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(54) **"Fuel pump module"**

Brennstoffpumpenmodul

Module de pompe à carburant

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(73) Proprietor: **Mitsuba Corporation**
Kiryu-shi, Gunma-ken (JP)

(72) Inventors:
• **Narushima, Masahiko**
Kiryu-shi, Gunma (JP)

• **Mori, Shinya**
Kiryu-shi, Gunma (JP)

(74) Representative: **Prato, Roberto et al**
STUDIO TORTA S.r.l.,
Via Viotti 9
10121 Torino (IT)

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a fuel pump module of an in-tank type, and in particular to a fuel pump module which achieves miniaturization of the fuel tank module in automobiles and the like.

[0002] Conventionally, a fuel pump module is mounted in a fuel tank, serves as a type of sub tank for the fuel tank, and supplies fuel accommodated in the fuel tank to an engine via a discharge port. That is, the fuel pump module comprises a pump for pumping fuel, a strainer linked to the pump via a first fuel passage, and a second fuel passage connected to the strainer and guiding the fuel to the engine. The second fuel passage is connected to the strainer at one end portion thereof, and has a discharge port at the other end portion thereof. And, the fuel pump module is integrally formed as a whole.

[0003] The pump is provided with a backflow-preventing functional portion in order to prevent the fuel flowing through the first fuel passage from back-flowing from the strainer to the pump. Furthermore, in order to keep fuel pressure of the fuel flowing through the second fuel passage constant, a pressure-regulating functional portion is provided at the discharge port (or at the other end portion of the second fuel passage).

SUMMARY OF THE INVENTION

[0004] However, in the prior art as described above, since the backflow-preventing functional portion is provided in the pump, and (or) the pressure-regulating functional portion is provided at the discharge port, there is the drawback that the size of the fuel pump module becomes large as a whole. Furthermore, in the case that some parts in the fuel pump module are out of order, it is necessary to replace the whole of the fuel pump module in which the other parts does not fail, so that the cost required for repair thereof is uneconomical.

[0005] The German Patent Application DE-A-44,44,854 discloses a fuel pump module.

[0006] An object of the present invention is to provide a fuel pump module that can be miniaturised, and handled economically with low cost even if some parts therein fail.

[0007] According to the present invention there is provided a fuel pump module comprising: a pumping functional portion accommodated in a reservoir and having only pump function; a strainer linked to the pumping functional portion via a first fuel passage; a backflow-preventing functional portion attached to the first fuel passage having only the function of preventing backflow of fuel which flows through the first fuel passage; the fuel pump module being characterised by further comprising: a second fuel passage for guiding the fuel from the strainer to an engine; and a pressure-regulating func-

tional portion connected to the second fuel passage having only the function of keeping constant the fuel pressure in the second fuel passage; the pumping functional portion, the backflow-preventing functional portion, and the pressure-regulating functional portion being incorporated in said fuel pump module and being individually replaceable.

BRIEF EXPLANATION OF THE DRAWINGS

[0008] FIG. 1 is a plane view showing one embodiment of the fuel pump module according to the present invention.

[0009] FIG. 2 is a plane view showing the lower case of FIG. 1.

[0010] FIG. 3 is a cross section taken along line N-N under the state that the conjunction cover is removed in FIG. 1.

[0011] FIG. 4 is a plane view showing the upper cover of FIG. 1.

[0012] FIG. 5 is a cross section taken along line Q-Q under the state that the conjunction cover is removed in FIG. 1.

[0013] FIG. 6 is a cross section taken along line M-M of FIG. 1.

[0014] FIG. 7 is a side view showing the state that the fuel pump module of FIG. 1 is mounted to a fuel tank.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] An essential concept of the present invention is the conception that a multi-functional portion having many functions is fully divided per a single-functional unit to provide a plurality of single-functional portions, and then the single-functional portions are again integrated into one. Alternatively, in the conception of the present invention, the multi-functional portion may be divided into several plural-functional portions, and then the plural-functional portions may be again integrated into one.

[0016] In the following, an embodiment of the present invention will be explained with reference to the drawings.

[0017] FIGs. 1 to 7 relate to one embodiment of the fuel pump module according to the present invention.

[0018] As shown in FIG. 1, this fuel pump module 1 is constituted such that a pumping functional portion 2, a backflow-preventing functional portion 3, and a pressure-regulating functional portion 4 which are fully separated therefrom per a single-functional unit are integrated in a lower case 5 into one.

[0019] That is, this fuel pump module 1 comprises the box-shaped lower case 5, an upper case 6 capped on the lower case 5, and a conjunction cover 7 to be attached to the upper case 6. A fuel pump 10, a strainer 11, and a pressure regulator 12 are respectively located in the lower case 5. Although the pumping functional

portion 2 corresponds to the fuel pump 10 in the present embodiment, any members having the same function as the fuel pump 10 may be used instead of the fuel pump 10. Furthermore, although the pressure-regulating functional portion 4 corresponds to the pressure regulator 12, any members having the same function as the pressure regulator 12 may be used instead of the pressure regulator 12.

[0020] As shown in FIGs. 2 and 3, the lower case 5 comprises a bottom wall 20, a peripheral wall 21 integrally provided on the peripheral edge of the bottom wall 20, and a fuel inlet 25 formed in the peripheral wall 21. A regulator mounting portion 22, a strainer mounting portion 23, and a sensor mounting portion 24 are respectively formed in the bottom wall 21. In the present embodiment, although the lower case 5 functions as a reservoir 8 for the fuel, the reservoir 8 may be formed so as to be separated from the lower case 5 and function as only a reservoir. As shown in FIGs. 1 to 3, the pressure regulator 12 is installed to the regulator mounting portion 22, the strainer 11 the strainer mounting portion 23, and a thermistor 13 the sensor mounting portion 24.

[0021] The peripheral wall 21 stands up from the bottom wall 20. A second fuel passage 26 is integrally provided in the bottom wall 20 so as to cross the bottom wall 20 at approximately right angles. One end of the second fuel passage 26 is connected to the strainer mounting portion 23, and the other end thereof extends to the outside of the lower case 5 to form a discharge port 27. To the discharge port 27 is connected a fuel pipe 28 for guiding the fuel from the second fuel passage 26 to an engine (not shown). To the intermediate portion of the second fuel passage 26, the regulator mounting portion 22 is connected via an auxiliary passage 29. The pressure regulator 12 may be directly provided in the intermediate portion of the second fuel passage 26.

[0022] As shown in FIGs. 1, 3 and 4, the upper case 6 comprises a bottom wall 31, and a peripheral wall 32 vertically formed in continuation with the periphery of the bottom wall 31. A regulator inserting hole 33, a strainer inserting hole 34, a sensor inserting hole 35, and a pump inserting hole 36 are respectively formed in the bottom wall 31. Any means for capping the upper case 6 on the lower case 5 are available.

[0023] A pushing portion 37 is integrally formed in the bottom cover 31 and downwardly projects from the periphery of the regulator inserting hole 33. The pushing portion 37 downwardly pushes the pressure regulator 12 mounted to the regulator mounting portion 22. The strainer 11 is inserted into the strainer inserting hole 34, and the thermistor 13 is inserted into the sensor inserting hole 35 and secured therein. The thermistor 13 corresponds to a remaining amount alarming sensor for the fuel reserved in a fuel tank 14. That is, this thermistor 13 recognizes a temperature change of the fuel tank 14 shown in FIG. 7 as a resistance change, and senses the remaining amount of fuel by measuring the resistance change.

[0024] Furthermore, as shown in FIGs. 3 to 5, a protecting tube 38 is integrally formed with the bottom wall 31 and downwardly projects from the peripheral edge of the pump inserting hole 36. The fuel pump 10 is inserted into the protecting tube 38 from the pump inserting hole 36 and is held therein. On the other end of the fuel pump 10, a pump filter 39 is detachably provided.

[0025] As shown in FIGs. 3 and 5, the pressure regulator 12 serves to regulate pressure of the fuel present in the second fuel passage 26, and return excess fuel remaining in the second fuel passage 26 to the reservoir 8. That is, when an engine (not shown) of a vehicle or the like rotates, the fuel is supplied to the engine via the second fuel passage 26 and the fuel pipe 28. However, when the engine is stopped, excess fuel remains in the second fuel passage 26 and (or) the fuel pipe 28. Then, the excess fuel back-flows in the fuel pipe 28 and the second fuel passage 26, so that there is the drawback that fuel pressure of the excess fuel lowers and (or) that air or the like is mixed with the excess fuel. As a result of this, the engine is difficult to drive at restarting of the engine.

[0026] For solving the above drawback, by keeping the fuel pressure of the excess fuel constant, the pressure regulator 12 can prevent the excess fuel from back-flowing, and thereby air or the like from being mixed with the excess fuel. As a result of this, restarting of the engine can be easily achieved.

[0027] As shown in FIGs. 1 and 6, the conjunction cover 7 comprises a cover body 40 to be mounted to the upper case 6, a first fuel passage 41 formed in the cover body 40, and a check valve 42 mounted to the first fuel passage 41. Any means for connecting the conjunction cover 7 and the upper case 6 are available. Furthermore, although the backflow-preventing functional portion 3 corresponds to the check valve 42 in the present embodiment, it is not limited to the check valve 42.

[0028] The first fuel passage 41 comprises a straight passage 43, a pump passage 44 crossing the straight passage 43 at approximately right angles, a strainer passage 45 approximately parallel with the pump passage 44, and the check valve 42 mounted in the straight passage 43. The straight passage 43 is provided with the check valve 42 at one end portion thereof and is closed at the other end portion thereof. To the pump passage 44, one end portion of the fuel pump 10 is connected via an O-ring 46. That is, the one end portion of the fuel pump 10 is connected to the pump passage 44, and the other end portion thereof is inserted into the protecting tube 38 via the pump inserting hole 36. To the strainer passage 45, one end portion of the strainer 11 is linked via an O-ring 47. That is, the one end portion of the strainer 11 is linked to the strainer passage 45, and the other end portion thereof is held by the strainer mounting portion 23 via an O-ring 30.

[0029] The check valve 42 prevents the fuel flowing through the straight passage 43 from back-flowing. That is, the check valve 42 allows the fuel guided from a side

of the fuel pump 10 to easily pass through the strainer passage 45 via the straight passage 43, and prevents the fuel guided from a side of the strainer 11 from flowing into the pump passage 44 via the straight passage 43.

[0030] Next, movement of the fuel supplied from the fuel tank 14 to the engine via the fuel pump module 1 will be explained.

[0031] As shown in FIG. 7, this fuel pump module 1, because being of such an in-tank type as to be mounted in the fuel tank 14, serves as a sub tank 15 for the fuel tank 14. The fuel accommodated in the fuel tank 14 flows into the sub tank 15 from the fuel inlet 25 formed in the peripheral wall 21 of the lower case 5. As shown in FIGs. 6 and 7, the fuel reserved in the reservoir 8 of the sub tank 15 is upward pumped by the fuel pump 10 serving as the pumping functional portion 2, and fed to the strainer 11 via the first fuel passage 41.

[0032] Since the check valve 42 serving as the backflow preventing functional portion 3 is mounted in the first fuel passage 41, the flowing direction of the fuel in the first fuel passage 41 is restricted by the check valve 42. That is, the check valve 42 allows the flowing direction of the fuel toward the strainer 11 from the fuel pump 10, but restricts the flowing direction of the fuel toward the fuel pump 10 from the strainer 11, namely restricts the backflow to the maximum. Therefore, after stopping of the engine, or at an inclined condition of a vehicle or the like, the check valve 42 prevents backflow into the first fuel passage 41.

[0033] As shown in FIGs. 1, 3 and 7, the fuel having flown into the strainer 11 is delivered to the second fuel passage 26. The fuel present in the second fuel passage 26 is supplied from the discharge port 27 to the engine via the fuel pipe 28, as well as introduced from the second fuel passage 26 to the pressure regulator 12 serving as the pressure-regulating functional portion 4, via the auxiliary passage 29.

[0034] Since the pressure regulator 12 is mounted to the auxiliary passage 29, the fuel pressure in the second fuel passage 41 is kept constant. That is, after stopping of the engine of a vehicle or the like, or at an inclined condition of a vehicle or the like, the pressure regulator 12 prevents the fuel pressure in the second fuel passage 41 from lowering. As a result of this, it is possible to activate easily of the engine at restarting of the engine.

[0035] As described above, in the lower case 5, the fuel pump 10, the strainer 11, and the pressure regulator 12 are located, respectively, and the pressure regulator 12 is linked to the second fuel passage 26. In the upper case 6, the fuel pump 10 and the strainer 11 are held, and the pressure regulator 12 is fixed. In addition, to the conjunction cover 7, the fuel pump 10 and the strainer 11 are fixed via the first fuel passage 41.

[0036] With such a structure, the number of parts constituting the fuel pump module 1 increases. However, the flexibility in design layout is improved due to the increased number of parts. Therefore, employing of the arrangement as described in the present embodiment,

for example, can make lower (shorter) a height (distance) between the bottom surface of the lower case 5 and the conjunction cover 7 in the fuel pump module 1. As a result of this, it is possible to achieve miniaturization of the fuel pump module 1 in comparison with the conventional pump modules.

[0037] According to the present invention, the pumping functional portion is given only the pump function, and the other functional portions are given all the functions other than the pump function. Therefore, if only the pumping functional portion and the other functional portions are integrated into one, an after-integration structure can have the same function as a before-division structure.

[0038] Furthermore, the fuel pump module is fully divided into single-functional portions such as pumping functional portion, backflow-preventing functional portion, and pressure-regulating functional portion. And, the single-functional portions are again integrated into one after the division. Therefore, it is possible to improve the flexibility of the design layout in designing the fuel pump module in comparison with the conventional pump modules. As a result of this, it is possible to achieve miniaturization of the fuel pump module and reduction of costs associated with the miniaturization.

[0039] Furthermore, by dividing the fuel pump module into single-functional portions and again integrating the divided single-functional portions into one, even if some of functional parts corresponding to the single-functional portions constituting the fuel pump module are out of order, only the failing functional parts can be easily detached from the fuel pump module. Therefore, replacement of just the failing functional parts allows the fuel pump module to be reconditioned (repaired) with economically low costs.

[0040] Moreover, even in the case of further adding other functional members different from the pumping functional portion, the backflow-preventing functional portion, and the pressure-regulating functional portion, the other functional members can be easily added to the fuel pump module. Contrary to this, at least one of the single-functional members can be easily eliminated from the plurality of single-functional members integrated.

Claims

1. A fuel pump module (1) comprising:

- a pumping functional portion (2) accommodated in a reservoir (8) and having only pump function;
- a strainer (11) linked to the pumping functional portion (3) via a first fuel passage (41);
- a backflow-preventing functional portion (3) attached to the first fuel passage (41) having only the function of preventing backflow of fuel

which flows through the first fuel passage (41);
 a second fuel passage (26) for guiding the fuel
 from the strainer (11) to an engine; and
 a pressure-regulating functional portion (4)
 connected to the second fuel passage (26) hav- 5
 ing only the function of keeping constant the fu-
 el pressure in the second fuel passage (26); the
 fuel pump module (1) being **characterised by** :
 the pumping functional portion (2), the back-
 flow-preventing functional portion (3), and the 10
 pressure-regulating functional portion (4) being
 incorporated in said fuel pump module (1) and
 being individually replaceable.

Patentansprüche

1. Ein Kraftstoffpumpenmodul (1) aufweisend:

ein pumpendes Funktionsteil (2), das in einem 20
 Behälter (8) untergebracht ist und lediglich eine
 pumpende Funktion hat;

ein Filter (11), das über einen ersten Kraftstoff-
 kanal (41) mit dem pumpenden Funktionsteil 25
 (2) verbunden ist;

ein den Rückfluss verhinderndes Funktionsteil
 (3), das mit dem ersten Kraftstoffkanal (41) ver- 30
 bunden ist und lediglich die Funktion hat, den
 Rückfluss des Kraftstoffes zu verhindern, der
 durch den ersten Kraftstoffkanal (41) fließt;

einen zweiten Kraftstoffkanal (26) zur Leitung
 des Kraftstoffes von dem Filter (11) zu einem 35
 Motor; und

ein den Druck regulierendes Funktionsteil (4),
 das mit dem zweiten Kraftstoffkanal (26) ver- 40
 bunden ist und lediglich die Funktion hat, den
 Druck des Kraftstoffes in dem zweiten Kraft-
 stoffkanal (26) konstant zu halten; wobei das
 Kraftstoffpumpenmodul (1) **dadurch gekenn-
 zeichnet ist,**

dass das pumpende Funktionsteil (2), das den 45
 Rückfluss verhindernde Funktionsteil (3) und
 das den Druck regulierende Funktionsteil (4) in
 dem Kraftstoffpumpenmodul (1) eingebaut und
 individuell austauschbar sind. 50

Revendications

1. Une pompe à carburant modulaire (1) 55 comprenant :

une portion fonctionnelle de pompage (2) logée

dans un réservoir (8) et ne remplissant que la
 fonction de pompage ;

un épurateur (11) relié à la portion fonctionnelle
 de pompage (3) par un premier passage de car-
 burant (41) ;

une portion fonctionnelle de prévention de re-
 tour (3) fixée au premier passage de carburant
 (41) et ne remplissant que la fonction consis-
 tant à empêcher le retour du carburant qui
 s'écoule à travers le premier passage de car-
 burant (41) ;

un second passage de carburant (26) destiné
 à guider le carburant provenant de l'épurateur
 (11) vers un moteur et ;

une portion fonctionnelle de régulation de pres-
 sion (4), réunie au second passage de carbu-
 rant (26) et ne remplissant que la fonction con-
 sistant à maintenir constante la pression du
 carburant dans le second passage de carbu-
 rant (26), cette pompe à carburant modulaire
 (1) étant **caractérisée par le fait que** la portion
 fonctionnelle de pompage (2), la portion fonc-
 tionnelle de protection contre les retours (3) et
 la portion fonctionnelle de régulation de pres-
 sion (4) sont également logées dans ledit mo-
 dule de pompe à carburant (1) et sont rempla-
 çables individuellement.

FIG.1

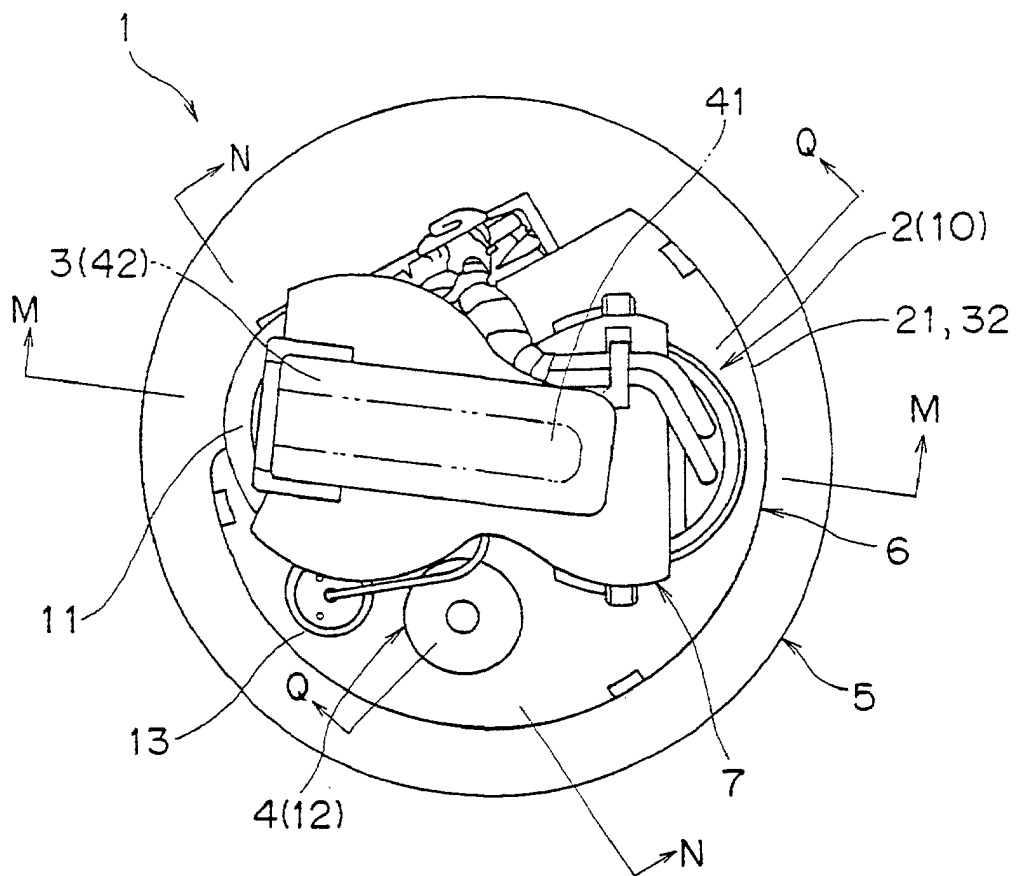


FIG.2

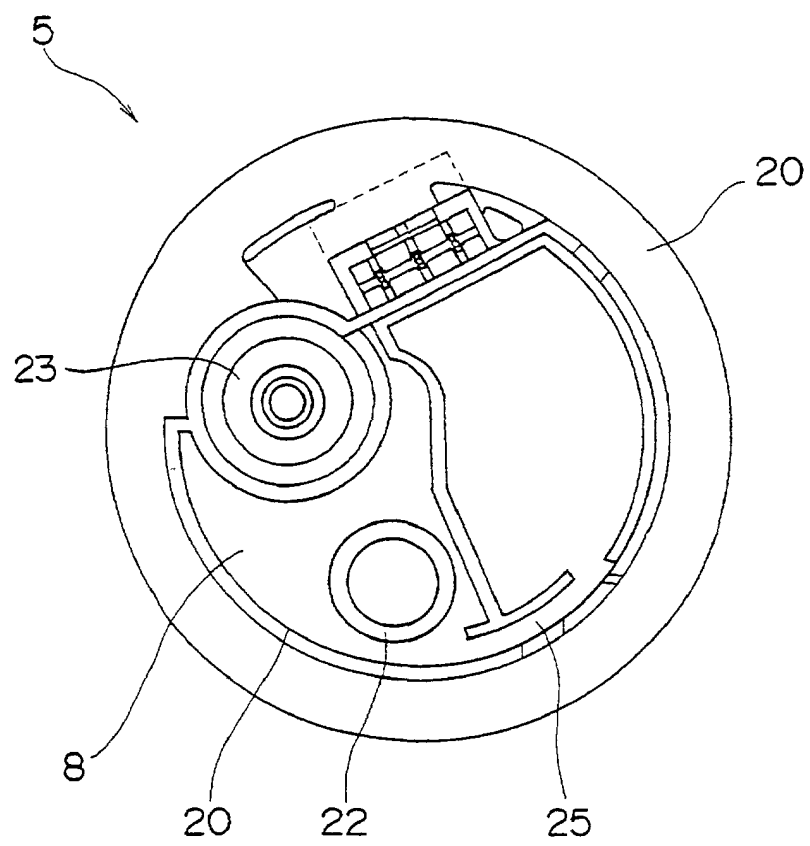


FIG.3

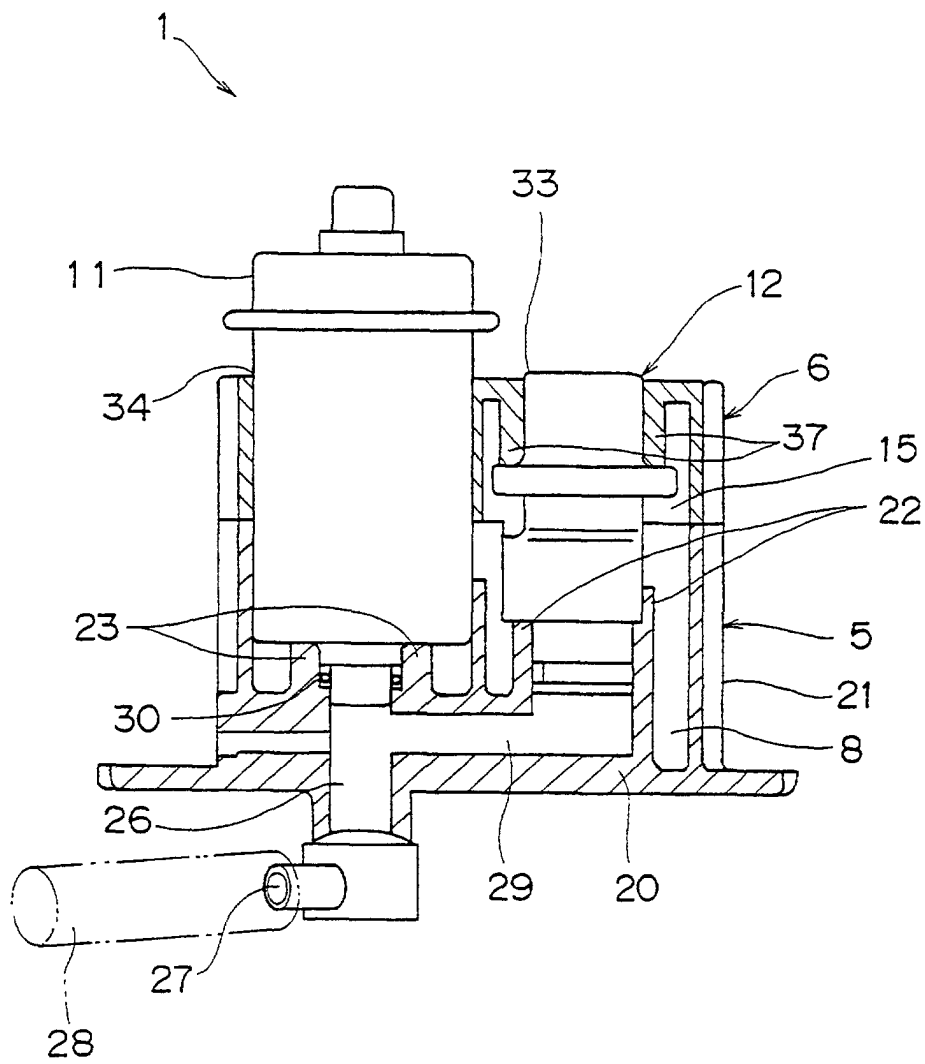


FIG.4

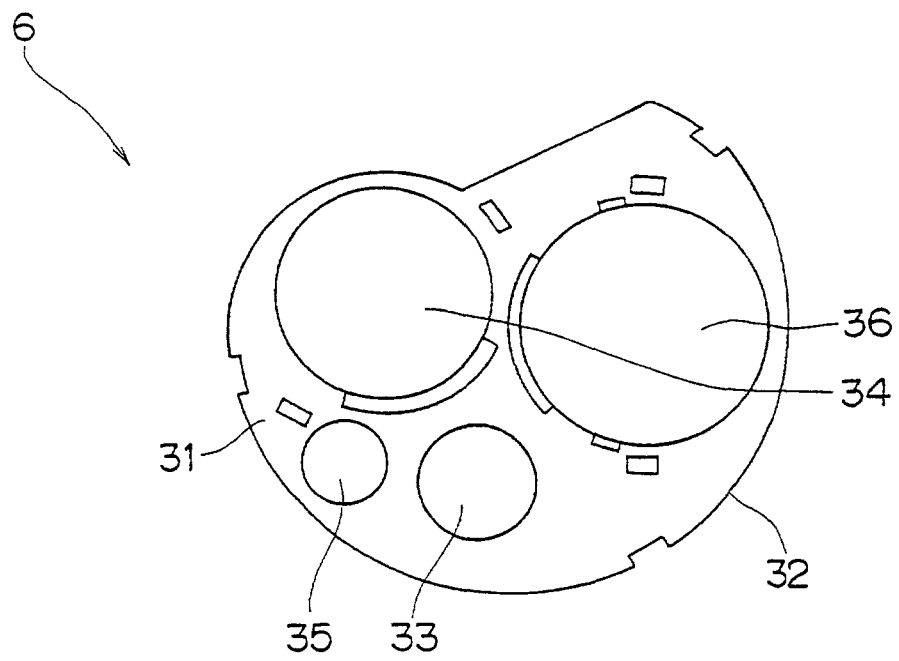


FIG.5

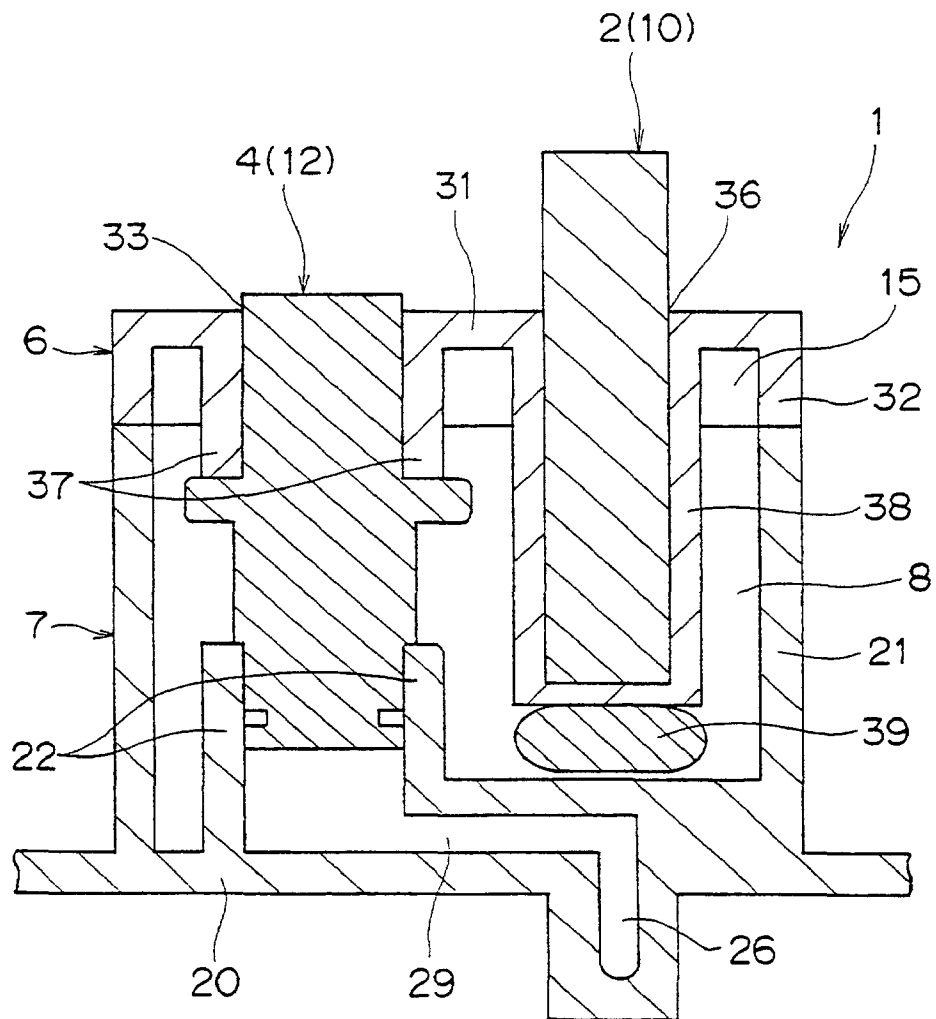


FIG.6

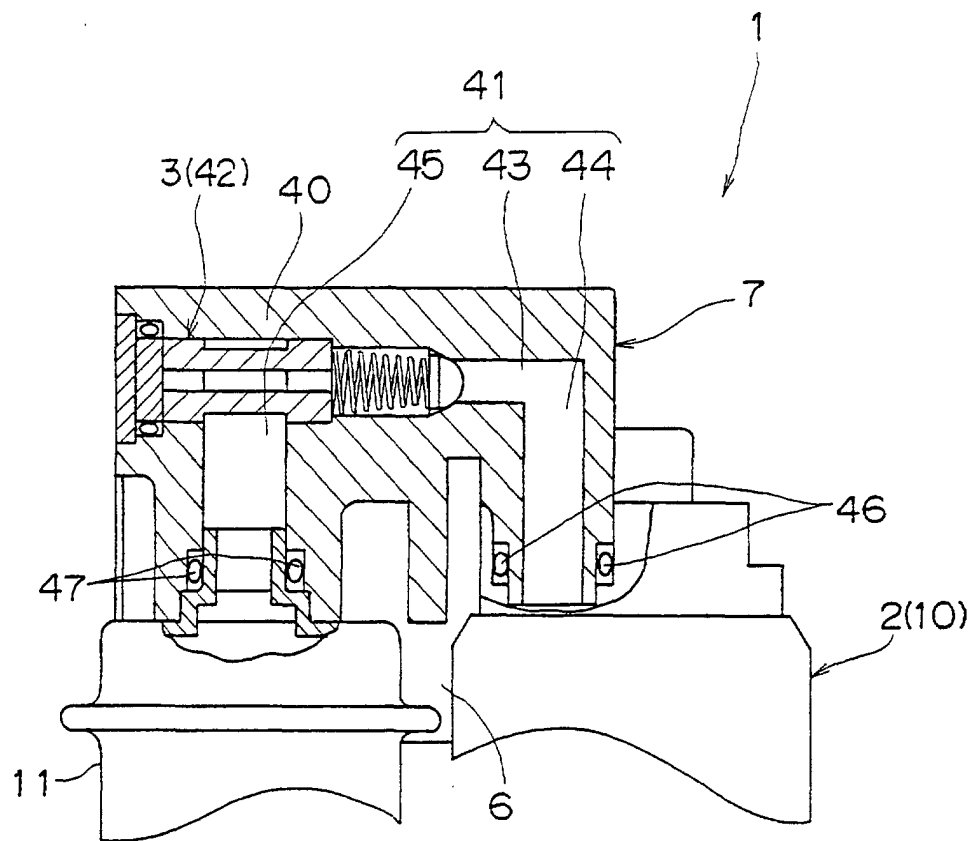


FIG.7

