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

(11) **EP 2 400 131 A1**

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

(43) Date of publication:
28.12.2011 Bulletin 2011/52

(21) Application number: **10755906.4**

(22) Date of filing: **15.03.2010**

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

(86) International application number:
PCT/JP2010/054324

(87) International publication number:
WO 2010/110108 (30.09.2010 Gazette 2010/39)

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

(30) Priority: **23.03.2009 JP 2009070030**

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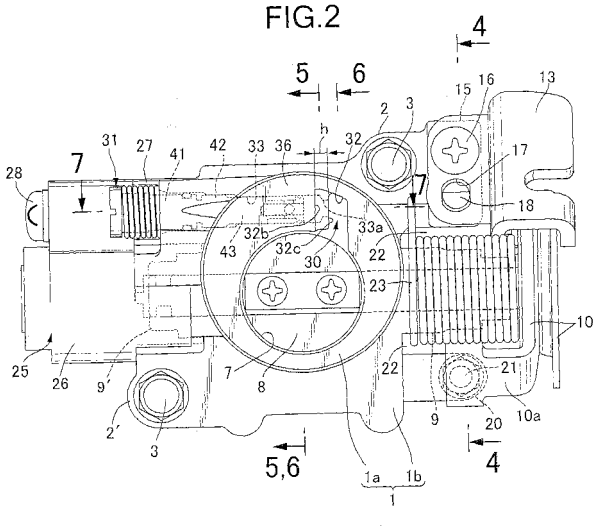
(54) **AIR INTAKE CONTROL DEVICE FOR ENGINE**

(57) In an air intake control device for an engine, a throttle body (1) includes a drum portion (1a) and a flange portion (1b) protruding from an outer periphery of one end portion of the drum portion (1a) and having an end surface in an substantially square form; first and second fastening bosses (2, 2') are integrally formed respectively at corner portions of the flange portion (1b), the corner portions being positioned respectively at diagonal positions of the flange portion (1b); first and second bearing bosses (9, 9') supporting a valve stem (8a) of a throttle valve (8) are formed over the flange portion (1b) and the drum portion (1a); one of a full-closing-stopper boss (20) and a stay boss (15), which are positioned so as to interpose the first bearing boss (9), is continuously provided to the first fastening boss (2) in the flange portion (1b), while the other is formed in the flange portion (1b); a stopper bolt (21) for restricting a full-closing position of the throttle valve (8) is screwed to the full-closing-stopper boss (20); and a screw (16) fixing a guide tube stay (13) supporting a guide tube (12) of an operation wire (11) is screwed to the stay boss (15). With this configuration, reduction in size of the throttle body is possible.

FIG.2



EP 2 400 131 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to an improvement of an air intake control device for an engine in which a pair of first and second bearing bosses are integrally formed respectively on opposite side walls of a throttle body having an air intake path therein, the first and second bearing bosses supporting a valve stem of a throttle valve for opening and closing the air intake path, a throttle drum is fixed to one end portion of the valve stem to be adjacent to the first bearing boss, an operation wire is connected to the throttle drum while a return spring biasing the throttle drum in a closing direction of the throttle valve is disposed around the first bearing boss, and a casing of a throttle sensor connected to the valve stem for detecting an opening degree of the throttle valve is fitted to the second bearing boss.

BACKGROUND ART

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

> Patent Document 1: Japanese Patent Application Laid-open No. 11-241667

DISCLOSURE OF INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0003] In the conventional air intake control device for an engine, a throttle body includes a drum portion having an air intake path and a flange portion protruding from the outer periphery of one end portion of the drum portion, and a pair of bearing bosses supporting a valve stem of a throttle valve are integrally provided to the outer periphery of the drum portion in a protruding manner. With this configuration, the pair of bearing bosses and the flange portion are positioned away from each other, and, due to this positioning, associated components including a throttle drum fixed to the valve stem of the throttle valve and stopper means for restricting full closing and full opening of the throttle valve are scattered. Consequently, the throttle body including these components inevitably ends up with being large in size.

[0004] 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 that can achieve reduction in size of a throttle body.

MEANS FOR SOLVING THE PROBLEMS

[0005] 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 pair of first and second bearing bosses are integrally formed respectively on opposite side walls of a throttle body having an air intake path therein, the first and second bearing bosses supporting a valve stem of a throttle valve for opening and closing the air intake path, a throttle drum is fixed to one end portion of the valve stem to be adjacent to the first bearing boss, an operation wire is connected to the throttle drum while a return spring biasing the throttle drum in a closing direction of the throttle valve is disposed around the first bearing boss, and a casing of a throttle sensor connected to the valve stem for detecting an opening degree of the throttle valve is fitted to the second bearing boss, **characterized in that** the throttle body includes a drum portion having the air intake path therein and a flange portion protruding from an outer periphery of one end portion of the drum portion and having an end surface in a substantially square form, and at least a pair of first and second fastening bosses fastened to an air intake pipe of the engine with fastening bolts are integrally formed respectively at corner portions of the flange portion, the corner portions being respectively at diagonal positions of the flange portion, the first and second bearing bosses are formed over the flange portion and the drum portion, in the flange portion, one of a full-closing-stopper boss and a stay boss which are positioned so as to interpose the first bearing boss and the return spring therebetween is continuously provided to the first fastening boss, while the other thereof is formed in the flange portion, a stopper bolt for restricting a full-closing position of the throttle valve by receiving a stopper arm integrally formed on the throttle drum is screwed to the full-closing-stopper boss, a screw fixing a guide tube stay supporting a guide tube of the operation wire is screwed to the stay boss, and holes of the full-closing-stopper boss and the stay boss are arranged in parallel with the air intake path.

[0006] Furthermore, according to a second aspect of the present invention, in addition to the first aspect, a positioning pin is formed on the stay boss in parallel with the screw, and is fitted to a positioning hole formed in the guide tube stay, and a full-opening position of the throttle valve is restricted by stopping the stopper arm with the alignment pin.

[0007] Moreover, according to a third aspect of the present invention, in addition to the first aspect, the first fastening boss is disposed to partially overlap with the drum portion in a plan view, and the stay boss is continuously provided on an outer side of the first fastening boss.

[0008] Furthermore, according to a fourth aspect of the present invention, in addition to the third aspect, a sensor-supporting boss positioned so as to interpose the second bearing boss between the second fastening boss and the sensor-supporting boss is formed in the flange portion, a bolt fixing the casing of the throttle sensor is screwed to the sensor-supporting boss, and the bolt is arranged in parallel with the second bearing boss.

[0009] Moreover, according to a fifth aspect of the present invention, in addition to the fourth aspect, a bypass is formed in the throttle body, the bypass communicating with the air intake path while bypassing the throttle valve, and an idle adjustment valve for opening and closing the bypass is disposed in parallel with the second bearing boss and adjacent to the sensor-supporting boss.

[0010] Furthermore, according to a sixth aspect of the present invention, in addition to the fourth aspect, a cut-out portion serving as a downstream end portion of the bypass is formed in an end surface of the flange portion, a sealing groove surrounding the air intake path and the cut-out portion is formed in one of facing surfaces respectively of the flange portion and the air intake pipe fastened to each other, an O-ring is attached to the sealing groove so as to be in close contact with the other of the facing surfaces, seating surfaces protruding from a surface in which the sealing groove of the flange portion is formed and being in contact with an end surface of the air intake pipe are formed respectively to the first and second fastening bosses, and the cut-out portion is disposed on one side of a straight line joining the centers of the respective first and second fastening bosses while a contact seating protruding from the surface in which the sealing groove is formed and being in contact with the end surface of the air intake pipe is formed on the other side of the straight line in the flange portion.

[0011] Moreover, according to a seventh aspect of the present invention, in addition to the sixth aspect, the throttle body is formed by die casting, and the seating surfaces and the contact seating are finished to be flush with each other.

EFFECTS OF THE INVENTION

[0012] According to the first aspect of the present invention, the stay boss, the first bearing boss, the return spring and the full-closing-stopper boss are aligned on one side of the flange portion. This allows reduction in size of the throttle body, especially reduction in size of the throttle body in an axial direction. Moreover, the holes in the first and second fastening bosses, the stay boss and the full-closing-stopper boss are arranged in parallel with the air intake path. This allows the holes to be formed all at once by molding, drilling and the like.

[0013] According to the second aspect of the present invention, the positioning pin which is in parallel with the screw is formed to the stay boss, and is fitted to the positioning hole formed in the guide tube stay, to prevent the guide tube stay from rotating around the screw. With this configuration, the guide tube stay can be fixed to the stay boss with the single screw. Further, the positioning pin can also function as a stopper pin for restricting the full-opening position of the throttle valve. Accordingly, a dedicated stopper pin is not required, and hence the configuration can be simplified.

[0014] According to the third aspect of the present invention, the stay boss is integrally and continuously provided to the outer side of the first fastening boss disposed to partially overlap with the drum portion in a plan view. With this configuration, the protruding length of the stay boss from one side of the flange portion can be reduced as much as possible, and consequently the protruding length of the full-closing-stopper boss, vertically aligned with the stay boss, from the flange portion can also be reduced. Thus, this configuration can contribute to reduction in size of the throttle body further.

[0015] According to the fourth aspect of the present invention, the second fastening boss, the second bearing boss and the sensor-supporting boss can be aligned on the other side of the flange portion. In combination with the configuration that the stay boss, the first bearing boss, the return spring and the full-closing-stopper boss are aligned on the one side of the flange portion, significant reduction in size of the entire throttle body can be achieved. In addition, since the sensor-supporting boss is arranged in parallel with the second bearing boss, molding and drilling can be performed on the second bearing boss and the sensor-supporting boss all at once. Hence, excellent processibility is provided.

[0016] According to the fifth aspect of the present invention, the idle adjustment valve is disposed in parallel with the second bearing boss while being adjacent to the sensor-supporting boss. This allows molding and drilling to be performed for an accommodation hole for the idle adjustment valve, the sensor-supporting boss and the second bearing boss all at once. Hence, excellent processibility is provided.

[0017] According to the sixth aspect of the present invention, at the time when the first and second fastening bosses of the flange portion are fastened to the air intake pipe, the three portions, i.e. the seating surfaces of the first and second fastening bosses and the contact seating that protrudes from the surface in which the sealing is formed, come in contact with the end surface of the air intake pipe. With this configuration, the compressive deformation amount of the O-ring in the sealing groove can be regulated accurately, and the sealing function can be maintained for a long time. Moreover, in finishing the surfaces of the flange portion to be in contact with the air intake pipe, to be flush with each other, the processing only needs to be performed for the three portions, i.e. the seating surfaces of the first and second fastening bosses and the contact seating. This can improve the processing efficiency and extend the life of processing tools. Further, the cut-out portion at the downstream end of the bypass and the contact seating are arranged on the opposite sides of the straight line joining the centers of the first and second fastening bosses. This can distribute the portions having complex shapes and improve the run characteristics in molding the throttle body. Furthermore, the cut-out portion at the downstream end of the bypass can be formed by using an enlarged end surface of the flange portion.

BRIEF DESCRIPTION OF DRAWINGS

[0018]

[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 6 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

[0019]

1	throttle body
1a	drum portion
1b	flange portion
2	first fastening boss
2'	second fastening boss
3	fastening bolt
7	air intake path
8	throttle valve
8a	valve stem
9	first bearing boss
9'	second bearing boss
10	throttle drum
11	operation wire
12	guide tube
13	guide tube stay
15	stay boss
16	screw
17	positioning hole
18	positioning pin
20	full-closing-stopper boss
21	full-closing-stopper bolt
23	return spring
25	throttle sensor
26	casing
27	sensor-supporting boss
28	bolt
30	bypass
31	idle adjustment valve
35	cut-out portion
53	sealing groove
54	O-ring
55	straight line
56	contact seating

BEST MODE FOR CARRYING OUT THE INVENTION

[0020] 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

[0021] 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.

[0022] 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.

[0023] 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.

[0024] 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.

[0025] 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.

[0026] 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.

[0027] 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.

[0028] 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.

[0029] 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.

[0030] 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.

[0031] 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.

[0032] 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.

[0033] 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).

[0034] 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.

[0035] 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 second 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.

[0036] 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.

[0037] 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.

[0038] 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.

[0039] 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.

[0040] 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.

[0041] 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.

[0042] 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.

[0043] 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.

[0044] 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.

[0045] 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.

[0046] 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 form the idle intake air.

[0047] 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.

[0048] 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.

[0049] 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.

[0050] 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 include seating surfaces 2a and 2a' formed thereon to 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.

[0051] Since the three portions, i.e. the seating surfac-

es 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.

[0052] 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. Moreover, 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.

Claims

1. An air intake control device for an engine in which a pair of first and second bearing bosses (9, 9') are integrally formed respectively on opposite side walls of a throttle body (1) having an air intake path (7) therein, the first and second bearing bosses (9, 9') supporting a valve stem (8a) of a throttle valve (8) for opening and closing the air intake path (7), a throttle drum (10) is fixed to one end portion of the valve stem (8a) to be adjacent to the first bearing boss (9), an operation wire (11) is connected to the throttle drum (10) while a return spring (23) biasing the throttle drum (10) in a closing direction of the throttle valve (8) is disposed around the first bearing boss (9), and a casing (26) of a throttle sensor (25) connected to the valve stem (8a) for detecting an opening degree of the throttle valve (8) is fitted to the second bearing boss (9'),
characterized in that
the throttle body (1) includes a drum portion (1a) having the air intake path (7) therein and a flange portion (1b) protruding from an outer periphery of one end portion of the drum portion (1a) and having an end surface in a substantially square form, and at least a pair of first and second fastening bosses (2, 2') fastened to an air intake pipe (5) of the engine with fastening bolts (3) are integrally formed respectively at corner portions of the flange portion (1b), the corner portions being respectively at diagonal positions of the flange portion (1b),
the first and second bearing bosses (9, 9') are formed over the flange portion (1b) and the drum portion (1a),
in the flange portion (1b), one of a full-closing-stopper boss (20) and a stay boss (15) which are positioned so as to interpose the first bearing boss (9) and the return spring (23) therebetween is continuously provided to the first fastening boss (2), while the other thereof is formed in the flange portion (1b),
a stopper bolt (21) for restricting a full-closing position of the throttle valve (8) by receiving a stopper arm (10a) integrally formed on the throttle drum (10) is screwed to the full-closing-stopper boss (20),
a screw (16) fixing a guide tube stay (13) supporting a guide tube (12) of the operation wire (11) is screwed to the stay boss (15), and
holes of the full-closing-stopper boss (20) and the stay boss (15) are arranged in parallel with the air intake path (7).

2. The air intake control device for an engine according to claim 1, wherein
a positioning pin (18) is formed on the stay boss (15) in parallel with the screw (16), and is fitted to a positioning hole (17) formed in the guide tube stay (13), and
a full-opening position of the throttle valve (8) is restricted by stopping the stopper arm (10a) with the alignment pin (18).

3. The air intake control device for an engine according to claim 1, wherein
the first fastening boss (2) is disposed to partially overlap with the drum portion (1a) in a plan view, and the stay boss (15) is continuously provided on an outer side of the first fastening boss (2).

4. The air intake control device for an engine according to claim 3, wherein
a sensor-supporting boss (27) positioned so as to interpose the second bearing boss (9') between the second fastening boss (2') and the sensor-supporting boss (27) is formed in the flange portion (1b),
a bolt (28) fixing the casing (26) of the throttle sensor (25) is screwed to the sensor-supporting boss (27), and
the bolt (28) is arranged in parallel with the second bearing boss (9').

5. The air intake control device for an engine according to claim 4, wherein

a bypass (30) is formed in the throttle body (1), the bypass (30) communicating with the air intake path (7) while bypassing the throttle valve (8), and
an idle adjustment valve (31) for opening and closing the bypass (30) is disposed in parallel with the second bearing boss (9') and adjacent to the sensor-supporting boss (27).

6. The air intake control device for an engine according to claim 4, wherein
a cut-out portion (35) serving as a downstream end portion of the bypass (30) is formed in an end surface of the flange portion (1b),
a sealing groove (53) surrounding the air intake path (7) and the cut-out portion (35) is formed in one of facing surfaces respectively of the flange portion (1b) and the air intake pipe (5) fastened to each other,
an O-ring (54) is attached to the sealing groove (53) so as to be in close contact with the other of the facing surfaces,
seating surfaces (2a, 2a') protruding from a surface in which the sealing groove (53) of the flange portion (1b) is formed and being in contact with an end surface of the air intake pipe (5) are formed respectively to the first and second fastening bosses (2, 2'), and
the cut-out portion (35) is disposed on one side of a straight line (55) joining the centers of the respective first and second fastening bosses (2, 2') while a contact seating (56) protruding from the surface in which the sealing groove (53) is formed and being in contact with the end surface of the air intake pipe (5) is formed on the other side of the straight line (55) in the flange portion (1b).

7. The air intake control device for an engine according to claim 6, wherein
the throttle body (1) is formed by die casting, and
the seating surfaces (2a, 2a') and the contact seating (56) are finished to be flush with each other.

FIG.1

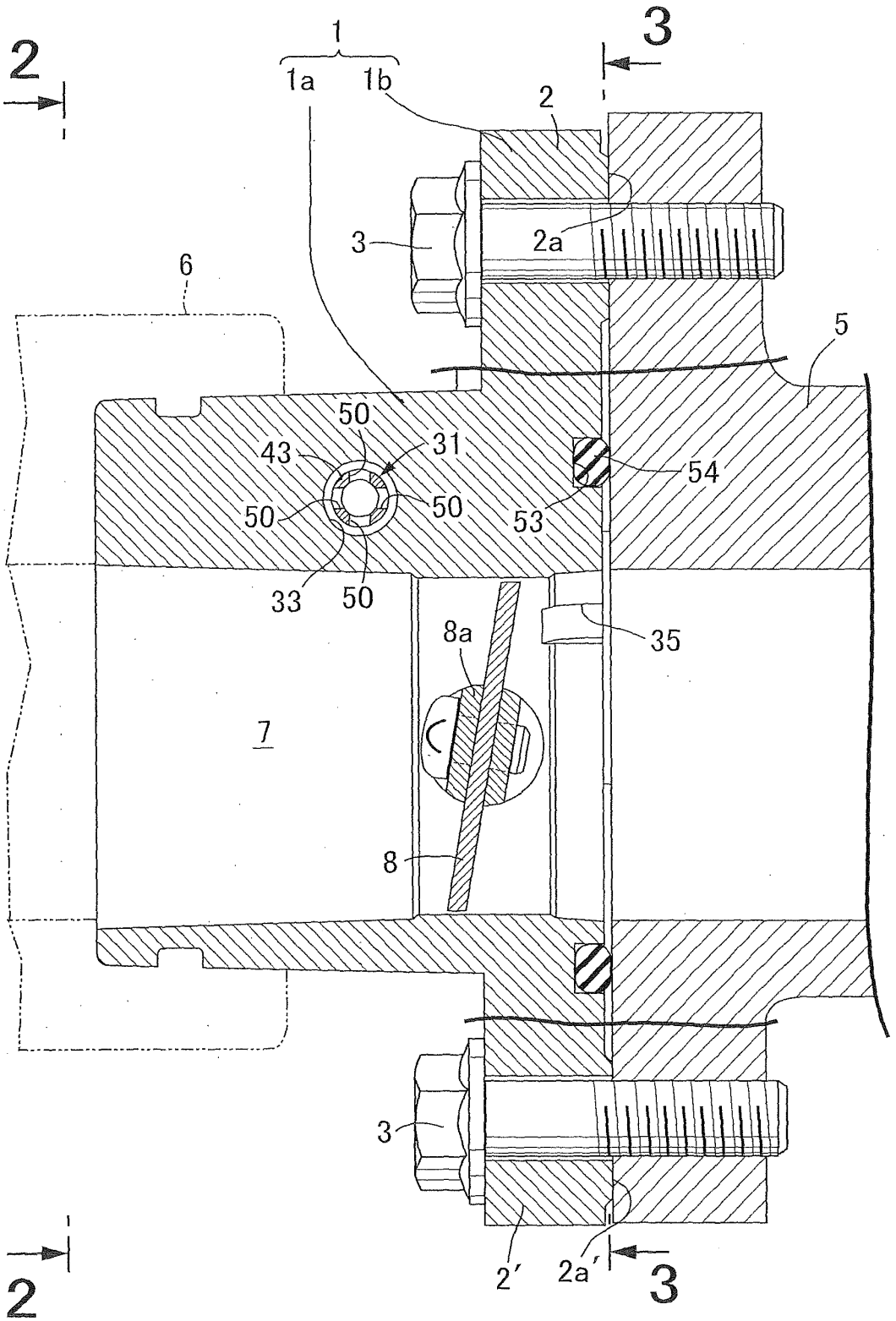
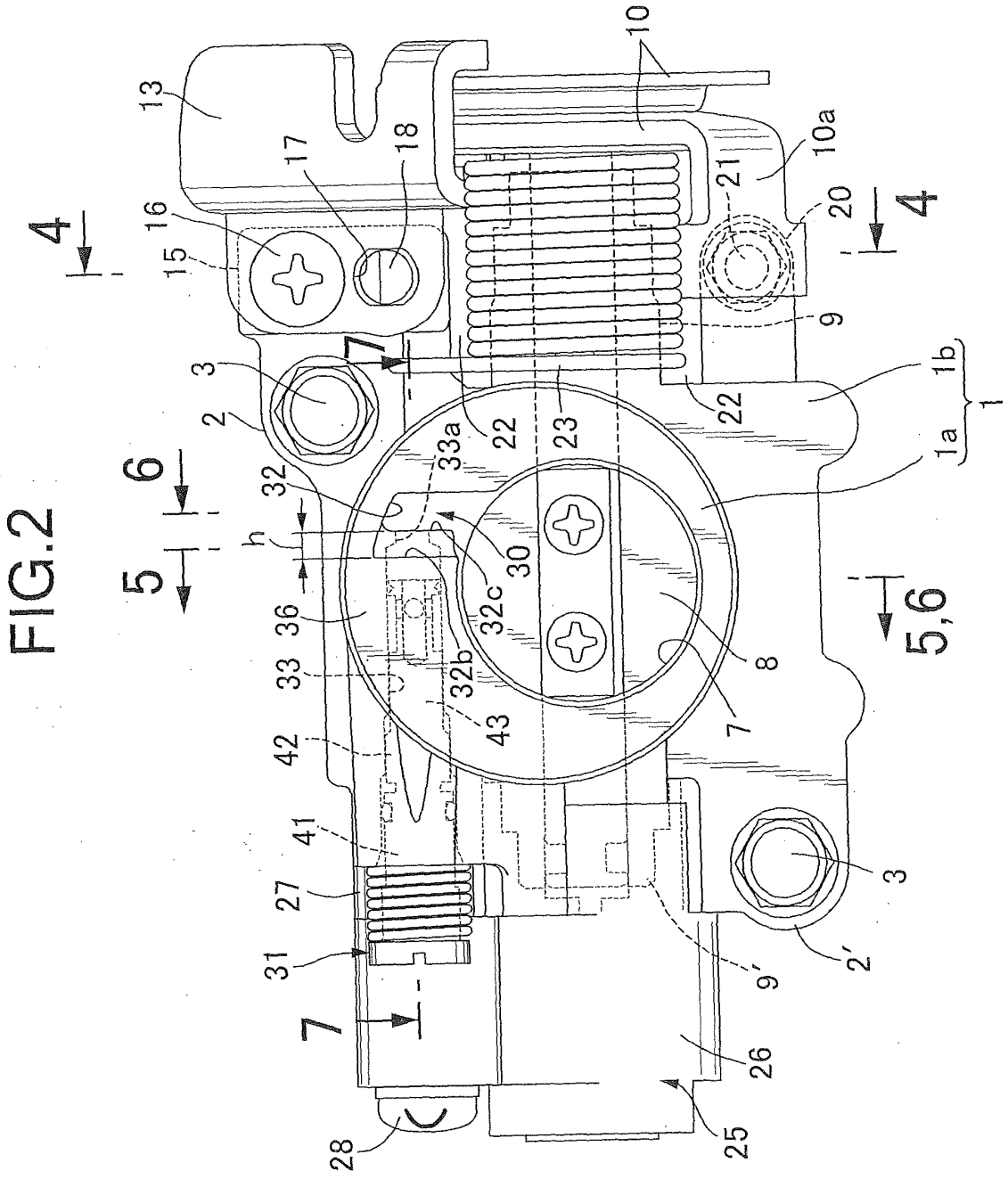


FIG.2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6
32
h
30
5
32c
36
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32b
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43
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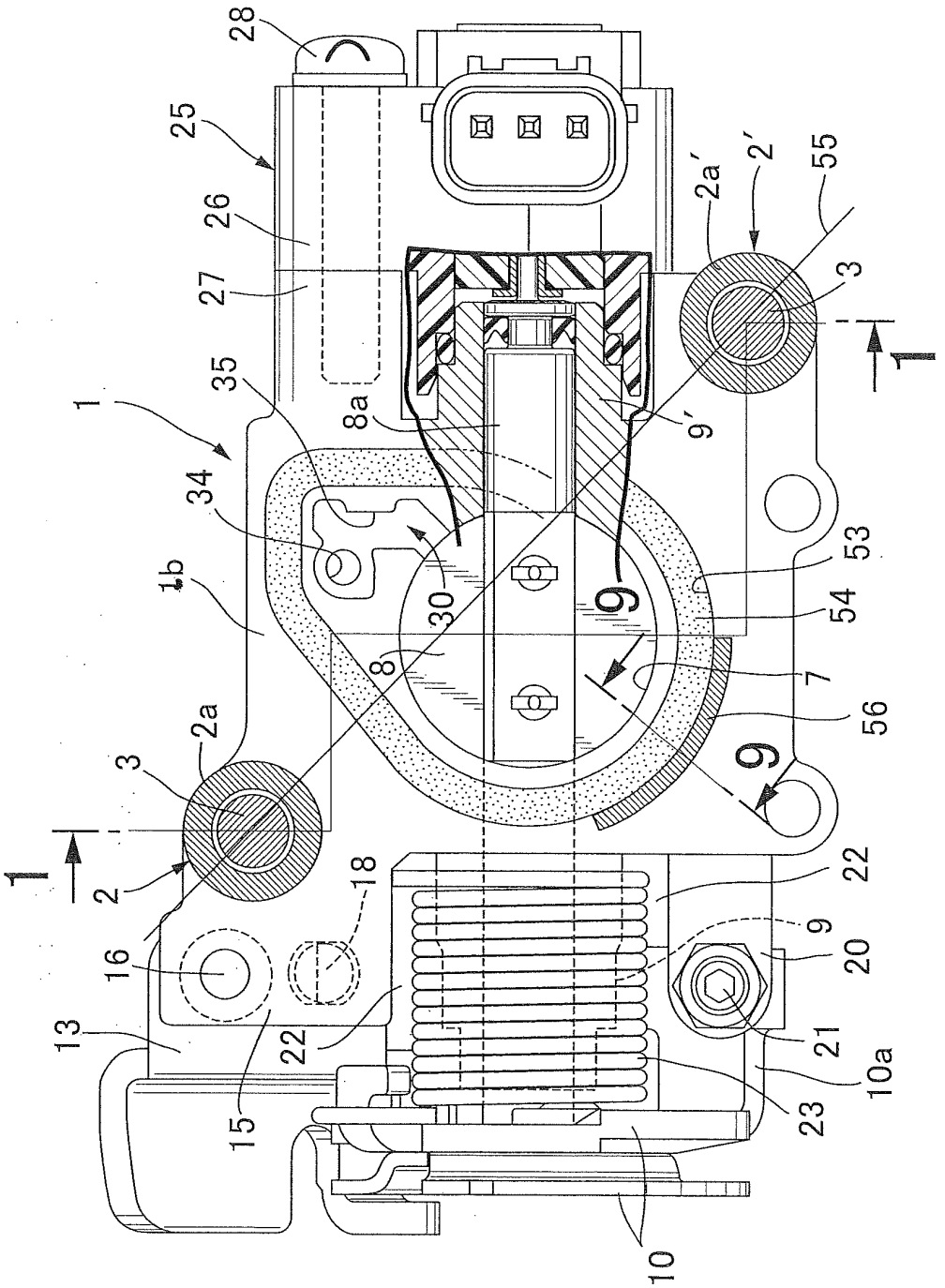
41
3
27
2'
31
9'
7
26
28
25

FIG.3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2a'
2'
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8a
9'
9

FIG.4

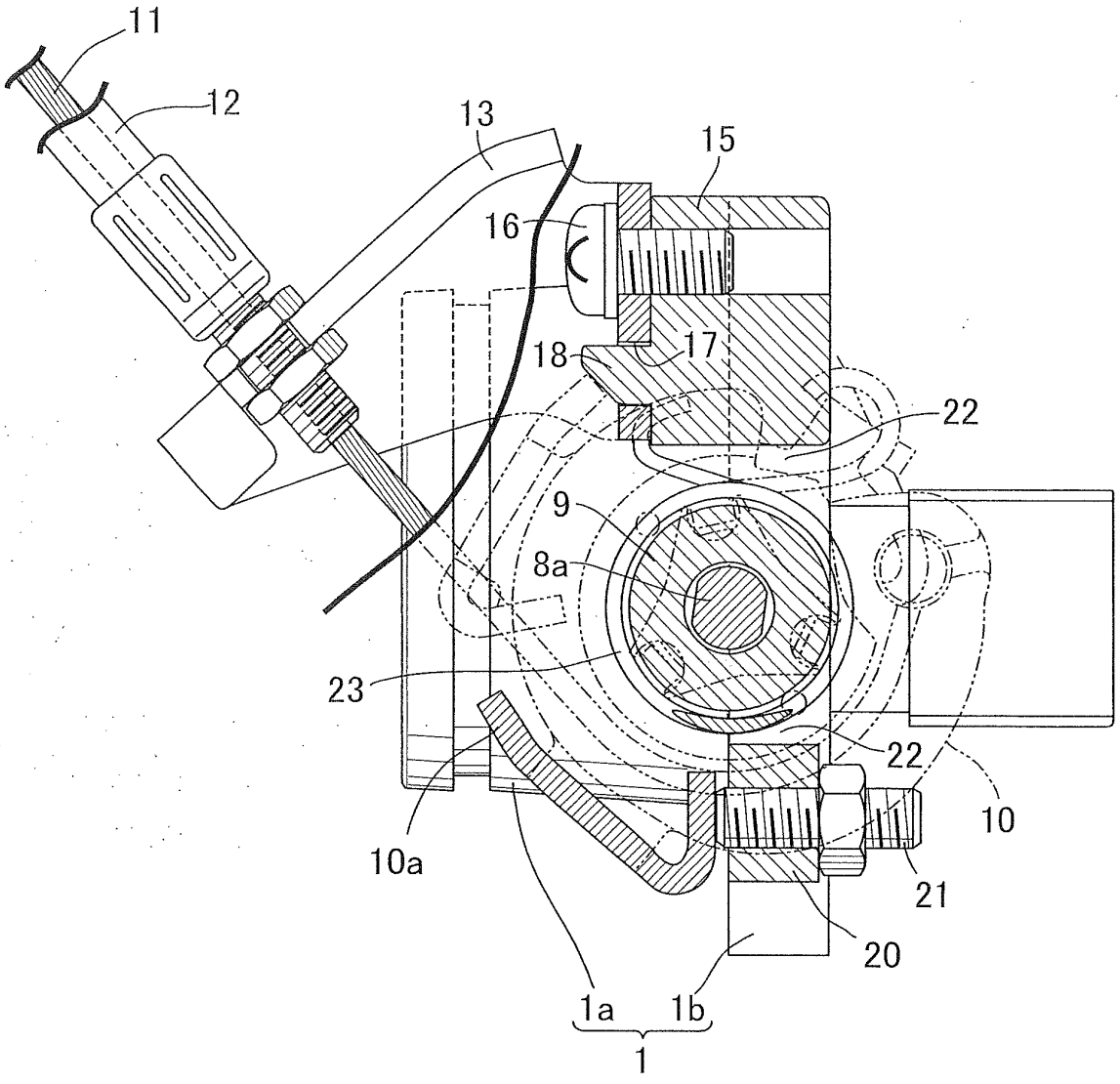

FIG.5

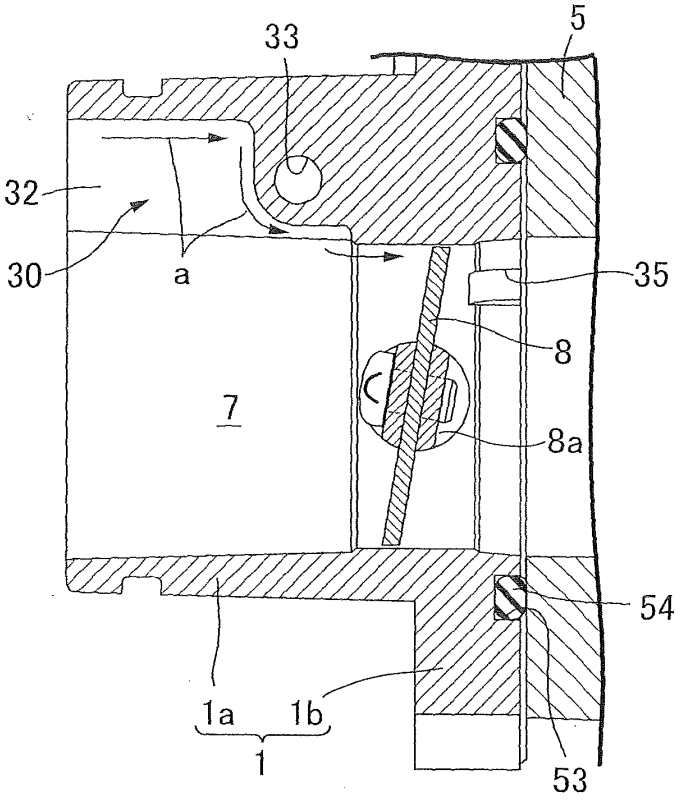
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FIG.6

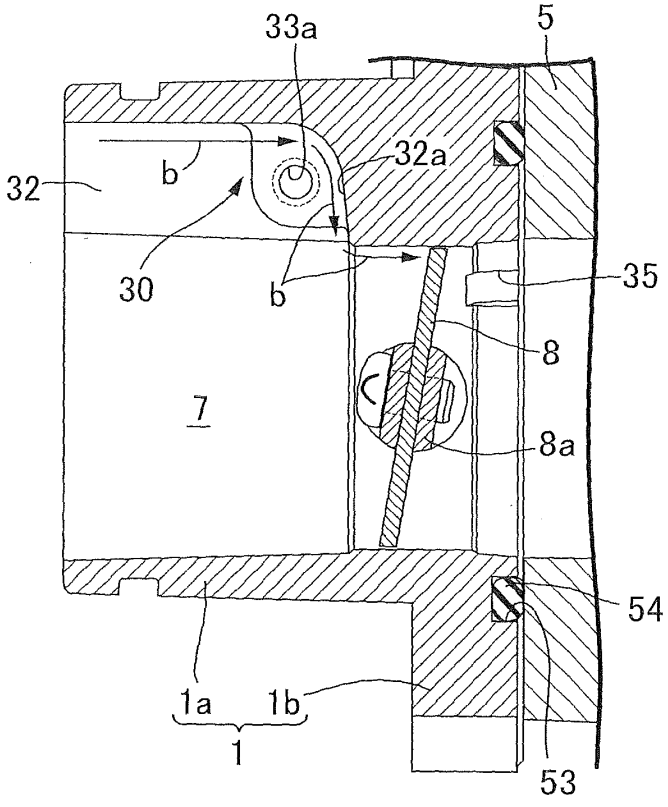
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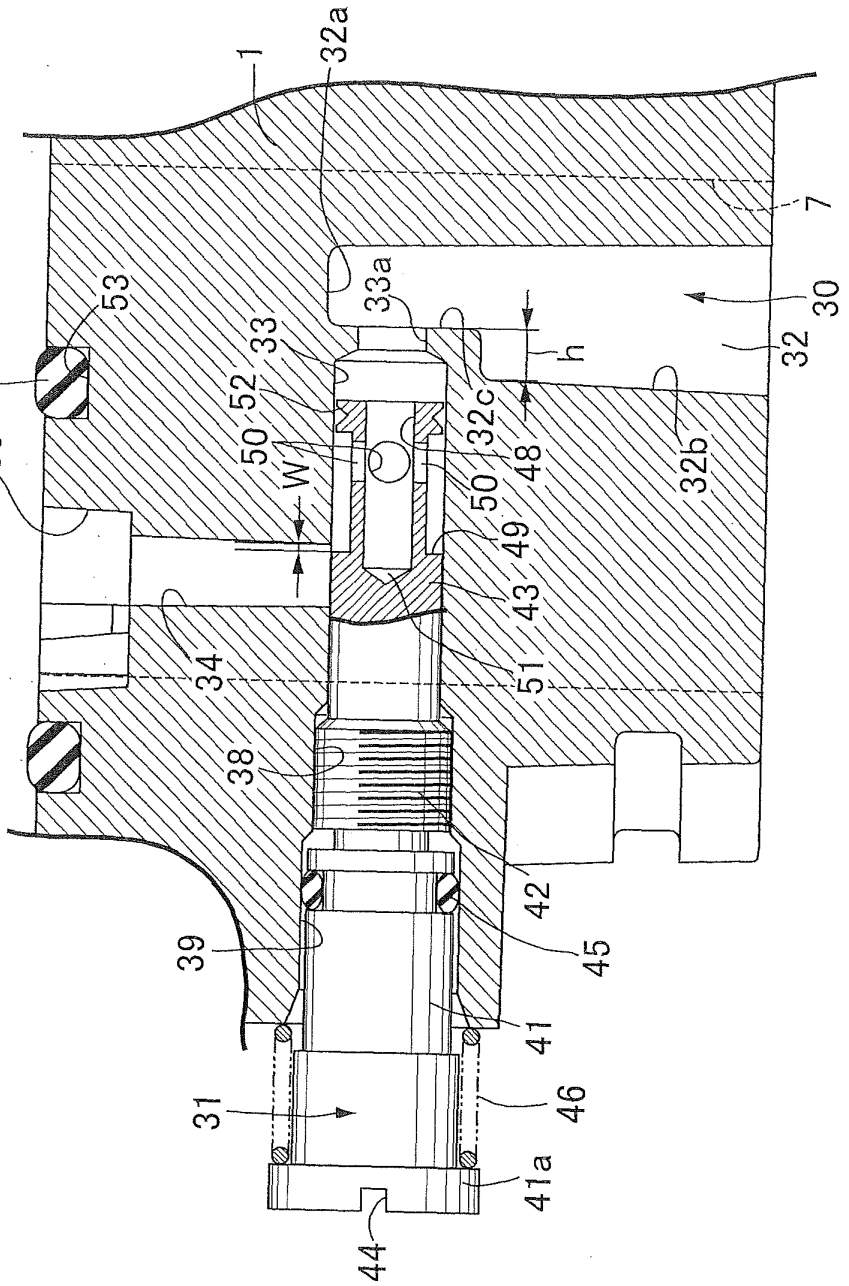
FIG.7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32c
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39
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41
31
46
41a
44

FIG.8

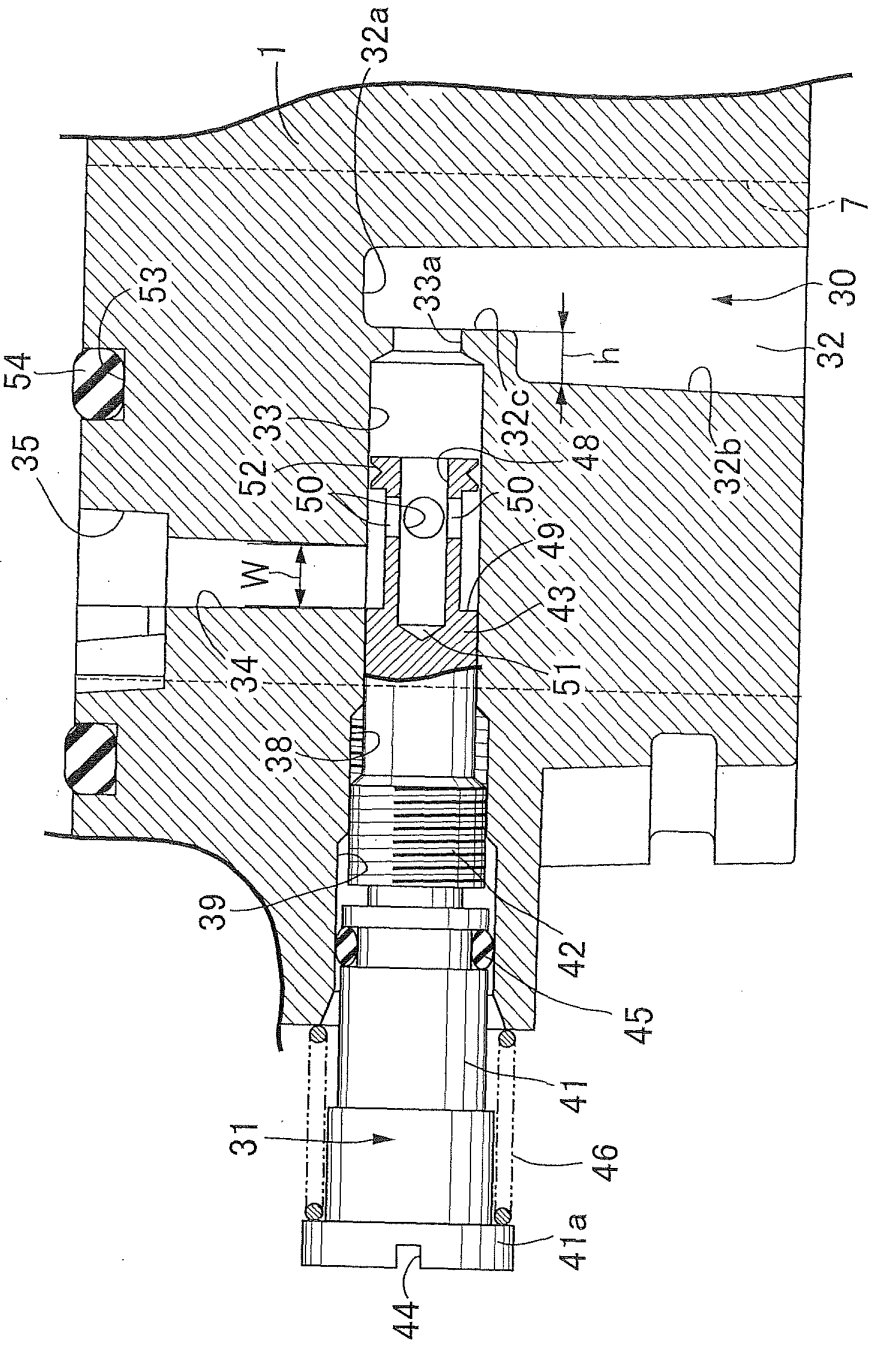
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FIG.9

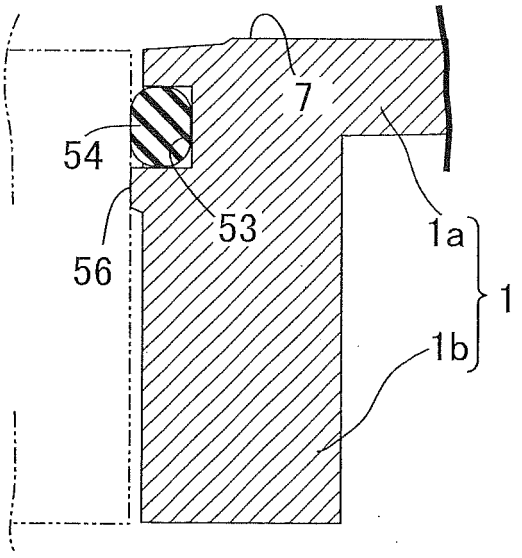
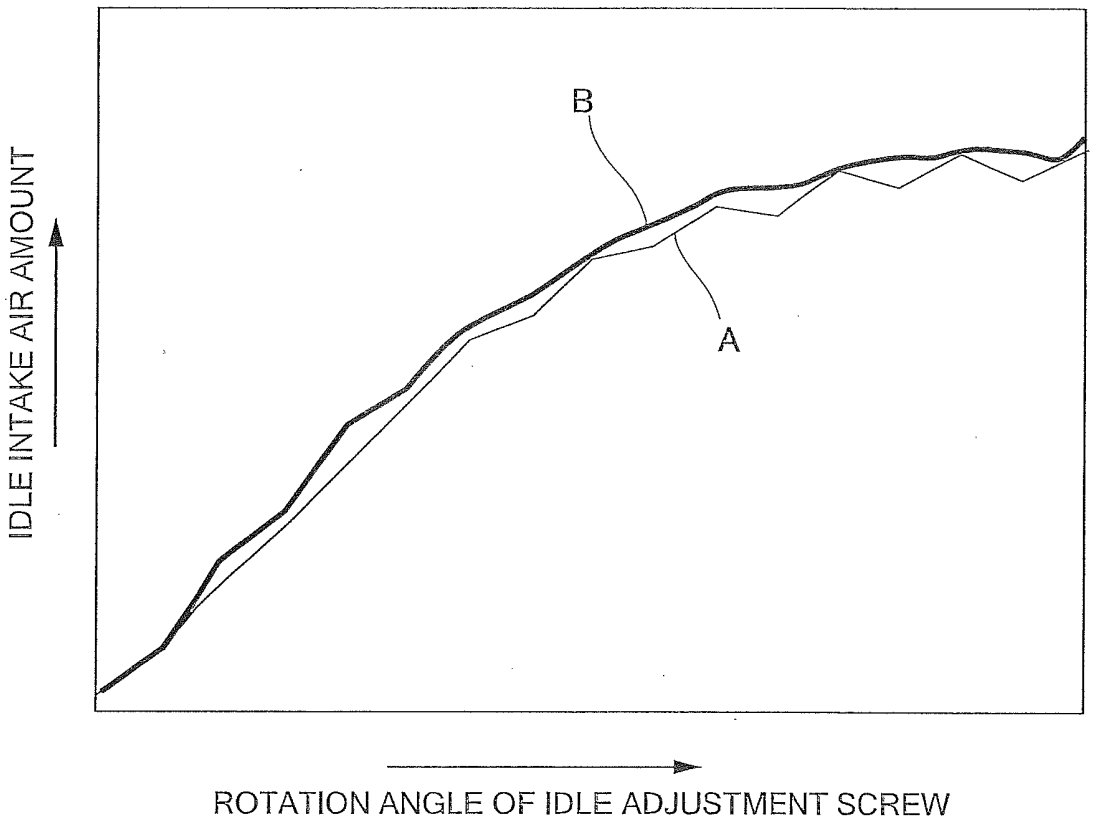


FIG.10


B
A
IDLE INTAKE AIR AMOUNT
ROTATION ANGLE OF IDLE ADJUSTMENT SCREW

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/054324

A. CLASSIFICATION OF SUBJECT MATTER
F02D9/10(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F02D9/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2010
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 2007-303357 A (Kehin Corp.), 22 November 2007 (22.11.2007), entire text; all drawings & US 2007/0272205 A1 & EP 1854977 A2	1-7
A	JP 2001-342913 A (Kehin Corp.), 14 December 2001 (14.12.2001), entire text; all drawings & US 2001/0047797 A1	1-7
A	JP 3-43632 A (Nippondenso Co., Ltd.), 25 February 1991 (25.02.1991), entire text; all drawings (Family: none)	1-7

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 March, 2010 (30.03.10)	13 April, 2010 (13.04.10)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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

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Patent documents cited in the description

- JP 11241667 A **[0002]**