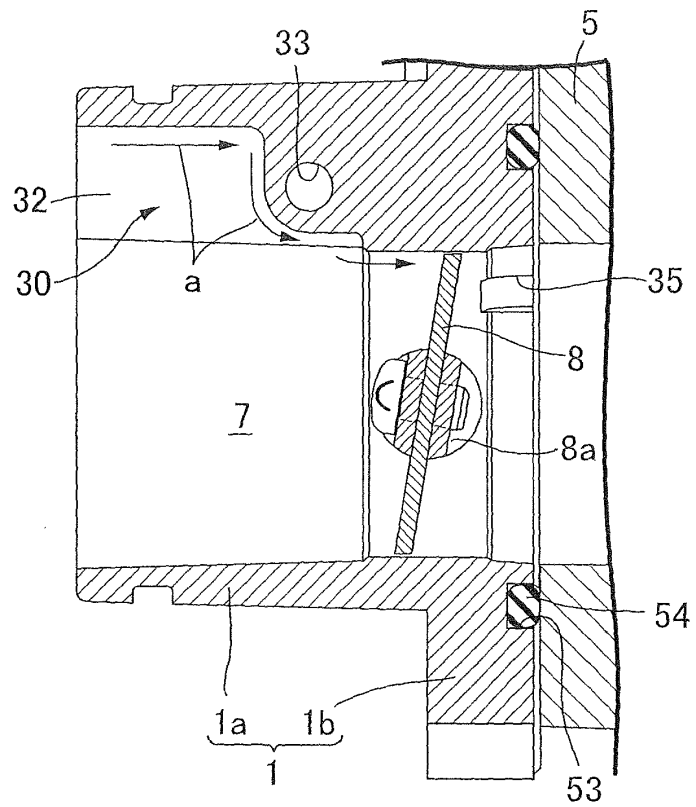


FIG.6

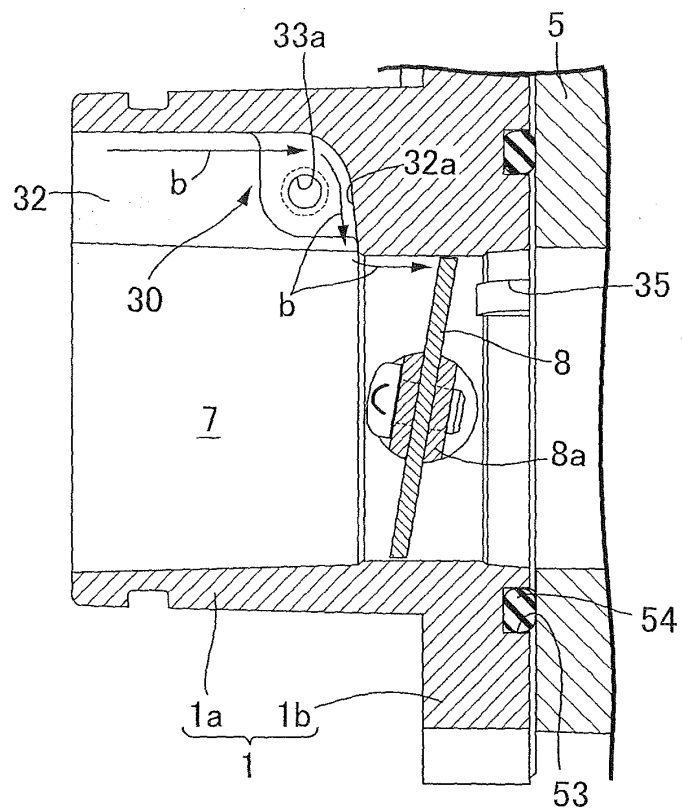


FIG. 7

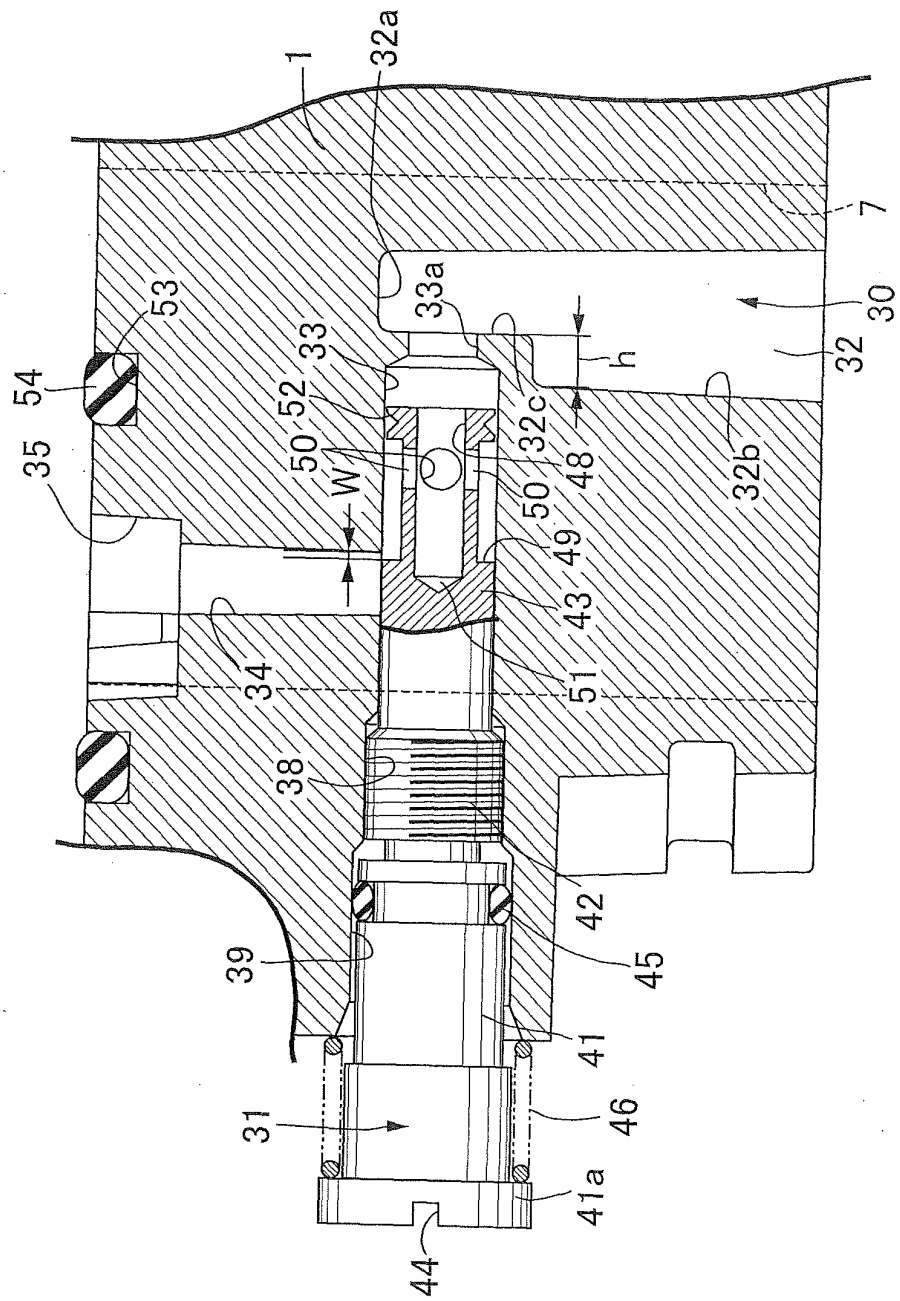


FIG.8

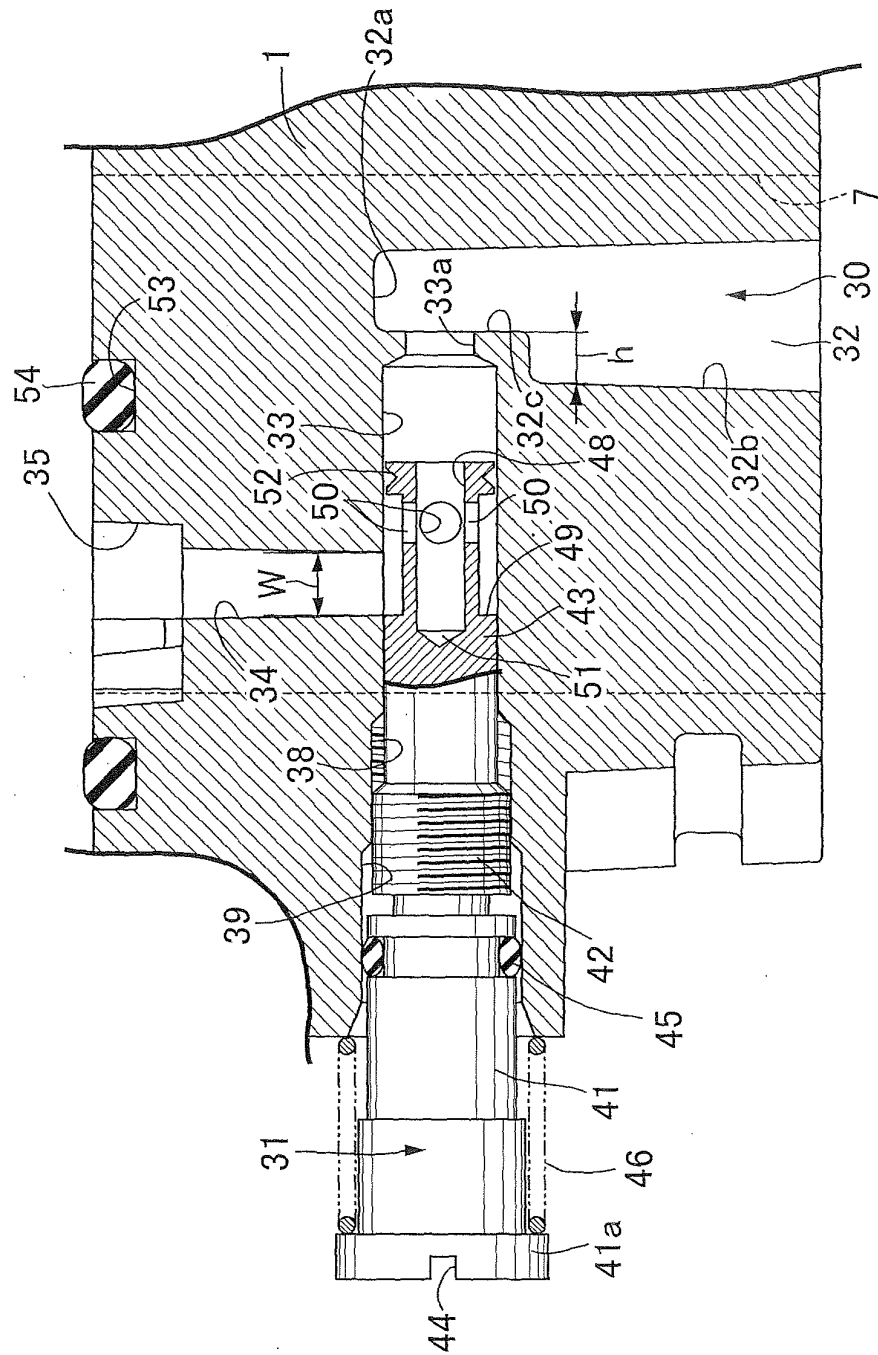


FIG.9

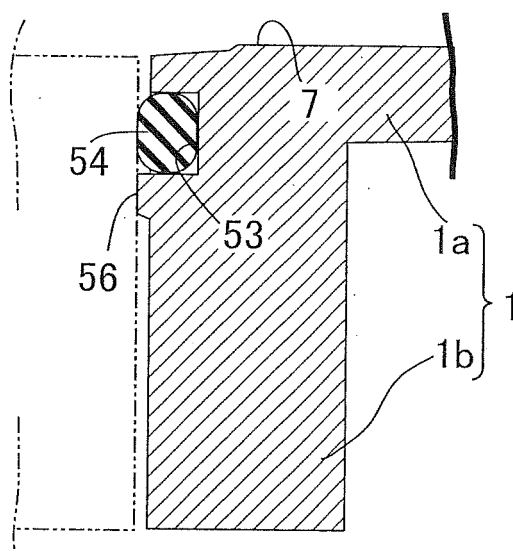
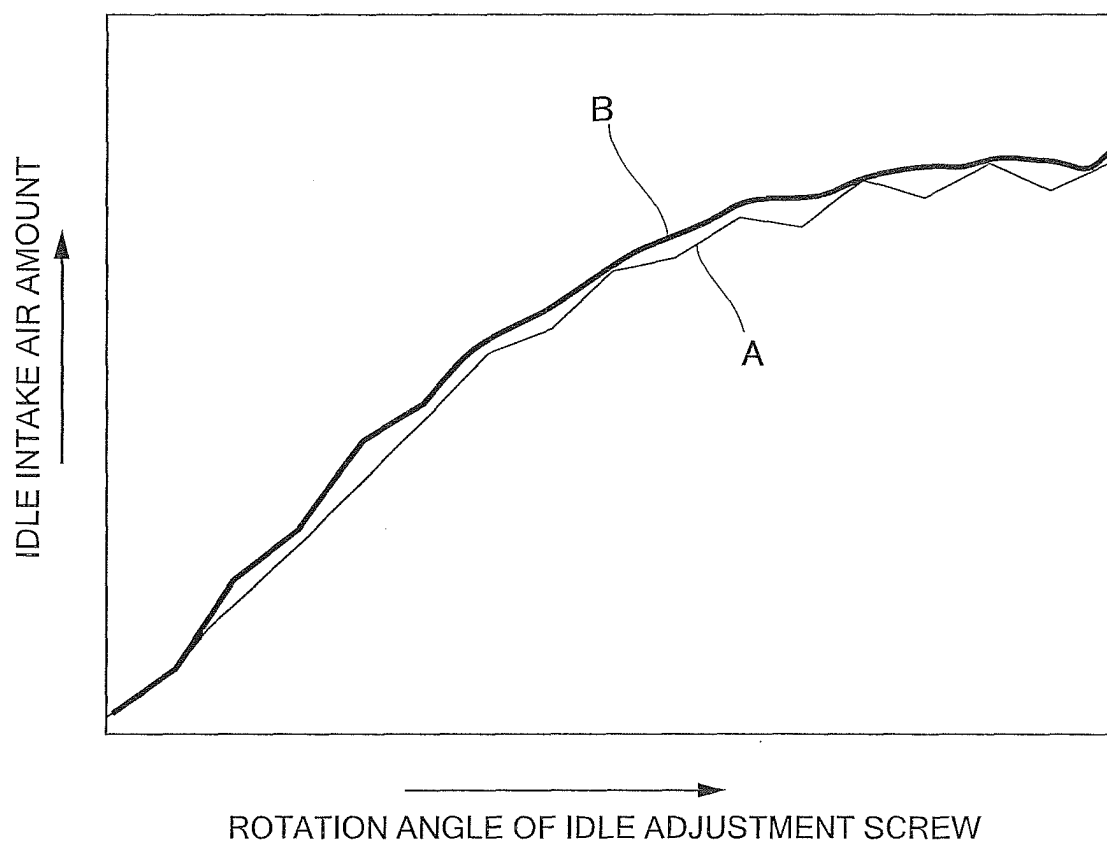


FIG.10



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/054822

A. CLASSIFICATION OF SUBJECT MATTER

F02M69/32 (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)

F02M69/32

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	1996-2010
Kokai Jitsuyo Shinan Koho	1971-2010	Toroku Jitsuyo Shinan Koho	1994-2010

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.
A	JP 2004-92393 A (Denso Corp.), 25 March 2004 (25.03.2004), entire text; all drawings & US 2004/0040536 A1 & DE 10339667 A1	1-7
A	JP 2005-273647 A (Aisan Industry Co., Ltd.), 06 October 2005 (06.10.2005), entire text; all drawings (Family: none)	1-7
A	JP 11-201003 A (Nippon Soken, Inc.), 27 July 1999 (27.07.1999), entire text; all drawings & US 6041754 A	1-7

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

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Date of the actual completion of the international search
18 May, 2010 (18.05.10)Date of mailing of the international search report
01 June, 2010 (01.06.10)Name and mailing address of the ISA/
Japanese Patent Office

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Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/054822

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 29304/1987 (Laid-open No. 136237/1988) (Mitsubishi Electric Corp.), 07 September 1988 (07.09.1988), entire text; all drawings & DE 3806186 A1	1-7
A	JP 7-269377 A (Mikuni Corp.), 17 October 1995 (17.10.1995), entire text; all drawings (Family: none)	1-7

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 59088236 A [0003]
- JP 63151965 A [0003]