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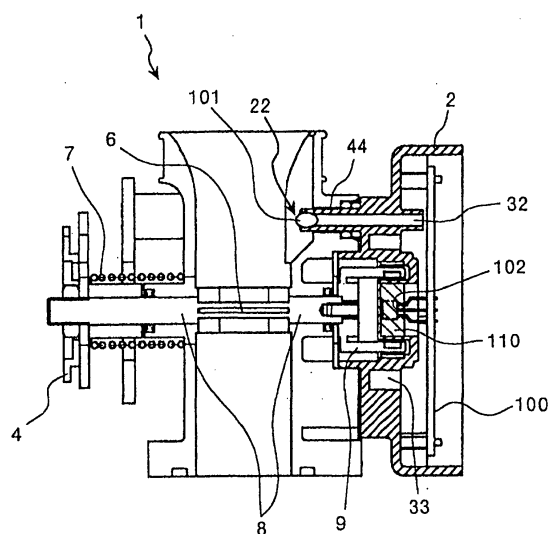
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(54) **ENGINE CONTROLLER, ECU (ELECTRONIC CONTROL UNIT),
ECU CASE, AND TPS (THROTTLE POSITION SENSOR)**

(57) It is an object of the present invention to provide an engine control device, and an electronic control unit (ECU) and ECU case constituting this engine control device, which make it possible to realize a reduction in size and reduction in cost. A throttle body 1 and an ECU case 2 which accommodates an ECU which is manufactured by a separate process from the throttle body 1 are attached by means of screws. The ECU case has internal recesses (31, 32, 33, 34) for accommodating members that protrude from one surface of the circuit board 100, including at least one sensor selected from an intake air pressure sensor, an intake air temperature sensor and a throttle position sensor (TPS), which are attached to one surface of the circuit board 100, and projections (41, 42, 43) formed on the outside of the ECU case 2 by these recesses are attached facing the throttle body 1.

FIG.15



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an engine control device, an electronic control unit (ECU) and ECU case that constitute the abovementioned electronic control device together with a throttle body, and a throttle position sensor (TPS) that detects the degree of opening of the throttle valve of the abovementioned throttle body.

Description of the Related Art

[0002] In the past, for example, a technique in which an ECU (control box) that is integrated with the intake pipe wall of a throttle body, and a board and pressure sensor, temperature sensor or the like that is disposed on this board are fastened inside this ECU, has been disclosed in Japanese Patent Application Laid-Open No. H11-294216 as a technique for integrating a throttle body and ECU for the sake of compactness (saving space) and other reasons.

[0003] Furthermore, as another conventional technique, a technique in which sensors (throttle opening sensor, pressure sensor, temperature sensor and cooling water temperature sensor) are integrally disposed on a throttle body, and the output signals of a plurality of sensors are provided in the form of a plurality of concentrated output terminals, has been disclosed in Kokai (Japanese patent application laid-open) No. H9-250374, for example.

[0004] Furthermore, for example, a technique in which an electronic control device, a throttle mechanism, a throttle adjustment motor and a recovery valve (purge valve) air amount sensor are formed into a pre-assembled, pre-inspected constituent unit, and [this constituent unit] is accommodated in a casing formed in the throttle sleeve, is disclosed in Kohyo (published Japanese translation of PCT patent application) No. H9-508954 as still another conventional technique.

[0005] However, in the abovementioned conventional techniques, when the throttle body and ECU case are molded as an integral unit, a material that is suited to the throttle body must be used in order to ensure the full-closed precision of the throttle, in spite of the fact that no particular precision is required in the ECU case. As a result, there have been cases in which the overall cost is increased. Furthermore, especially in the case of application to two-wheeled vehicles, the caliber of the throttle body is determined by the amount of intake air required in the engine, so that numerous variations with different calibers cannot be set. As a result, there have been cases in which the cost is further increased because mass production is impossible.

[0006] Furthermore, in cases where the ECU case is

formed as an integral unit with the throttle body, the structure of the mold becomes complicated, and the molding of a plurality of units at one time becomes difficult, so that the cost is increased. Moreover, when an integrated ECU case is formed, the material must have a uniform thickness; as a result, the ECU case part has a deeper removal of thickness, so that problems such as the requirement of a large amount of material to fill the resulting space with resin are generated.

[0007] Moreover, if the throttle body and ECU case are integrated, it will restrict the place in the ECU case used for the installation of concentrated input-output terminals that are used to input and output various types of information to and from the ECU and to supply power thereto. Specifically, the concentrated input-output terminals must be installed on the outside of the integrated throttle body and ECU case terminals themselves; as a result, a space for the concentrated input-output terminals themselves and a space for the wiring that is connected to these concentrated input-output terminals must be ensured on the outside of the integrated throttle body and ECU case terminals themselves, so that the overall space occupied by the engine control device is increased by a corresponding amount, thus reducing the degree of freedom of installation of other devices. Furthermore, in the case of two-wheeled vehicles, the installation location of concentrated input-output terminals is a serious problem if restrictions on the vehicle body frame width and damage in the case of a spill are taken into consideration.

[0008] Furthermore, in the case of a conventional TPS, the TPS is ordinarily installed in the vicinity of the throttle valve in order to detect the degree of opening of the throttle valve. This is an especially important condition in cases where the overall device is to be made more compact. Accordingly, liquids such as fuel and the like tend to adhere to the TPS; as a result, there have been instances in which the sensor operates in an erroneous manner. Furthermore, preventing such a problem so that the operating stability is improved has been an important task from the standpoint of insuring safety.

SUMMARY OF THE INVENTION

[0009] The present invention was devised in order to solve the abovementioned problems; it is an object of the present invention to provide an engine control device which makes it possible to realize a compact size and low cost, and an ECU and ECU case that constitute such an engine control device. Furthermore, in light of the abovementioned problems, it is also an object of the present invention to provide a TPS with further improved operating stability, and an engine control device in which such a TPS is mounted.

[0010] In order to solve the abovementioned problems, the engine control device of the invention of claim 1 comprises a throttle body, an ECU case which accommodates an ECU (electronic control unit), and which is

manufactured in a separate process from said throttle body, and attachment means for attaching said throttle body and said ECU case.

[0011] According to this invention of claim 1, an engine control device can be manufactured more easily than in a case where the throttle body and ECU case are manufactured as an integral unit.

[0012] Furthermore, the engine control device of the invention of claim 2 is the invention according to claim 1, wherein a screw is used as the abovementioned attachment means.

[0013] According to this invention of claim 2, the attachment of the throttle body and ECU case can easily be accomplished; furthermore, the removal of the throttle body and ECU case that have been attached can also easily be accomplished.

[0014] Furthermore, the engine control device of the invention of claim 3 is the engine control device according to claim 1 or claim 2, wherein the abovementioned throttle body and the abovementioned ECU case are made of different materials.

[0015] According to this invention of claim 3, a material that is suitable for the throttle body and a material that is suitable for the ECU case can be respectively selected; accordingly, manufacture can be made more efficient, and the cost of materials can be reduced.

[0016] Furthermore, the engine control device of the invention of claim 4 is the invention according to any of claims 1 through 3, wherein the abovementioned ECU case has an internal recess for the purpose of accommodating a members that protrudes from one surface of a circuit board, including at least one sensor selected from a TPS (throttle position sensor), intake air pressure sensor and intake air temperature sensor, which is attached to one surface of the abovementioned circuit board, and the abovementioned attachment means attach the throttle body and the ECU case such that a protruding part formed on the outside of the abovementioned ECU case by the abovementioned recess faces the abovementioned throttle body.

[0017] According to this invention of claim 4, the protruding parts of the ECU case can be accommodated in the space that is generated between the throttle body and the ECU case when the two parts are attached. Accordingly, the engine control device as a whole can be made more compact; furthermore, the surface of the ECU case on the opposite side from the attachment surface attached to the throttle body can be flattened with a minimal width.

[0018] Furthermore, the ECU of the invention of claim 5 is an ECU which is accommodated inside an ECU (electronic control unit) case, and which is equipped with at least one sensor selected from a TPS (throttle position sensor), intake air pressure sensor and intake air temperature sensor, and a circuit board to which the abovementioned sensor or sensors are attached, wherein the attachment of the throttle body and the abovementioned ECU case causes the abovementioned

sensor or sensors to contact or approach a specified part of the throttle body via a hole formed in the abovementioned ECU case, or with the abovementioned ECU case interposed therebetween.

[0019] According to this invention of claim 5, the circuit board and various types of sensors can be integrated; furthermore, waterproofing can be accomplished by accommodating various types of sensors inside the ECU case, so that abnormalities in the outputs of these various types of sensors caused by adhering liquids can be prevented.

[0020] Furthermore, the ECU case of the invention of claim 6 is an ECU case which has a recess that is used for the internal accommodation of a circuit board and at least one sensor selected from a TPS (throttle position sensor), intake air pressure sensor and intake air temperature sensor, which is attached to one surface of the abovementioned circuit board, wherein the attachment is performed with a protruding part formed on the outside of the abovementioned ECU case by the abovementioned recesses facing the throttle body.

[0021] According to this invention of claim 6, an ECU including a circuit board and various types of sensors can be accommodated; furthermore, the size of the engine control device as a whole (integrated throttle body ECU case) can be minimized in the state of attachment to the throttle body.

[0022] Furthermore, according to the invention of claim 7, the ECU case of claim 6 is further provided with concentrated input-output terminals that are used to input and output various types of data, on the surface on which said protruding part is disposed.

[0023] According to this invention of claim 7, a space for the concentrated input-output terminals themselves and a space for the wiring that is connected to these concentrated input-output terminals can be ensured between the integrated throttle body and ECU case itself.

[0024] Furthermore, the TPS of the invention of claim 8 is a TPS in which a magnet that is disposed on a throttle body and that pivots in accordance with the opening and closing of the throttle valve of the abovementioned throttle body, and a stator and Hall element that are disposed inside an ECU (electronic control unit) case, are assembled with the ECU case interposed therebetween, and the degree of opening of the abovementioned throttle valve is detected by using the abovementioned Hall element to detect the variation in magnetic flux that occurs in the abovementioned stator via the abovementioned ECU case as a result of the pivoting of the abovementioned magnet.

[0025] According to this invention of claim 8, the stator and Hall element can be appropriately waterproofed by being housed in the ECU case, and it is possible to prevent abnormal output of the Hall element due to adhesion of liquids.

[0026] Furthermore, the TPS of the invention of claim 9 is the invention according to claim 8, wherein the abovementioned stator is attached to the ECU case, the

abovementioned Hall element is attached to the circuit board, and the abovementioned Hall element is inserted into a specified hollow cavity part in the abovementioned stator when the abovementioned circuit board is accommodated in the abovementioned ECU case.

[0027] According to this invention of claim 9, since the Hall element is attached to the circuit board, assembly with the stator attached to the ECU case is facilitated.

[0028] Furthermore, the engine control device of the invention of claim 10, is equipped with the TPS according to claim 8 or claim 9.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029]

Fig. 1 is a perspective view which shows the engine control device constituting the present embodiment of the present invention;

Fig. 2 is a front view (view seen in the direction indicated by the arrow A in Fig. 1) of the engine control device constituting the present embodiment of the present invention;

Fig. 3 is a side view (view seen in the direction indicated by the arrow B in Fig. 1) of the engine control device constituting the present embodiment of the present invention;

Fig. 4 is a back view (view seen in the direction indicated by the arrow C in Fig. 1) of the engine control device constituting the present embodiment of the present invention;

Fig. 5 is another side view (view seen in the direction indicated by the arrow D in Fig. 1) of the engine control device constituting the present embodiment of the present invention;

Fig. 6 is a front view which shows the ECU case constituting the present embodiment of the present invention;

Fig. 7 is a side view (view seen in the direction of the arrow G in Fig. 6) of the ECU case constituting the present embodiment of the present invention;

Fig. 8 is another side view (view seen in the direction of the arrow H in Fig. 6) of the ECU case constituting the present embodiment of the present invention;

Fig. 9 is a back view which shows the ECU case constituting the present embodiment of the present invention;

Fig. 10 is a sectional view (a view of I-I' in Fig. 9 as seen from the side of J') which shows the ECU case constituting the present embodiment of the present invention;

Fig. 11 is a sectional view (a view of J-J' in Fig. 9 as seen from the side of I') which shows the ECU case constituting the present embodiment of the present invention;

Fig. 12 is an explanatory diagram which shows one part of the construction of the TPS constituting the

present embodiment of the present invention;

Fig. 13 is an explanatory diagram which shows another part of the construction of the TPS constituting the present embodiment of the present invention;

Fig. 14 is an enlarged sectional view (sectional view in Fig. 4) which shows essential parts of the engine control device constituting the present embodiment of the present invention;

Fig. 15 is a sectional view (a view of E-E' in Fig. 2 as seen from the side of F) which shows the engine control device constituting the present embodiment of the present invention;

Fig. 16 is an enlarged sectional view (sectional view in Fig. 4) which shows other essential parts of the engine control device constituting the present embodiment of the present invention;

Fig. 17 is an explanatory diagram (perspective view) which shows the state prior to the attachment of the throttle body and ECU case constituting the present embodiment of the present invention;

Fig. 18 is another explanatory diagram (i. e., another perspective view) which shows the state prior to the attachment of the throttle body and ECU case constituting the present embodiment of the present invention; and

Fig. 19 is an explanatory diagram (perspective view) which shows the state following the attachment of the throttle body and ECU case constituting the present embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0030] Preferred embodiments of the engine control device, ECU, ECU case and TPS of the present invention will be described in detail below with reference to the attached figures. Furthermore, the present invention is not limited to these embodiments; various alterations are possible.

(Construction of Engine Control Device)

[0031] First, the construction of the engine control device constituting the present embodiment of the present invention will be described. Fig. 1 is a perspective view which shows the engine control device constituting the present embodiment of the present invention. Furthermore, Fig. 2 is a front view which shows the engine control device constituting the present embodiment of the present invention; in concrete terms, this figure is a view seen in the direction indicated by the arrow A in Fig. 1. Furthermore, Fig. 3 is a side view which shows the engine control device constituting the present embodiment of the present invention; in concrete terms, this figure is a view seen in the direction indicated by the arrow B in Fig. 1. Furthermore, Fig. 4 is a back view which shows the engine control device constituting the present embodiment of the present invention; in concrete terms,

this figure is a view seen in the direction indicated by the arrow C in Fig. 1. Furthermore, Fig. 5 is another side view which shows the engine control device constituting the present embodiment of the present invention; in concrete terms, this figure is a view seen in the direction indicated by the arrow D in Fig. 1.

[0032] In Figs. 1 through 5, the engine control device is a device that is especially meant for use in a small engine with a small displacement (50 to 250 cc) used in a two-wheeled vehicle, and is constructed from a throttle body 1 and an ECU case 2. Furthermore, the throttle body 1 and ECU case 2 are manufactured in separate processes. Moreover, the throttle body 1 and ECU case 2 may be formed from different materials; for example, the throttle body 1 may be formed from a metal (more concretely, by aluminum die casting), and the ECU case 2 may be formed from a synthetic resin. Depending on the material of the ECU case 2, the ECU can be protected from heat by using a material that is superior in terms of heat-insulating properties.

[0033] Thus, by forming the throttle body 1 and ECU case 2 as separate bodies, and separately producing the mechanical and electrical elements, production costs can be kept even lower, and the performance following assembly can be improved.

[0034] The throttle body 1 uses a butterfly valve system, and is equipped with an injector attachment part 3, throttle lever 4, screws 5, throttle valve 6, return spring 7, throttle shaft 8 (see Fig. 15 and other figures described later) and the like.

[0035] An injector (omitted from the figures) is attached to the injector attachment part 3, and fuel is supplied from this injector. The throttle lever 4 moves in linkage with the movement of an axle (omitted from the figures), and opens and closes the throttle valve 6; the return spring 7 drives the throttle valve 6 toward the full-open side. The screws 5 are shown as an example of attachment means, and connect the throttle body 1 and ECU case 2. In addition, attachment may also be accomplished using an adhesive agent or the like as the attachment means. Furthermore, it would also be possible to form projections and recesses used for attachment in the throttle body 1 and ECU case 2, and to engage the two parts using these recesses and projections. In this case, the abovementioned projections and recesses constitute the attachment means.

[0036] The throttle shaft 8 opens and closes the throttle valve 6 by transmitting the rotational movement of the throttle to the throttle valve 6. Furthermore, a rotor 9 (see Fig. 17 and other figures) is attached to the opposite end of the throttle valve 6 from the throttle lever 4. Details of the rotor 9 will be described later.

(Construction of ECU Case)

[0037] Next, the construction of the ECU case 2 will be described. Fig. 6 is a front view which shows the ECU case 2 constituting the present embodiment of the

present invention. Furthermore, Fig. 7 is a side view (view seen in the direction of the arrow G in Fig. 6) of the ECU case 2 constituting the present embodiment of the present invention. Furthermore, Fig. 8 is another side view (view seen in the direction of the arrow H in Fig. 6) of the ECU case 2 constituting the present embodiment of the present invention. Furthermore, Fig. 9 is a back view which shows the ECU case 2 constituting the present embodiment of the present invention; this figure shows the interior of the ECU case 2.

[0038] In Figs. 6 through 9, 21 indicates a TPS groove (recess), 22 indicates an intake air temperature sensor hole, 23 indicates an intake air pressure sensor hole, 24 indicates concentrated input-output terminals, 25 and 26 indicate screw holes, and 27 indicates a TPS protruding part (projection). Furthermore, 31 indicates a concentrated input-output terminal groove (recess), 32 indicates an intake air temperature sensor groove (recess), 33 indicates an intake air pressure sensor groove (recess), 34 indicates a capacitor groove (recess), 41 indicates a concentrated input-output terminal protruding part (projection), 42 indicates an intake air temperature sensor protruding part (projection), 43 indicates an intake air pressure sensor protruding part (projection), and 44 indicates a capacitor protruding part (projection).

[0039] As is shown in Figs. 6 through 9, the ECU case 2 is formed so that the protruding parts (projections) are all concentrated on the side of one surface (i. e., on the side of the front surface shown in Fig. 6), while the other surface (i. e., the back surface shown in Fig. 9) is in a flat state. As a result of one surface of the ECU case 2 thus being formed in a flat state, there are no unreasonable restrictions on the shapes or sizes of other devices when these other devices are disposed adjacent to this engine control device, so that the engine parts of the two-wheeled vehicle can be made more compact overall. Furthermore, another circuit board can be disposed so that this circuit board is superimposed on the abovementioned flat surface; as a result, the device can be constructed so that there is no great increase in size even if two circuit boards are present.

[0040] Furthermore, the respective protruding parts (projections) that protrude to the outside of the ECU case 2 are formed by forming groove parts (recesses) in the interior of the ECU case 2. Moreover, various types of sensors that are attached and electrically connected to the circuit board 100 (described later), and other electronic members (e. g., capacitors and the like) that are similarly attached and electrically connected to the circuit board 100, are accommodated in the spaces formed by the grooves (recesses) that are formed in the interior of the ECU case 2. Accordingly, the sizes (width, depths) of the abovementioned grooves (recesses) are determined according to the sizes of the abovementioned various types of sensors and other electronic parts.

[0041] Furthermore, in regard to the positions of the

abovementioned respective protruding parts (projections) on the front surface of the ECU case 2, if (for example) these protruding parts are protruding parts used for sensors, the positions are determined by the positions of various parts of the throttle body 1 (positions where sensing is performed) when the throttle body 1 and ECU case 2 are attached. In concrete terms, the TPS protruding part (projection) 27 is disposed in accordance with the shape of the rotor 9, and in a position which allows the rotor 9 to be installed in the TPS groove (recess) 21 when the throttle body 1 and ECU case 2 are attached, so that the rotational angle of the rotor 9 can be detected, as will be described later. Furthermore, the intake air temperature sensor protruding part (projection) 42 and the intake air pressure sensor protruding part (projection) 43 are also similarly disposed in positions that are suitable for the measurement of the intake air temperature or intake air pressure in the throttle body 1 when the throttle body 1 and ECU case 2 are attached.

[0042] Furthermore, if the protruding parts are protruding parts other than protruding parts used for sensors, [the positions of the protruding parts] are determined in accordance with the shape of the throttle body 1. In more concrete terms, the positions are selected utilizing the spaces that are formed in the throttle body 1 and ECU case 2 when the two parts are attached, so that the protruding parts (projections) can be accommodated in these spaces. Accordingly, it is desirable that the respective protruding parts (projections) be disposed so that the abovementioned spaces are as small as possible.

[0043] Furthermore, the concentrated input-output terminals 24 are also disposed on the same surface as the surface on which the abovementioned respective protruding parts (projections) of the ECU case 2 are disposed. As a result, a space for the concentrated input-output terminals 24 themselves and a space for the wiring that is connected to these integrated input-output terminals 24 can be insured between the integrated throttle body 1 and ECU case 2 itself, so that the space occupied by the engine control device as a whole is correspondingly reduced, thus making it possible to increase the degree of freedom in the installation of other devices. In more concrete terms, this is the space [between] the throttle body 1 and ECU case 2 [that is formed] when the two parts are attached; by forming this space on the side of the surface on which the abovementioned respective protruding parts (projections) are disposed, it is possible to facilitate connections with other devices by wiring. Furthermore, waterproofing can be accomplished by using a waterproof connector for the concentrated input-output terminals (connector) 24.

[0044] Here, for example, data that is input into the concentrated input-output terminals 24 includes data such as data relating to the engine temperature from an engine temperature sensor, data relating to the engine rpm from a pick-up, data that is sent from a spill sensor in cases where the two-wheeled vehicle suffers a spill

accident, data from a kickstand neutral sensor that indicates whether or not the kickstand is protruding, and the like. Furthermore, data that is output from the concentrated input-output terminals 24 includes data that is used to control the ignition coil and the like. Furthermore, the supply of power to the ECU is also accomplished via the concentrated input-output terminals 24.

[0045] Thus, it is desirable that the shapes and dispositions of the abovementioned protruding parts (projections) of the ECU case 2 be designed on the basis of a comprehensive evaluation of the shape of the attached throttle body 1, the circuit layout of the circuit board 100 of the ECU, and the like.

[0046] Furthermore, as is shown in Fig. 5, after the ECU (circuit board 100 and various types of sensors that are attached and electrically connected to the circuit board 100) has been accommodated inside the ECU case 2, the interior of the ECU case is molded by filling the interior of the ECU case 2 with a synthetic resin. As a result, complete waterproofing can be realized.

(Construction of TPS)

[0047] Fig. 10 is a sectional view (a view of I-I' in Fig. 9 as seen from the side of J') which shows the ECU case constituting the present embodiment of the present invention. Furthermore, Fig. 11 is a sectional view (a view of J-J' in Fig. 9 as seen from the side of I') which shows the ECU case constituting the present embodiment of the present invention. Furthermore, Fig. 12 is an explanatory diagram which shows one part of the construction of the TPS constituting the present embodiment of the present invention.

[0048] The TPS in the present embodiment is a non-contact type TPS; some of the constituent parts that form the TPS are disposed inside the ECU case 2, while other parts are disposed outside the ECU case 2 with the ECU case positioned therebetween. In Figs. 10 through 12, 110 indicates a stator that is disposed inside the ECU case 2. Furthermore, as is shown in Figs. 10 and 12, 120 is a hollow cavity part in the stator 110; a Hall element 102 which is attached to the circuit board 100 is inserted into this hollow cavity part 120.

[0049] A Hall IC equipped with a temperature correction function is used as the Hall element (hall IC) 102. The circuit board 100 is accommodated in the ECU case in a state in which the Hall element 102 is attached and electrically connected to the circuit board 100. In this case, the assembly of the TPS can easily be accomplished by arranging the system so that the Hall element 102 can be inserted into the hollow cavity part 120 of the stator 110 in this case.

[0050] Fig. 13 is an explanatory diagram which shows another part of the construction of the TPS constituting the present embodiment of the present invention. In Fig. 13, the rotor 9 has a non-tubular shape in which a portion of the cross section is omitted for a specified angle. A permanent magnet 111 is fastened to the inside of the

rotor 9 so that this permanent magnet 111 runs along the inside surface of the rotor 9. Furthermore, 112 indicates an (outer) yoke 112; this outer yoke 112 has a ring-form (tubular) shape, and the diameter of this yoke 112 is greater than the external shape of the rotor 9. Furthermore, the permanent magnet 111 may be fastened to the inside surface of the rotor 9 by bonding or the like as shown in Fig. 13; alternatively, as is shown in Fig. 14 (described later), a groove part may be formed in the inside surface of the rotor 9, and the magnet 111 may be fastened in place by being inserted into this groove part.

[0051] Fig. 14 is an enlarged sectional view (sectional view in Fig. 4) which shows essential parts of the engine control device constituting the present embodiment of the present invention. Fig. 14 shows a state in which the throttle body 1 and ECU case 2 are attached; in this state, the rotor 9 and the magnet 111 that is fastened to the inside surface of the rotor 9 are inserted into the TPS groove (recess) 21. Furthermore, in this state, the (outer) yoke 112 is inserted to the outside of the rotor 9 in the TPS groove (recess) 21.

[0052] Thus, the stator 110 and Hall element 102, and the magnet 111 and (outer) yoke 112, are assembled with the ECU case 2 positioned therebetween; as a result, a TPS is constructed. Furthermore, the magnetic flux that is generated by the magnet 111 as a result of the rotational movement of the throttle shaft 8 (rotor 9) is transmitted to the stator 110 via the ECU case 2, and variations in this magnetic flux are detected by the Hall element 102, so that the rotational angle of the throttle shaft 8, i.e., the degree of opening of the throttle valve 6, can be detected with good efficiency.

[0053] Furthermore, since the stator 110 and Hall element 102 are installed inside the ECU case 2, and do not contact the outside of the ECU case, there is no adhesion of liquids such as fuel or the like to the stator 110 or Hall element 102. Accordingly, abnormalities in output caused by the adhesion of liquids can be effectively prevented.

(Disposition of Circuit Board (Including Sensors), ECU Case and Throttle Body)

[0054] Next, the disposition of the circuit board (including the respective sensors), the ECU case and the throttle body will be described. Fig. 15 is a sectional view (a view of E-E' in Fig. 2 as seen from the side of F) which shows the engine control device constituting the present embodiment of the present invention. Furthermore, Fig. 16 is an enlarged sectional view (sectional view in Fig. 4) which shows other essential parts of the engine control device constituting the present embodiment of the present invention.

[0055] An ECU which is constructed from the circuit board 100, an intake air temperature sensor 101 disposed at the tip end of 22, which is electrically connected to the circuit board 100, and the Hall element 102 which

is similarly electrically connected to the circuit board 100 and which is inserted into a specified hollow cavity part 120 of the stator 110 (as shown in Fig. 15), as well as an intake air pressure sensor 103 and the like shown in Fig. 16, is accommodated in the ECU case. Furthermore, the respective sensors 101 through 103 detect various conditions of the throttle body 1 by contacting or approaching the throttle body 1 via the ECU case 2.

[0056] In particular, in Fig. 15, the rotation of the throttle lever 4 causes the throttle shaft 8 to rotate, so that the throttle valve 6 opens and closes. At the same time, the rotational angle of the rotor 9 disposed on the tip end of the throttle shaft 8 is detected by the TPS; in this way, the degree of opening of the throttle valve 6 is detected.

(Attachment of Throttle Body and ECU Case)

[0057] Next, one example of the attachment of the throttle body 1 and ECU case will be described. Fig. 17 is an explanatory diagram (perspective view) which shows the state prior to the attachment of the throttle body and ECU case constituting the present embodiment of the present invention. Furthermore, Fig. 18 is a perspective view seen from a different angle than Fig. 17. Furthermore, Fig. 19 is an explanatory diagram (perspective view) which shows the state following the attachment of the throttle body and ECU case constituting the present embodiment of the present invention. Furthermore, for convenience of description, an example of attachment in a state in which the ECU is not accommodated in the ECU case 2 is shown in Figs. 17 through 19. In actuality, the ECU case is attached to the throttle body after the circuit board has already been disposed inside the ECU case 2, and the ECU case has been filled with a synthetic resin and molded.

[0058] The state prior to the attachment of the throttle body 1 and ECU case 2 is seen from Figs. 17 and 18. Furthermore, as is shown in Fig. 19, the throttle body 1 and ECU case 2 are joined together, and the two parts are fastened by means of the screws 5. In this case, attachment is accomplished in a state in which the protruding surface (surface with projections) of the ECU case 2 faces toward the throttle body 1. Furthermore, the device is constructed so that in the state in which attachment has been accomplished, the abovementioned projections make contact in some areas, while the throttle body 1 and ECU case 2 are engaged in other areas.

[0059] In the present invention, as was described above, a throttle body and an ECU case that constitute separate bodies are attached so that the formation of a space is prevented as far as possible. Accordingly, the present invention offers the following merit: specifically, an engine control device and an ECU and ECU case forming this engine control device which make it possible to realize both reduced size and reduced cost at the same time can be obtained. Furthermore, the present invention also possesses the following merit: specifical-

ly, a TPS which makes it possible to improve the operating stability can be obtained.

Claims

1. An engine control device comprising:

a throttle body;
an ECU case which accommodates an electronic control unit (ECU), and which is manufactured in a separate process from said throttle body; and
attachment means for attaching said throttle body and said ECU case.

2. The engine control device according to claim 1, wherein a screw is used as said attachment means.

3. The engine control device according to claim 1 or claim 2, wherein said throttle body and said ECU case are made of different materials.

4. The engine control device according to any of claims 1 through 3, wherein said ECU case has an internal recess for the purpose of accommodating a member that protrudes from one surface of a circuit board, including at least one sensor selected from a throttle position sensor (TPS), intake air pressure sensor and intake air temperature sensor, which is attached to one surface of said circuit board; and

said attachment means attach said throttle body and said ECU case such that a protruding part formed on the outside of said ECU case by said recess faces said throttle body.

5. An electronic control unit (ECU) which is accommodated inside an ECU case, and which is equipped with at least one sensor selected from a throttle position sensor (TPS), intake air pressure sensor and intake air temperature sensor, and a circuit board to which said sensor or sensors are attached,

wherein the attachment of the throttle body and said ECU case causes said sensor or sensors to contact or approach a specified part of the throttle body via a hole formed in said ECU case, or with said ECU case interposed therebetween.

6. An electronic control unit (ECU) case which has a recess that is used for the internal accommodation of a circuit board and at least one sensor selected from a throttle position sensor (TPS), intake air pressure sensor and intake air temperature sensor, which is attached to one surface of said circuit board,

wherein the attachment is performed with a protruding part formed on the outside of said ECU

case by said recess facing the throttle body.

7. The ECU case according to claim 6, wherein concentrated input-out terminals that are used to input and output various types of data are disposed on the surface on which said protruding part is disposed.

8. A throttle position sensor (TPS), wherein a magnet that is disposed on a throttle body and that pivots in accordance with the opening and closing of the throttle valve of said throttle body, and a stator and Hall element that are disposed inside an electronic control unit (ECU) case, are assembled with the ECU case interposed therebetween; and

wherein the degree of opening of said throttle valve is detected by using said Hall element to detect the variation in magnetic flux that occurs in said stator via said ECU case as a result of the pivoting of said magnet.

9. The TPS according to claim 8, wherein said stator is attached to the ECU case, said Hall element is attached to the circuit board, and said Hall element is inserted into a specified hollow cavity part in said stator when said circuit board is accommodated in said ECU case.

10. An engine control device which is equipped with the TPS according to claim 8 or claim 9.

FIG. 1

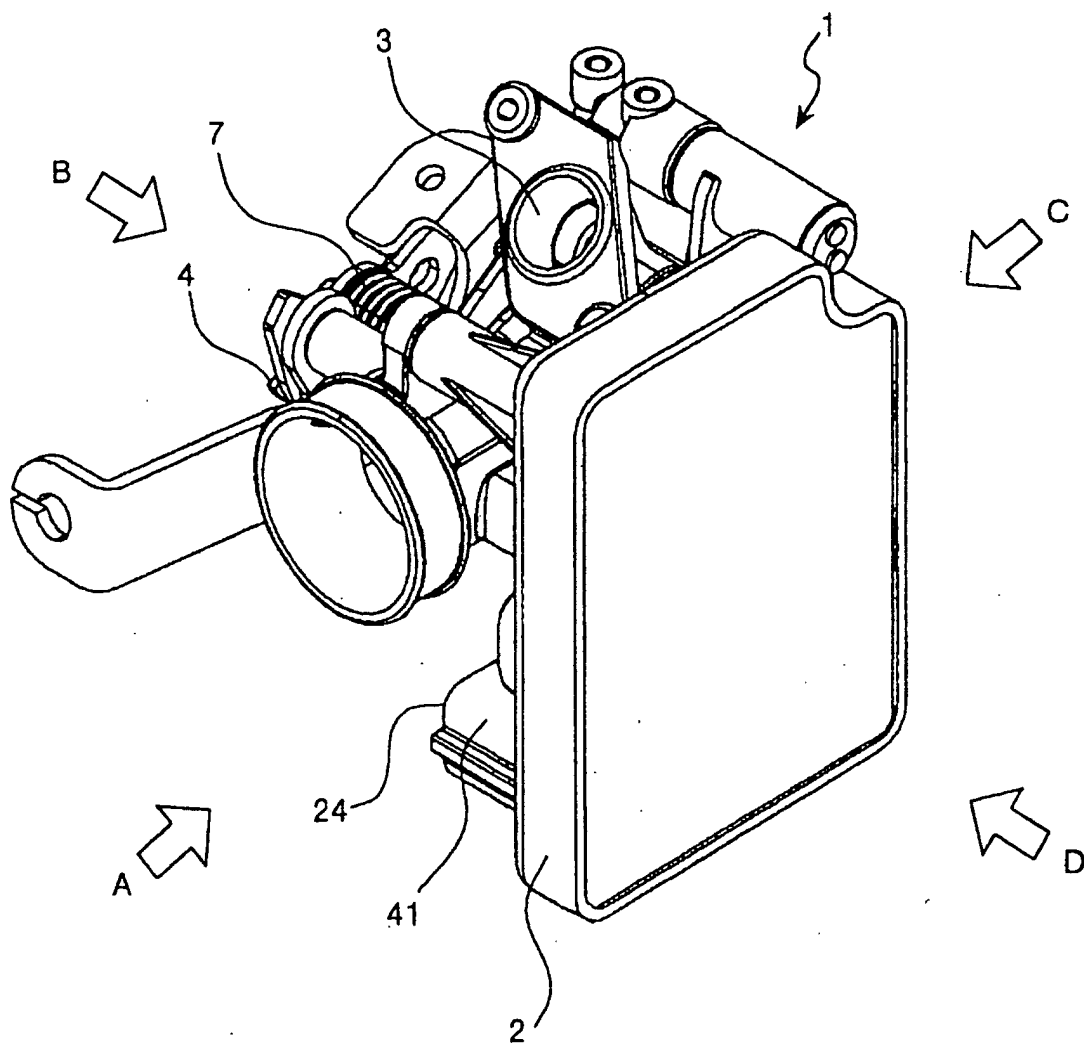


FIG.2

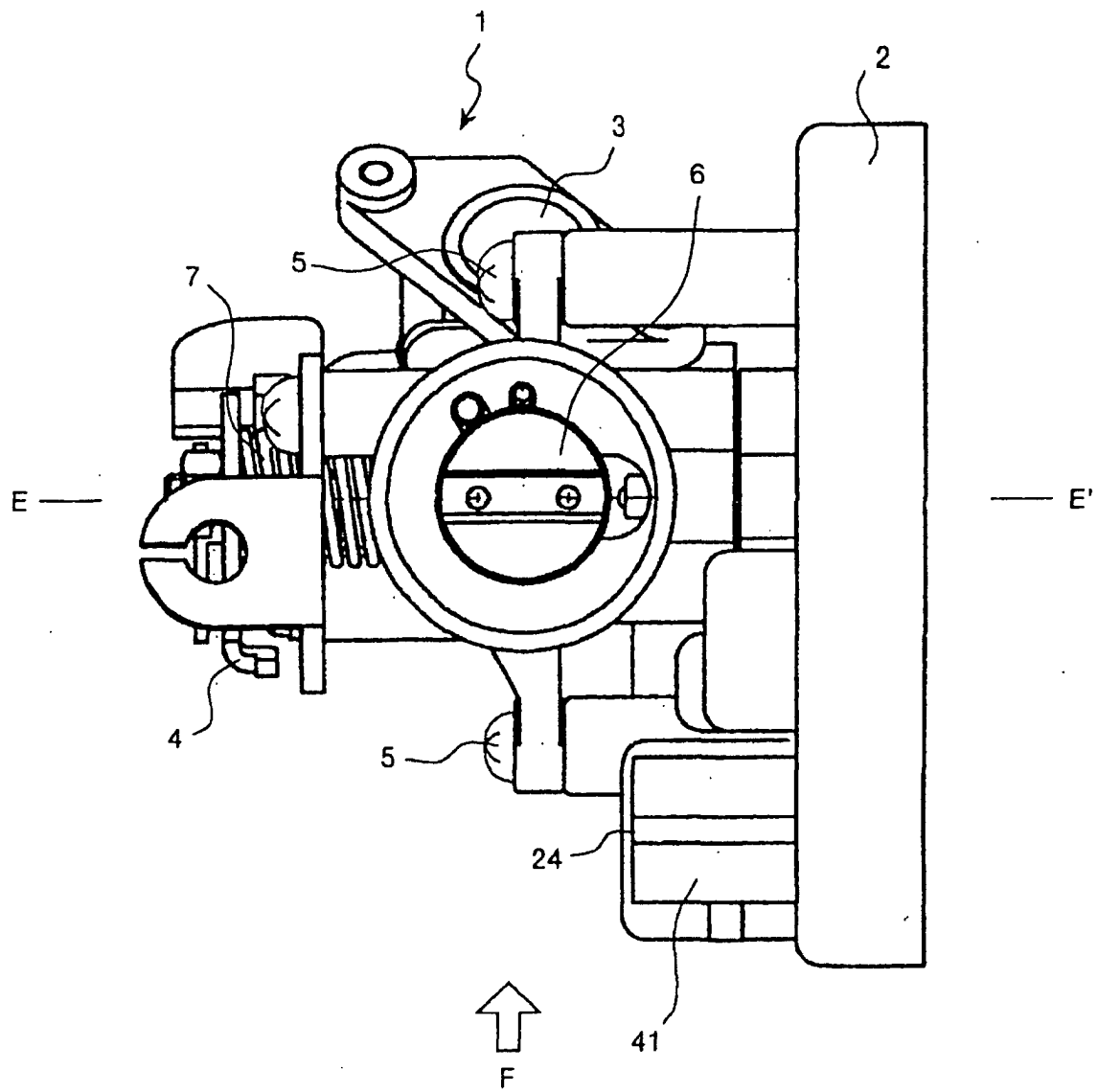


FIG.3

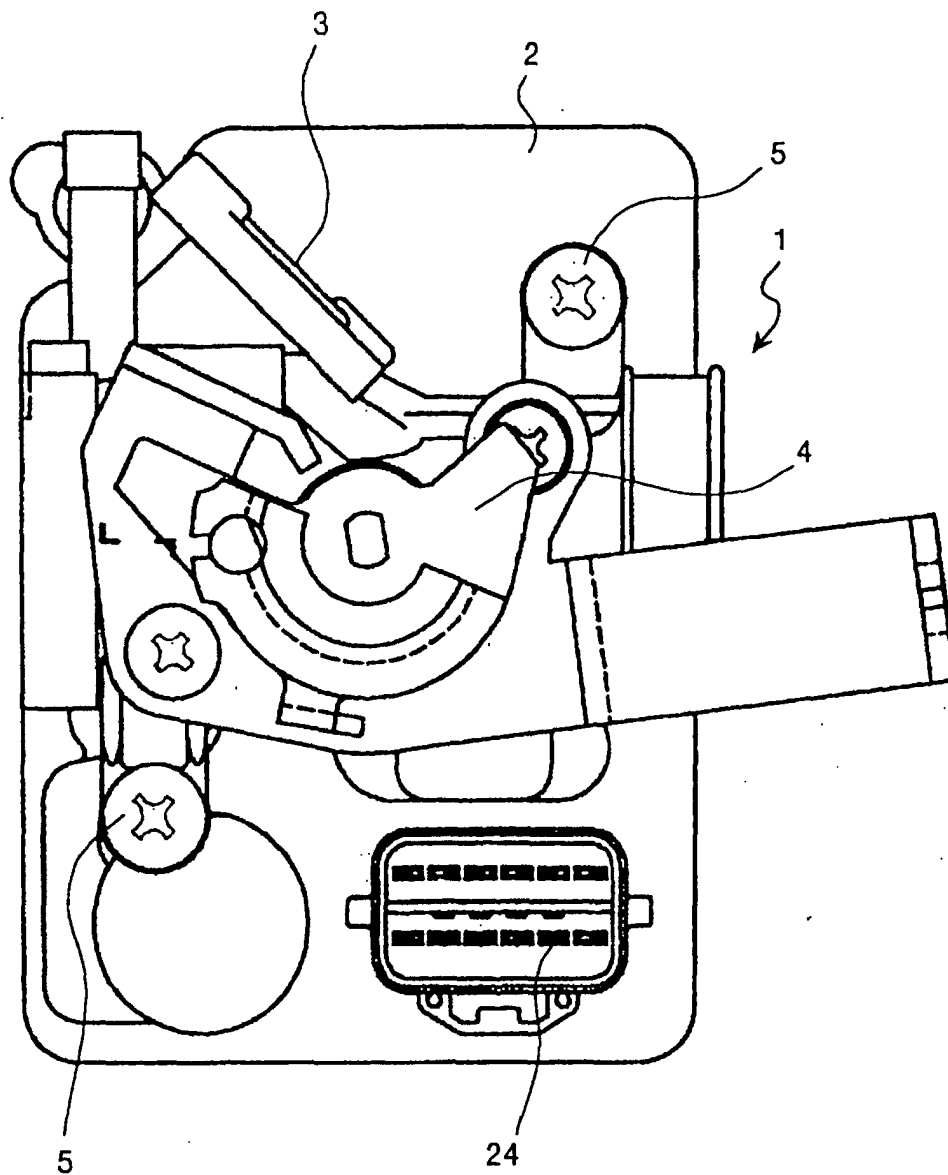


FIG.4

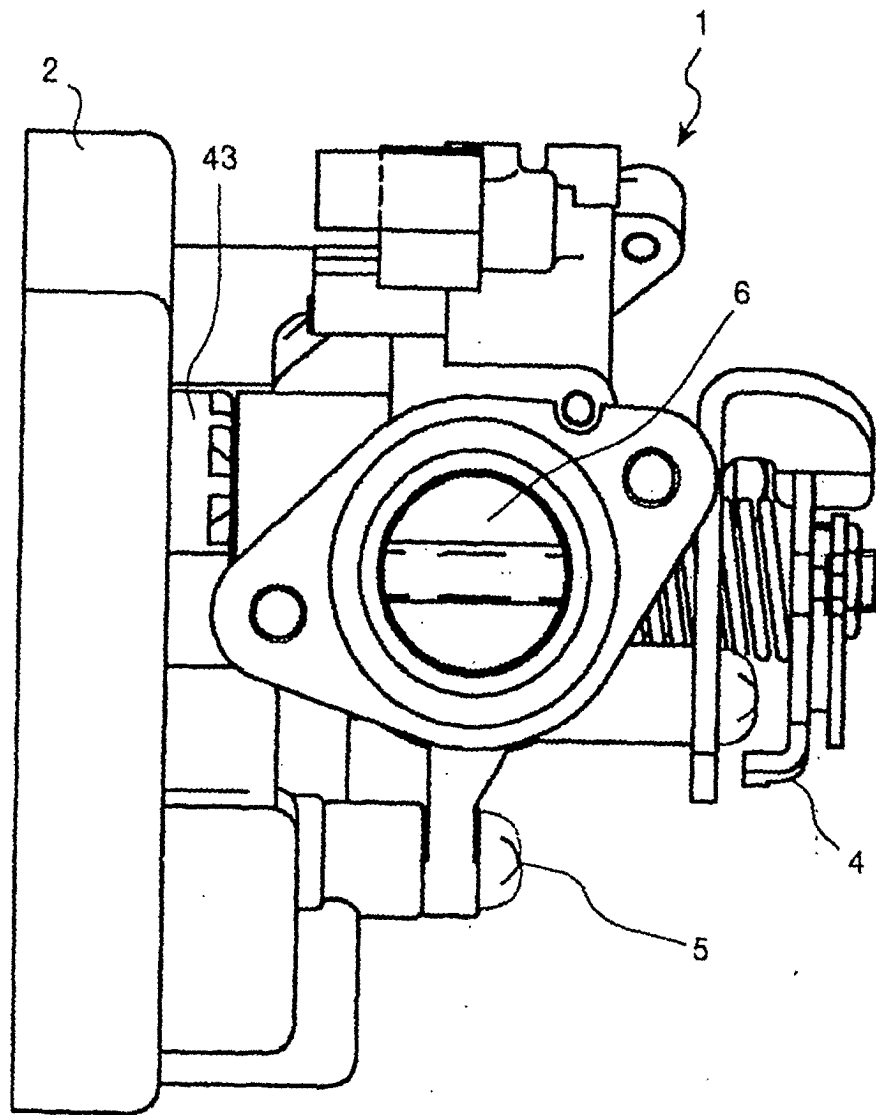


FIG.5

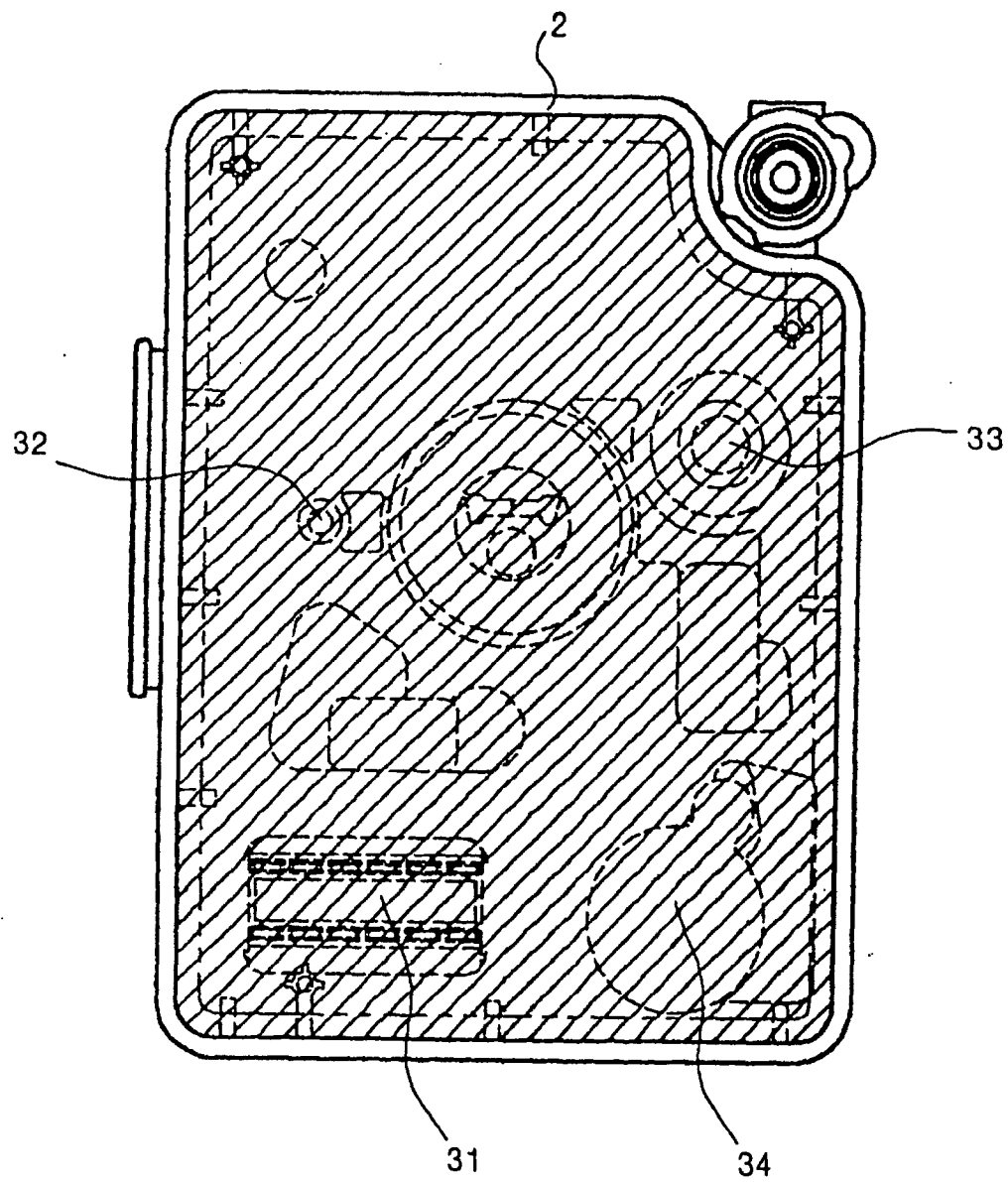


FIG.6

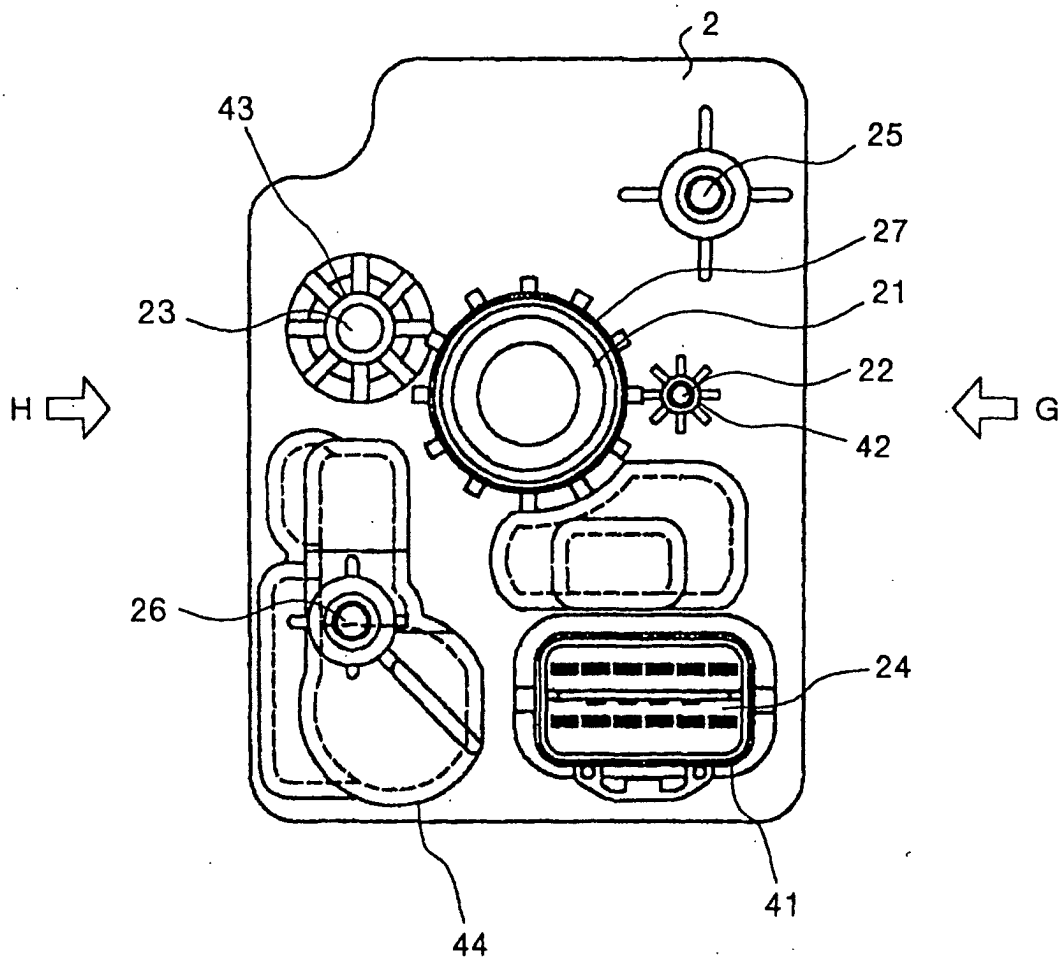


FIG.7

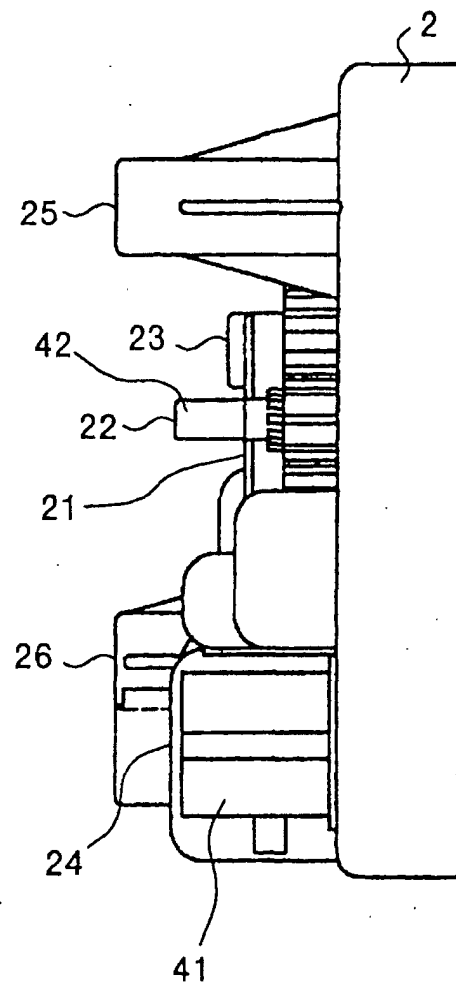


FIG.8

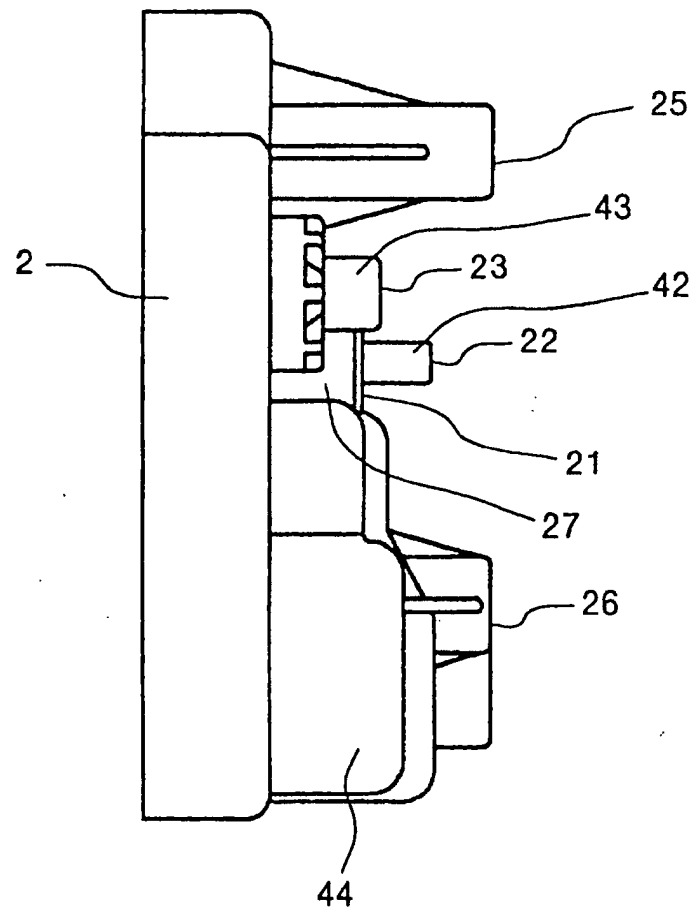


FIG.9

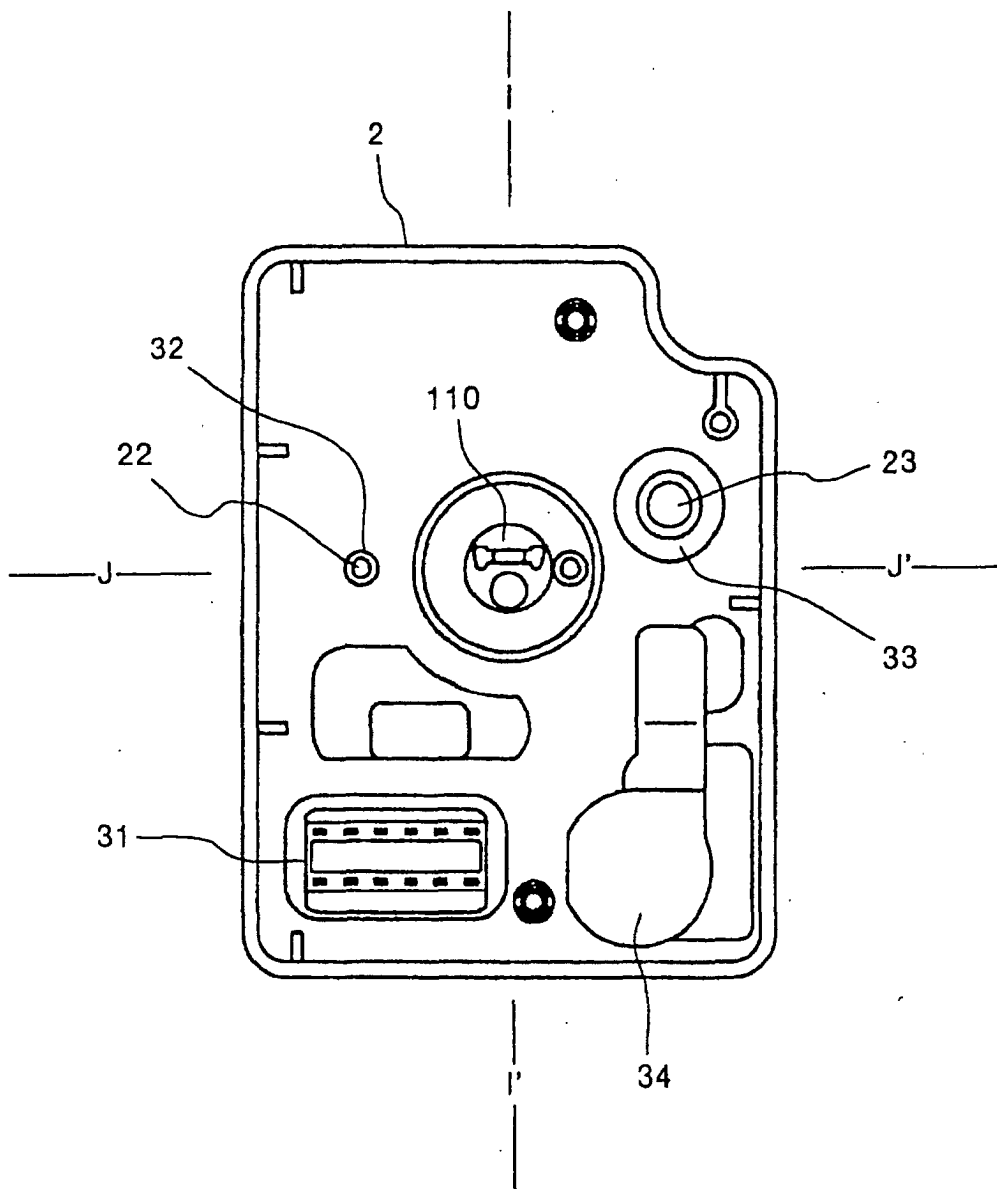


FIG.10

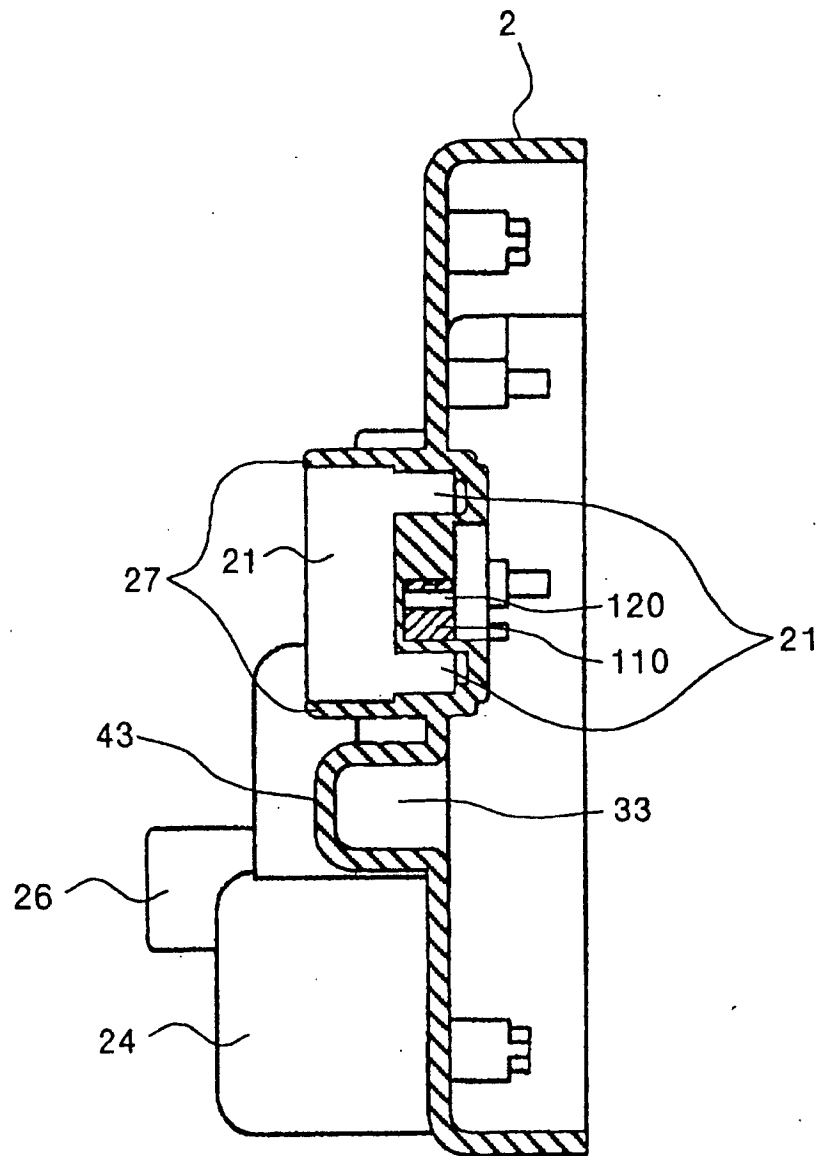


FIG.11

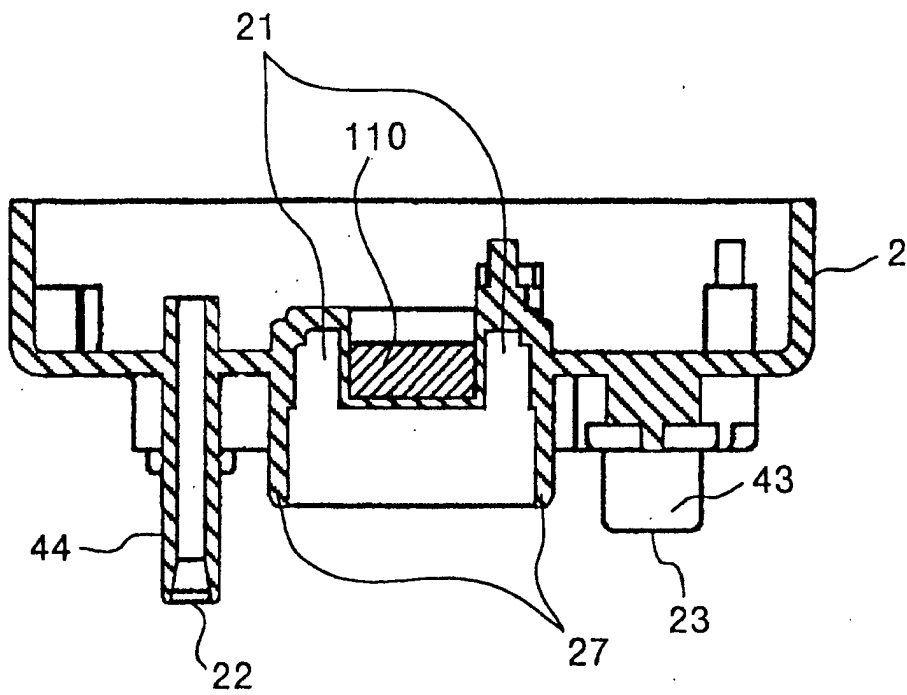


FIG. 12

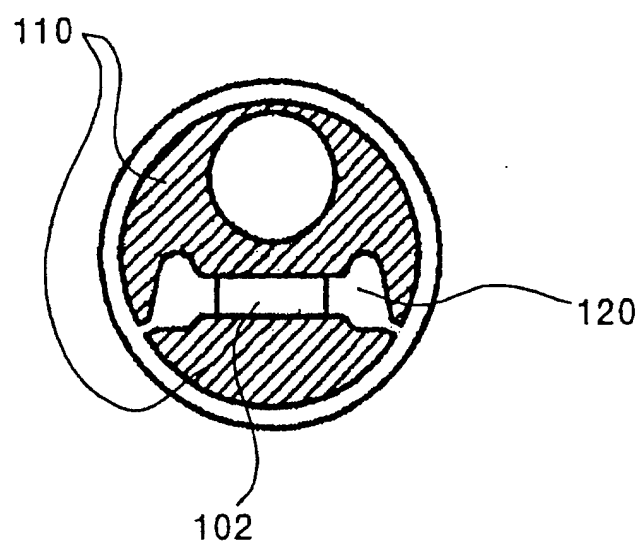


FIG.13

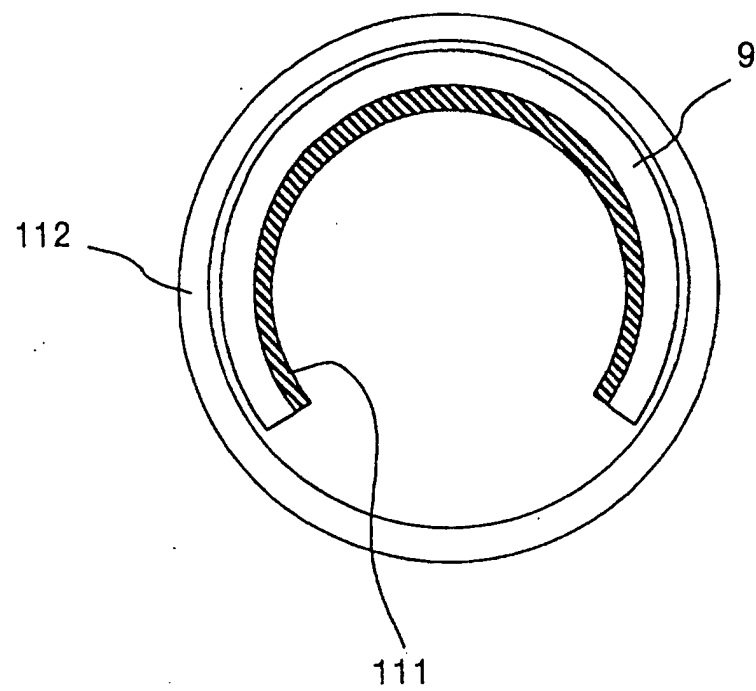


FIG. 14

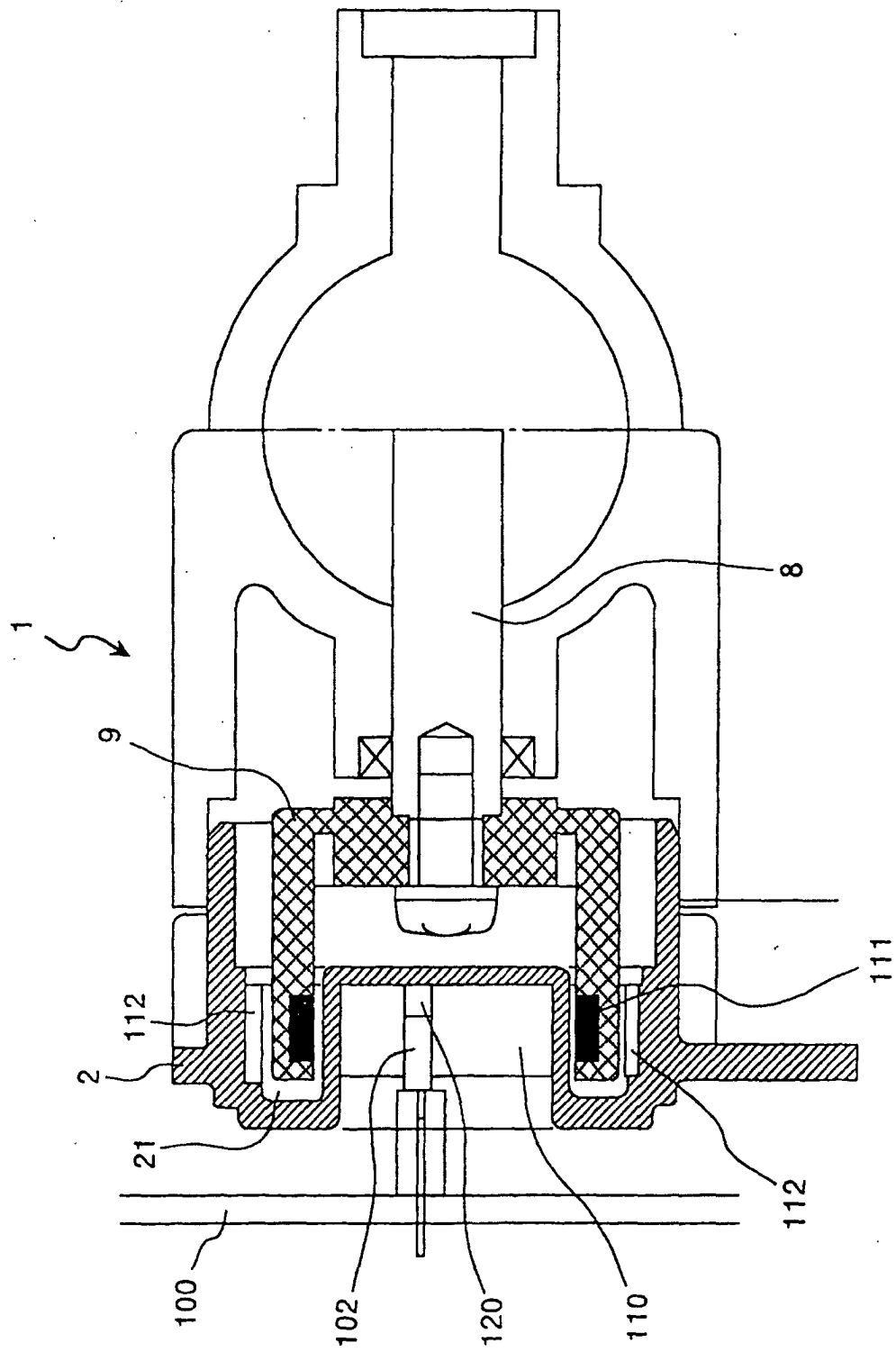


FIG.15

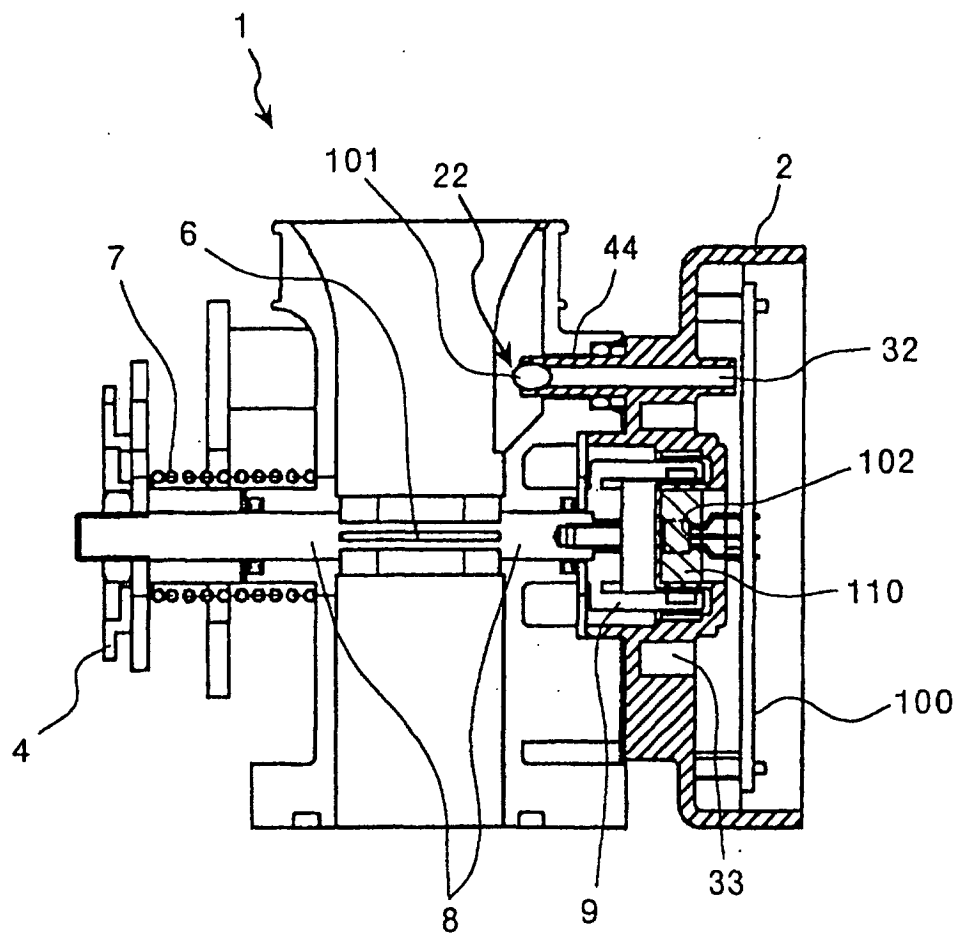


FIG.16

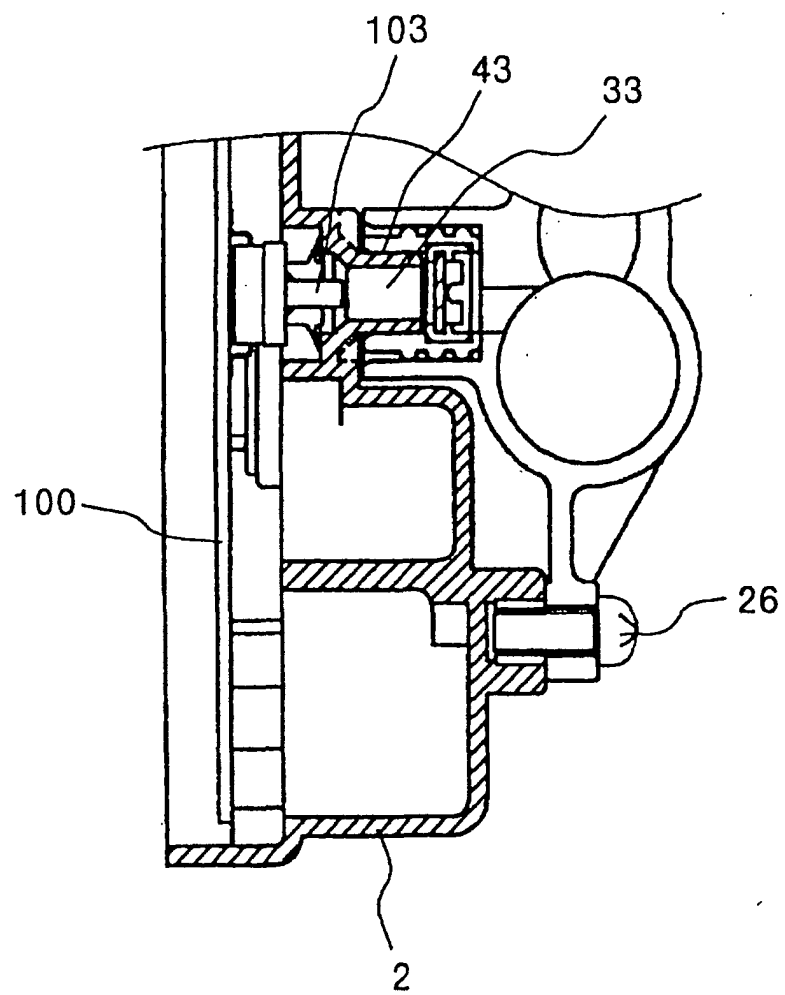


FIG.17

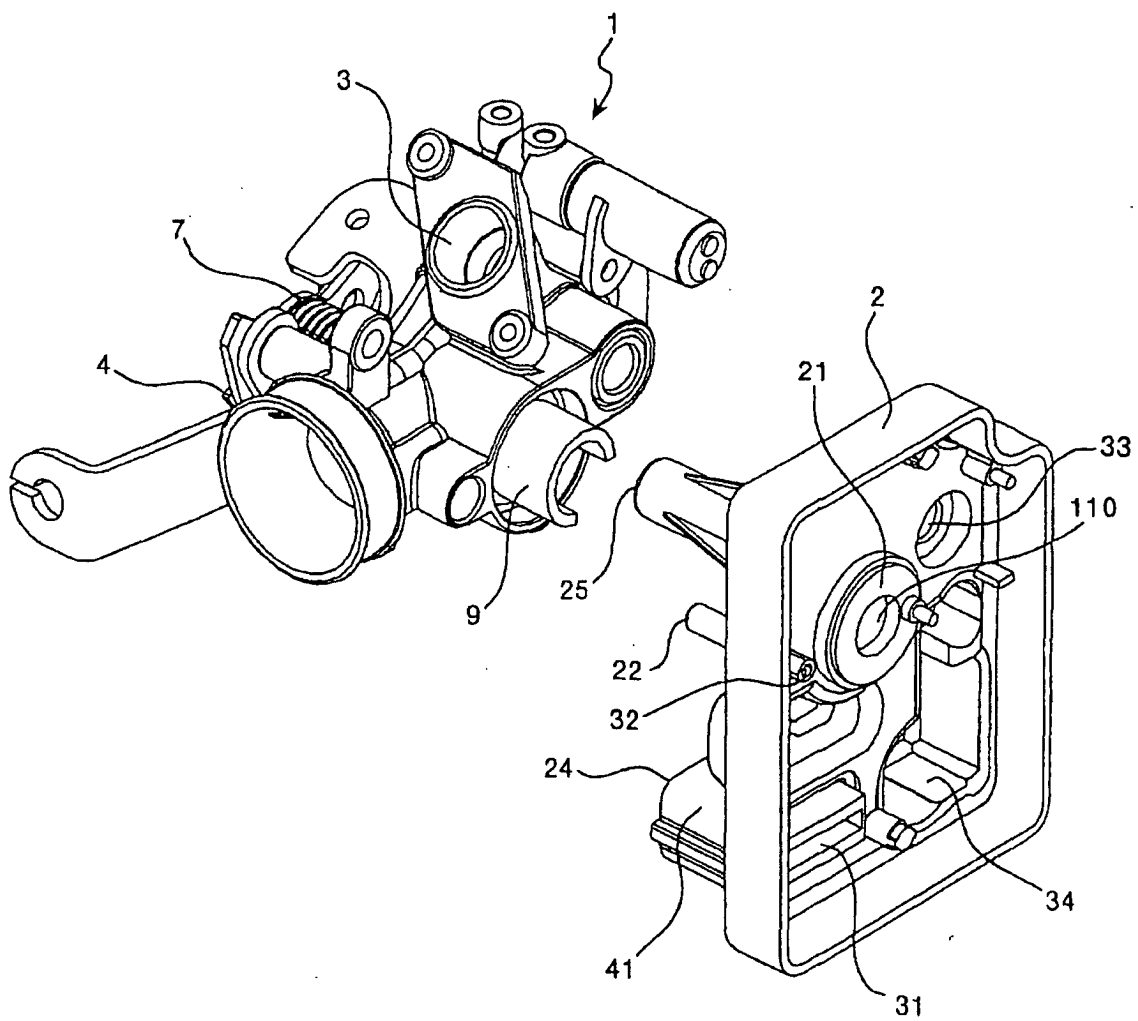


FIG.18

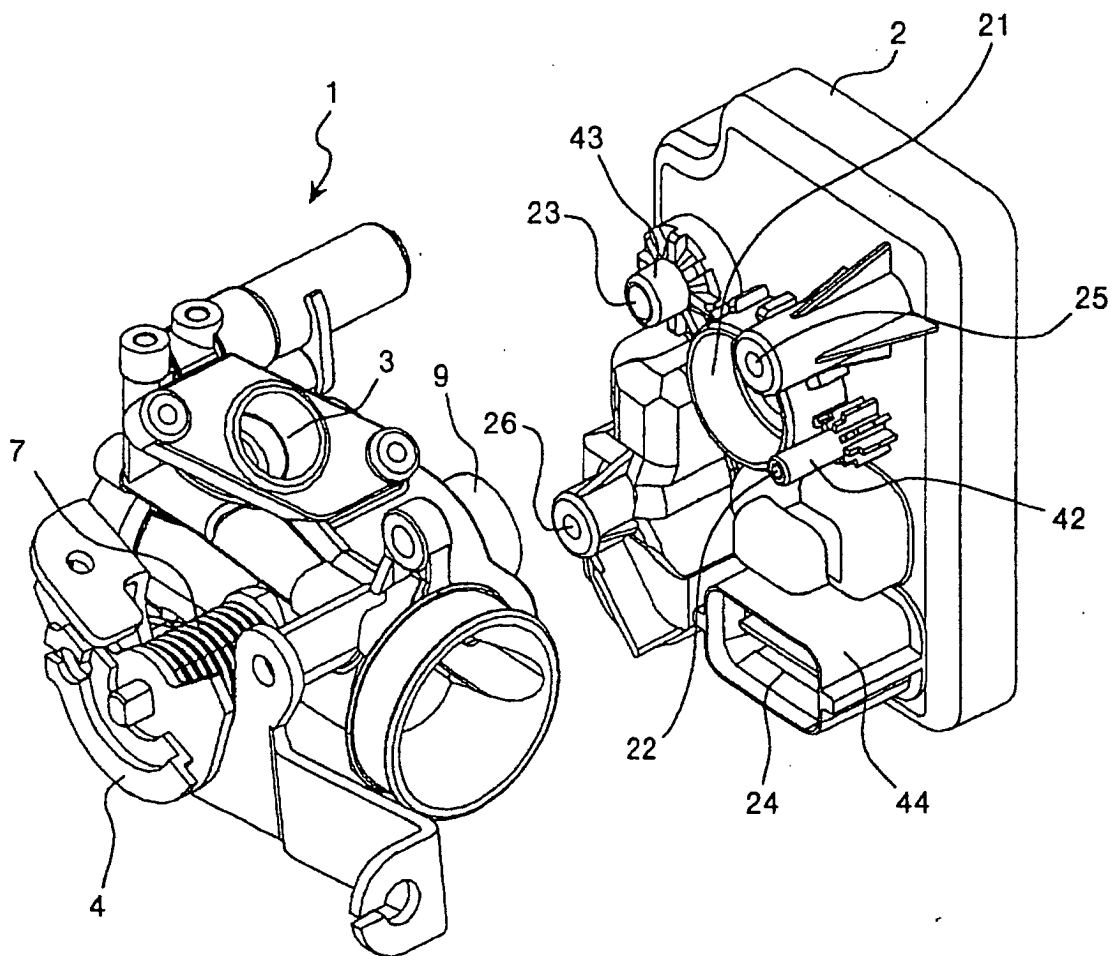
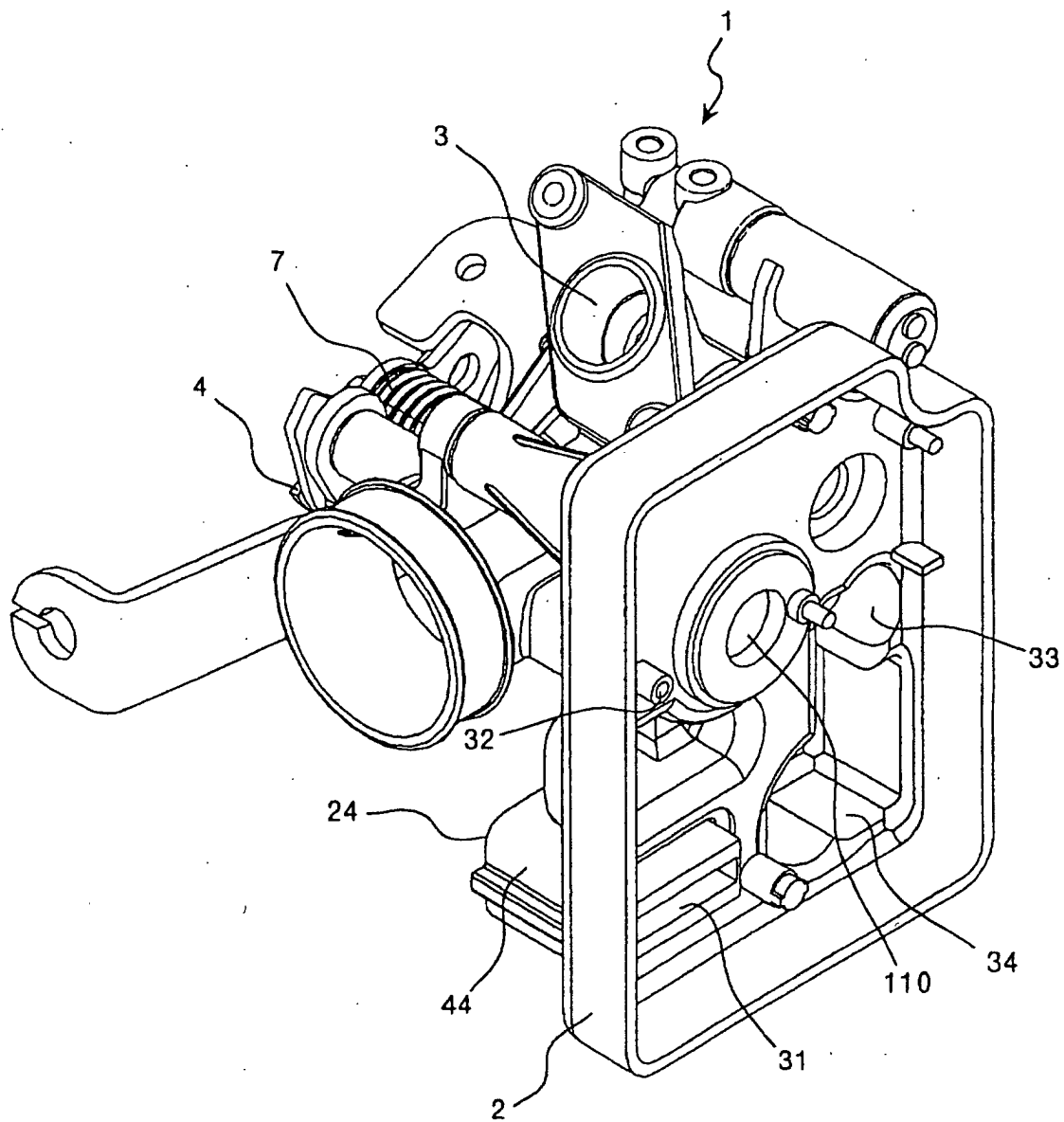


FIG.19



INTERNATIONAL SEARCH REPORT

International PCT/JP02/05733
PCT/JP02/07743

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ F02D41/00, F02D9/00, F02D35/00		
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) Int.Cl ⁷ F02D41/00, F02D9/00, F02D35/00		
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 1996-2002 Kokai Jitsuyo Shinan Koho 1971-2002 Toroku Jitsuyo Shinan Koho 1994-2002		
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.
Y	JP 2001-73829 A (Yazaki Corp.), 21 March, 2001 (21.03.01),	1-3, 5, 8-10
A	Full text; all drawings & DE 10032306 A	4, 6, 7
Y	JP 5-263735 A (Hitachi, Ltd.), 12 October, 1993 (12.10.93),	1-3, 5, 8-10
A	Full text; all drawings (Family: none)	4, 6
Y	JP 3-122246 U (Honda Giken Kogyo Kabushiki Kaisha),	5
A	13 December, 1991 (13.12.91), Full text; all drawings (Family: none)	4, 6, 7
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 29 October, 2002 (29.10.02)		Date of mailing of the international search report 12 November, 2002 (12.11.02)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

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INTERNATIONAL SEARCH REPORT

International PCT/JP02/05733
PCT/JP02/07743

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 10-62113 A (Denso Corp.), 06 March, 1998 (06.03.98), Full text; all drawings (Family: none)	8-10
A	US 5094212 A (Honda Giken Kogyo Kabushiki Kaisha), 10 March, 1992 (10.03.92), Full text; all drawings & JP 2-256865 A & JP 2-256838 A & JP 2-256864 A	7

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