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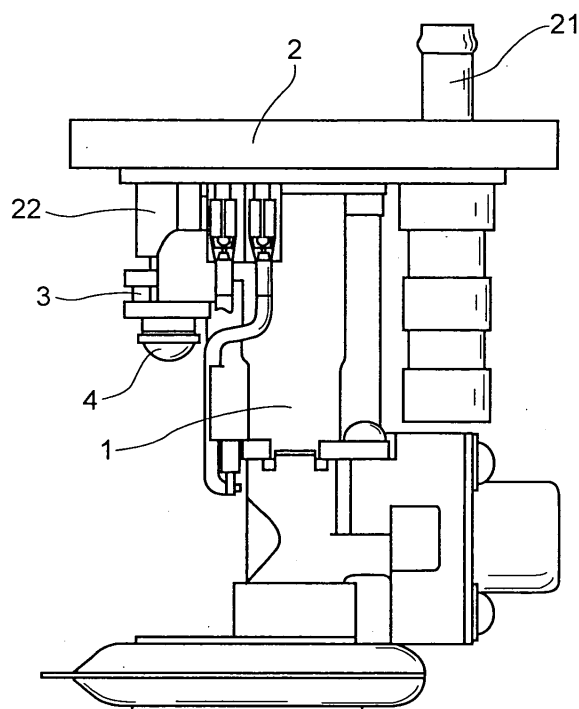
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(54) **FUEL PUMP MODULE**

(57) According to the present device, tapping screws 4 are fitted from below through through holes formed in a pump module mounting portion 3 which comprises a cushion 31 and an outer yoke 32, and are brought into threaded engagement with a convex portion 22 of an upper bracket 2 and are fixed thereby. The outside diameter of a collar inserted between the tapping screw 4 and the through hole is smaller than the inside diameter of the through hole in the cushion 31 and the overall length of the collar 5 is larger than the length of the through hole in the cushion 31. The pump module mounting portion 3 is attached to the convex portion 22 of the upper bracket 2 in a state in which it is given degree of freedom in the vertical direction. With this construction, the present invention aims at providing a fuel pump module wherein, even in the case where the fuel pump is of such a type as delivers fuel by a vertical reciprocating motion of a plunger, vertical vibration of the body of the fuel pump which is generated with the reciprocating motion of the plunger can be prevented from being transmitted to the upper bracket through a holding mechanism.

FIG.1



Description

TECHNICAL FIELD

[0001] The present invention relates to a fuel pump module for discharging fuel to the exterior of a fuel tank with use of a fuel pump housed within the fuel tank. Particularly, the present invention is concerned with a fuel pump module for discharging fuel to the exterior of a fuel tank with use of a fuel pump which delivers fuel by a vertical reciprocating motion of a plunger.

BACKGROUND ART

[0002] Heretofore, with a view to reducing noise caused by vibration which is transmitted to a fuel tank with operation of a fuel pump, there has been proposed a technique wherein only an engaging portion of the fuel pump and a holding member of an upper bracket which covers an upper opening of the fuel tank are engaged with each other, thereby accommodating the fuel pump within the fuel tank in a suspended state from the upper bracket (see, for example, Patent Literature 1).

[Patent Literature 1]

Japanese Patent Laid-Open No. 2002-13449 (FIG. 1)

[0003] However, according to the conventional holding mechanism wherein the engaging portion of the fuel pump and the holder member of the upper bracket which covers the upper opening of the fuel tank are engaged with each other, when the fuel pump is of the type in which fuel is sucked up by a rotary member, vibration of the body of the fuel pump is difficult to be transmitted to the upper bracket through the holding mechanism, but when the fuel pump is of the type in which fuel is delivered by a vertical reciprocating motion of a plunger, the fuel pump body also vibrates vertically following the reciprocating motion of the plunger, so that the vibration of the fuel pump body is transmitted to the upper bracket through the holding mechanism, causing vibration of a wall surface of the fuel tank adjacent to the upper bracket, with consequent increase of vibration and noise.

[0004] The present invention has been accomplished in view of such a problem and it is an object of the present invention to provide a fuel pump module wherein, at the time of accommodating a fuel pump into a fuel tank in a suspended state of the pump from an upper bracket, even in the case where the fuel pump is of such a type as delivers fuel by a reciprocating motion in the vertical direction of a plunger, vertical vibration of the body of the fuel pump which is generated with the reciprocating motion of the plunger can be prevented from being transmitted to the upper bracket through a holding mechanism, thereby permitting reduction of vibration and noise.

DISCLOSURE OF THE INVENTION

[0005] For solving the above-mentioned problem the present invention adopts the following construction.

[0006] The gist of the invention described in Claim 1 resides in a fuel pump module for discharging fuel stored in a fuel tank to the exterior of the fuel tank with use of a fuel pump mounted to a lower portion of an upper bracket which covers an opening formed in an upper portion of the fuel tank, the fuel pump module comprising mounting means provided in the fuel pump and having a through hole formed in the vertical direction and fixing means fixed to the upper bracket in a state in which it extends through the through hole to delimit a lower-limit position of the mounting means, the mounting means being attached to the upper bracket in a state in which it is given degree of freedom in the vertical direction by the fixing means.

[0007] The gist of the invention described in Claim 2 resides in the fuel pump module described in Claim 1, wherein the fixing means is fitted through the through hole in a state in which it extends through cylindrical collar means.

[0008] The gist of the invention described in Claim 3 resides in the fuel pump module described in Claim 2, wherein the overall length of the collar means is larger than the length of the through hole.

[0009] The gist of the invention described in Claim 4 resides in the fuel pump module described in any of Claims 1 to 3, wherein the mounting means comprises a cushion member with the through hole formed therein and holding means for holding the cushion member.

[0010] The gist of the invention described in Claim 5 resides in the fuel pump module described in any of Claims 1 to 4, wherein the mounting means has two said through holes positioned equidistant from the center of gravity of the fuel pump.

[0011] The gist of the invention described in Claim 6 resides in the fuel pump module described in any of Claims 1 to 5, wherein a discharge port of the fuel pump for discharging the fuel and a discharge pipe formed in the upper bracket to discharge the fuel to the exterior of the fuel tank are mounted through an elastic member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

FIG. 1 is a side view showing the construction of a fuel pump module according to a first embodiment of the present invention;

FIG. 2 is an enlarged diagram showing the construction of a mounting portion between a fuel pump and an upper bracket both shown in FIG. 1;

FIG. 3 is a diagram showing the construction of a pump module mounting portion shown in FIG. 1;

FIG. 4 is a diagram showing a relation between a cushion and a collar both shown in FIG. 1;

FIG. 5 is a diagram showing a relation between the cushion and a tapping screw both shown in FIG. 1; FIG. 6 is a diagram showing the construction of a mounting portion on a discharge pipe side in a fuel pump module according to a second embodiment of the present invention; and FIG. 7 is a side view showing the construction of a mounting portion on a discharge pipe side in a fuel pump module according to a third embodiment of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0013] Embodiments of the present invention will be described in detail hereinafter with reference to the drawings.

(First Embodiment)

[0014] FIG. 1 is a side view showing the construction of a fuel pump module according to a first embodiment of the present invention, FIG. 2 is an enlarged diagram showing the construction of a mounting portion between a fuel pump and an upper bracket both shown in FIG. 1, FIG. 3 is a diagram showing the construction of a pump module mounting portion shown in FIG. 1, FIG. 4 is a diagram showing a relation between a cushion and a collar both shown in FIG. 1, and FIG. 5 is a diagram showing a relation between the cushion and a tapping screw both shown in FIG. 1.

[0015] Referring to FIGS. 1 and 2, the fuel pump module of this embodiment comprises a fuel pump body 1 and an upper bracket 2 made of resin which covers an upper opening of a fuel tank (not shown). The fuel pump body 1 is mounted to a lower portion of the upper bracket 2 and is accommodated within the fuel tank to deliver fuel to the exterior of the fuel tank from a discharge pipe 21 which is installed through the upper bracket 2.

[0016] A pump module mounting portion 3 having through holes formed in the vertical direction is provided in the fuel pump body 1, while in a lower portion of the upper bracket 2 there is provided a convex portion 22 for mounting the pump module mounting portion 3. Tapping screws 4 as fixing means are fitted through the through holes of the pump module mounting portion 3 from below and are brought into threaded engagement with the convex portion 22 of the upper bracket 2, whereby the fuel pump body 1 is secured to the upper bracket 2.

[0017] Referring to FIGS. 2 and 3, the pump module mounting portion 3 provided in the fuel pump body 1 comprises a cushion 31 having two parallel through holes and an outer yoke 32 which holds the cushion 31 in such a manner that the two through holes of the cushion 31 are positioned in the vertical direction. The outer yoke 32 has a pair of holding portions extended sideways of the fuel pump body 1, and by fitting the cushion 31 in between the pair of holding portions of the outer

yoke 32, the cushion 31 is held by the outer yoke 32. In FIG. 3, (a) is a front view of the pump module mounting portion 3, (b) is a bottom view of the pump module mounting portion 3, and (c) is a sectional view taken on line X-X' in (a).

[0018] The cushion 31 is held by the outer yoke 32 in such a manner that the two through holes of the cushion 31 are positioned equidistant from the center of gravity of the fuel pump body 1, whereby, when the fuel pump body 1 is attached to the upper bracket 2, the weight of the fuel pump body 1 is applied equally to the two through holes. As the material of the cushion 31 there is used a rubbery material. Since the cushion 31 may be swollen by the fuel, it is preferable to use the cushion 31 of a smaller size by approximately 2 to 3 mm than an estimated size thereof. However, it is presumed that the inside diameter of the cushion 31 will become smaller as a result of swelling, and therefore the cushion 31 of a larger inside diameter by approximately 0.2 to 0.3 mm than an estimated size thereof is used.

[0019] Referring to FIG. 4, a metallic, cylindrical collar 5 is fitted in between each tapping screw 4 and the associated through hole. When fixing each tapping screw 4 by threaded engagement thereof with the convex portion 22, the distance between a flange portion 41 of the tapping screw 4 and the convex portion 22 of the upper bracket 2 is determined.

[0020] As shown in FIG. 4(a), the outside diameter of the collar 5 is smaller than the inside diameter of each of the through holes of the cushion 31, and as shown in FIG. 4(b), the overall length of the collar 5 is larger than the length of each of the through holes of the cushion 31 (the thickness of the cushion 31). The pump module mounting portion 3 is secured to the convex portion 22 of the upper bracket 2 in a state in which it is given degree of freedom in the vertical direction. Therefore, the pump module mounting portion 3 moves vertically with vertical vibration of the fuel pump body 1, whereby the vertical vibration of the fuel pump body 1 can be prevented from being transmitted to the upper bracket 2.

[0021] Referring to FIG. 5, the outside diameter of the flange portion 41 of each tapping screw 4 is larger than the inside diameter of each through hole of the cushion 31 and thus the flange portion 41 of each tapping screw 4 serves as a stopper which delimits a lower-limit position of the pump module mounting portion 3. There is a case where the cushion 31 and the flange portion 41 of each tapping screw 4 come into surface contact with each other with a vertical movement of the pump module mounting portion 3 caused by a vertical vibration of the fuel pump body 1. However, a cylindrical shock-absorbing protrusion 311 is provided in the contact portion between the cushion 31 and the flange portion 41 of each tapping screw 4 to narrow the area of contact between the cushion 31 and the flange portion 41 of each tapping screw 4, thereby preventing the transmission of vibration from the pump module mounting portion 3 to the upper bracket 2.

[0022] As described above, the first embodiment is constructed so that the pump module mounting portion 3 of the fuel pump body 1 is attached to the upper bracket 2 in a state in which it is given degree of freedom in the vertical direction. According to this construction, when accommodating the fuel pump body 1 into the fuel tank in a suspended state from the upper bracket 2, even in the case where the fuel pump body 1 is of the type in which fuel is delivered by a vertical reciprocating motion of a plunger, vertical vibration of the fuel pump body 1 which is generated with the reciprocating motion of the plunger can be prevented from being transmitted to the upper bracket through the pump module mounting portion 3, whereby there is attained an effect that vibration and noise can be reduced.

(Second Embodiment)

[0023] FIG. 6 shows the construction of a mounting portion on a discharge pipe side in a fuel pump module according to a second embodiment of the present invention.

[0024] According to this second embodiment, with respect to connection between a discharge pipe 21 of an upper bracket 2 and a fuel pump body 1, there is adopted such a construction as shown in FIG. 6 wherein the discharge pipe 21 of the upper bracket 2 and a discharge nipple 6 formed in a discharge port of the fuel pump body 1 are connected together through a rubber bushing 7 as an elastic member. In FIG. 6, (a) is a side view of the fuel pump module, (b) is an enlarged diagram of a mounting portion on the discharge pipe side, and (c) is a sectional view taken on line Y-Y' in (a).

[0025] Referring to FIG. 6, in the discharge pipe 21 is formed with a retaining portion 23 which is a size larger in both inside and outside diameters, and two recess grooves are formed in the inner periphery of the retaining portion 23. The rubber bushing 7 is supported within the retaining portion 23 by engagement of two ridges formed on the outer periphery of the rubber bushing 7 with the two recess grooves formed in the inner periphery of the retaining portion 23 and also by a holder 8 which is engaged with the outer periphery of the retaining portion 23. The discharge pipe 21 and the discharge nipple 6 are connected together by engaging the discharge nipple 6 with a stepped portion formed in a through hole of the rubber bushing 7.

[0026] According to this second embodiment, as described above, by connecting the discharge pipe 21 of the upper bracket 2 and the discharge nipple 6 of the fuel pump body 1 with each other through the rubber bushing 7 as an elastic member, vertical vibration of the fuel pump body 1 can be prevented from being transmitted to the upper bracket 2 through the mounting portion on the discharge pipe side, and thus by combining this second embodiment with the first embodiment it is possible to further improve the vibration and noise reducing effect.

(Third Embodiment)

[0027] FIG. 7 is a side view showing the construction of a mounting portion on a discharge pipe side in a fuel pump module according to a third embodiment of the present invention.

[0028] According to this third embodiment, with respect to connection between a discharge pipe 21 of an upper bracket 2 and a fuel pump body 1, there is adopted such a construction as shown in FIG. 7 wherein the discharge pipe 21 of the upper bracket 2 and a discharge port of the fuel pump body 1 are connected with each other through a rubber hose 9 as an elastic member, the rubber hose 9 being fixed using clamps 10 to both the discharge pipe 21 of the upper bracket 2 and the discharge port of the fuel pump body 1.

[0029] According to this third embodiment, as described above, by connecting the discharge pipe 21 of the upper bracket 2 and the discharge port of the fuel pump body 1 with each other through the rubber hose 9 as an elastic member, it is possible to prevent vertical vibration of the fuel pump body 1 from being transmitted to the upper bracket 2 through the mounting portion on the discharge pipe side, and thus by combining this third embodiment with the first embodiment it is possible to further improve the vibration and noise reducing effect.

[0030] It is apparent that the present invention is not limited to the above embodiments, but that the above embodiments can be modified suitably within the scope of the technical idea of the present invention.

[0031] Further, the numbers, positions and shapes of the constituent elements described above are not limited to those described in the above embodiments, but numbers, positions and shapes thereof which are suitable for practicing the present invention may be selected. In all of the drawings, the same constituent elements are identified by the same reference numerals.

INDUSTRIAL APPLICABILITY

[0032] The fuel pump module of the present invention is constructed in such a manner that the pump module mounting portion of the fuel pump body is attached to the upper bracket in a state in which it is given degree of freedom in the vertical direction. Therefore, when accommodating the fuel pump body within the fuel tank in a suspended state thereof from the upper bracket, even in the case where the fuel pump body is of the type in which fuel is delivered by a vertical reciprocating motion of the plunger, vertical vibration of the fuel pump body which is generated with the reciprocating motion of the plunger can be prevented from being transmitted to the upper bracket through the pump module mounting portion and there is obtained an effect that vibration and noise can be reduced.

[0033] In the fuel pump module of the present invention, moreover, by connecting the discharge pipe of the upper bracket and the discharge port of the fuel pump

body with each other through an elastic member, there is obtained an effect that vertical vibration of the fuel pump body can be prevented from being transmitted to the upper bracket through the mounting portion on the discharge pipe side.

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Claims

1. A fuel pump module for discharging fuel stored in a fuel tank to the exterior of said fuel tank with use of a fuel pump mounted to a lower portion of an upper bracket which covers an opening formed in an upper portion of said fuel tank, said fuel pump module comprising: 10 15

mounting means provided in said fuel pump and having a through hole formed in the vertical direction; and

fixing means fixed to said upper bracket in a state in which it extends through said through hole to delimit a lower-limit position of said mounting means, 20

said mounting means being attached to said upper bracket in a state in which it is given degree of freedom in the vertical direction by said fixing means. 25

2. A fuel pump module according to Claim 1, wherein said fixing means is fitted through said through hole in a state in which it extends through cylindrical collar means. 30

3. A fuel pump module according to Claim 2, wherein the overall length of said collar means is larger than the length of said through hole. 35

4. A fuel pump module according to any of Claims 1 to 3, wherein said mounting means comprises a cushion member with said through hole formed therein and holding means for holding said cushion member. 40

5. A fuel pump module according to any of Claims 1 to 4, wherein said mounting means has two said through holes positioned equidistant from the center of gravity of said fuel pump. 45

6. A fuel pump module according to any of Claims 1 to 5, wherein a discharge port of said fuel pump for discharging the fuel and a discharge pipe formed in said upper bracket to discharge the fuel to the exterior of said fuel tank are mounted through an elastic member. 50 55

FIG.1

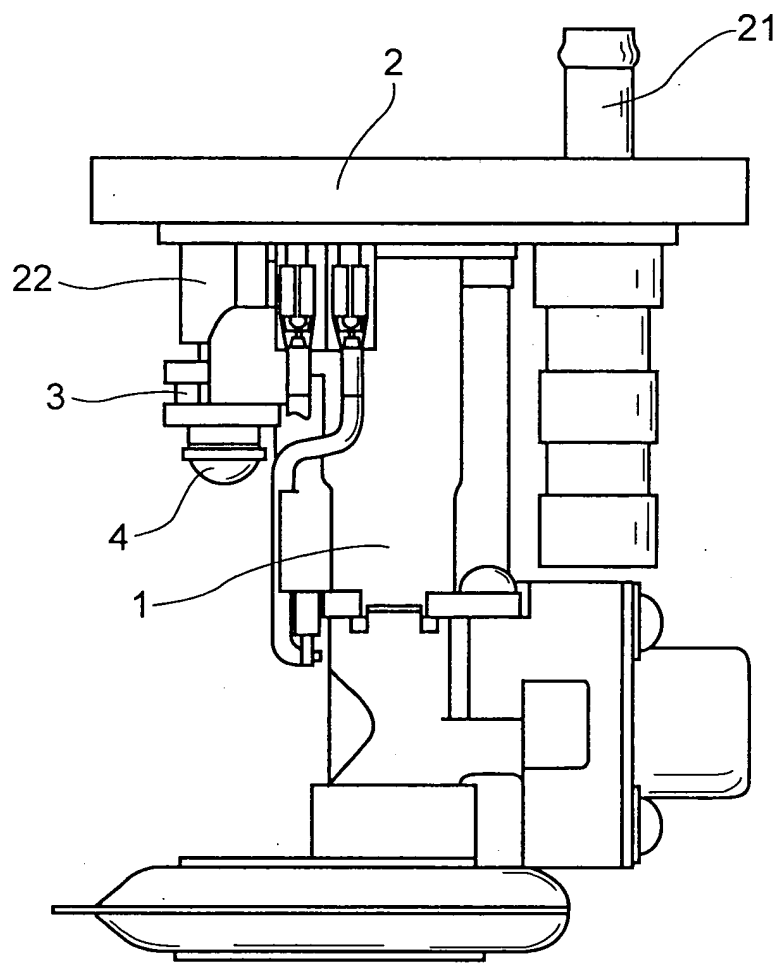


FIG.2

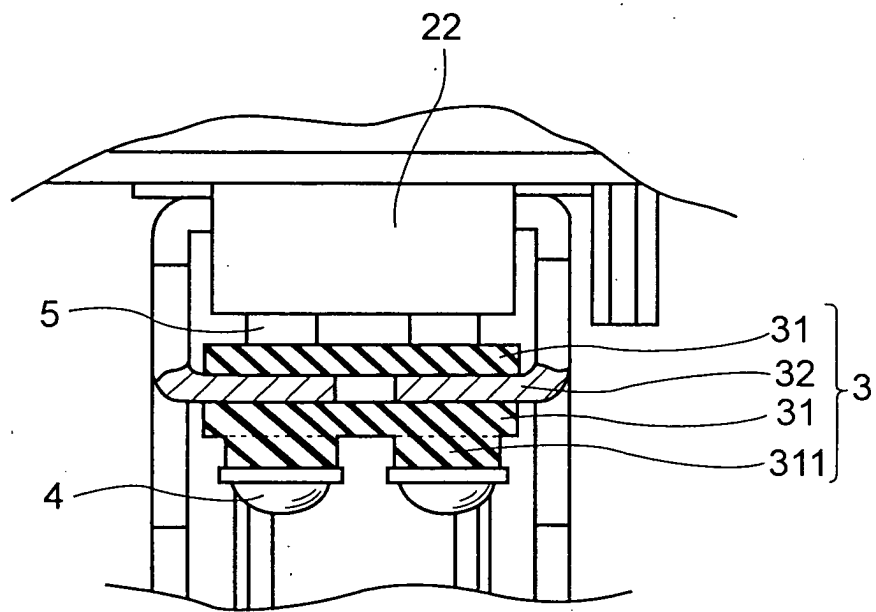


FIG.3

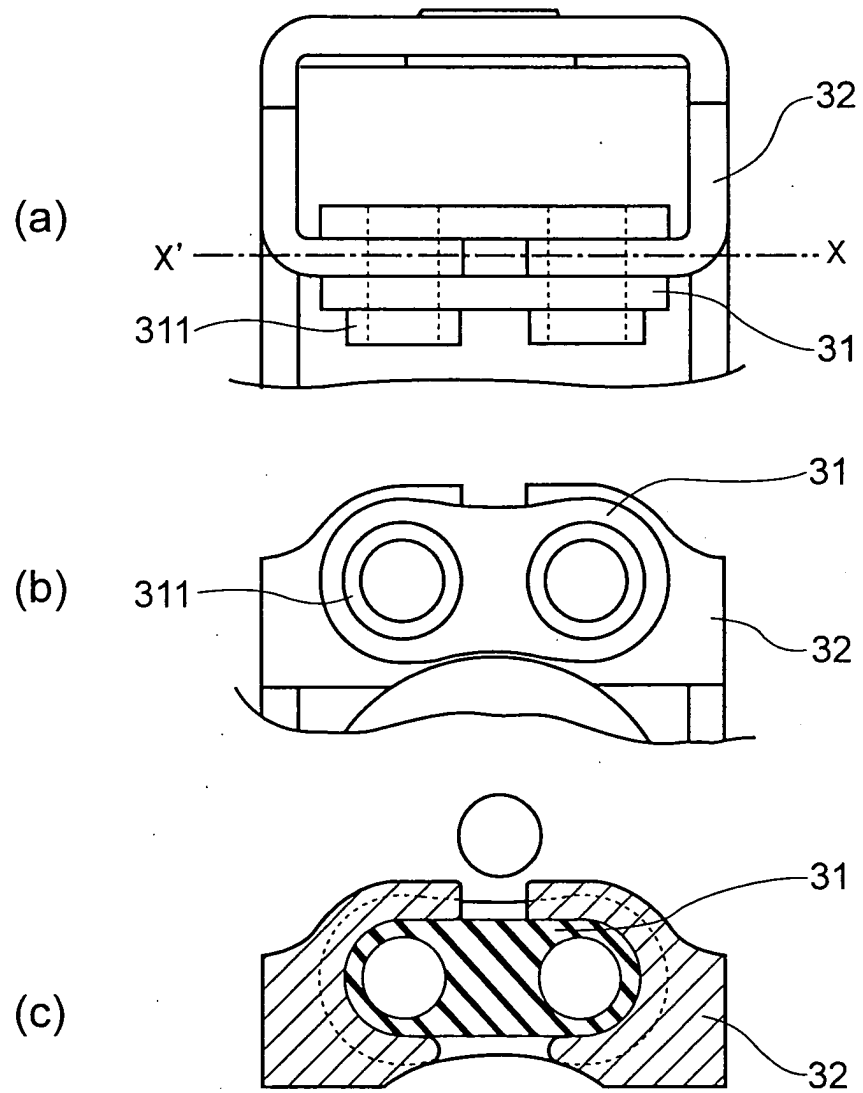


FIG.4

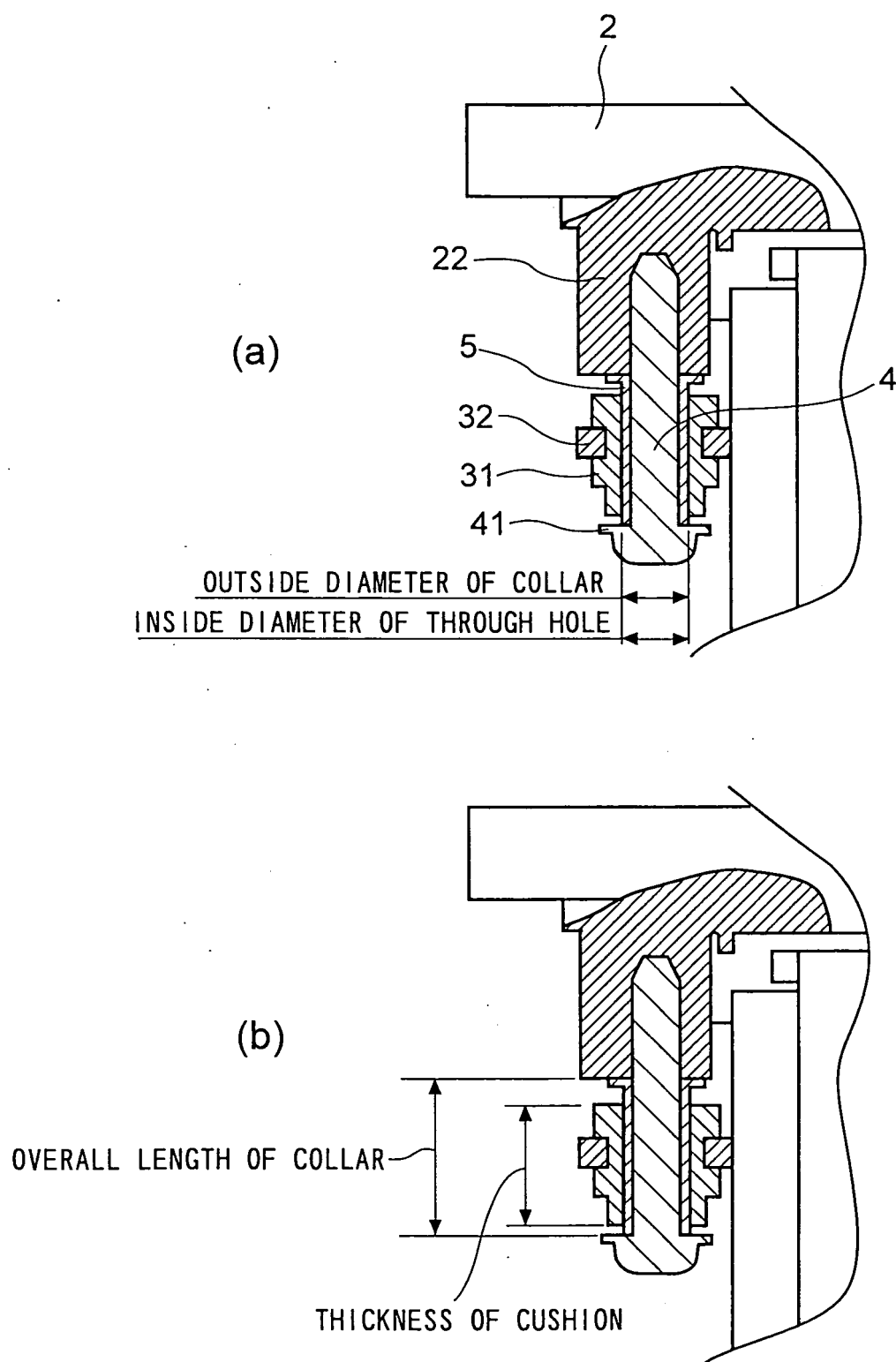


FIG.5

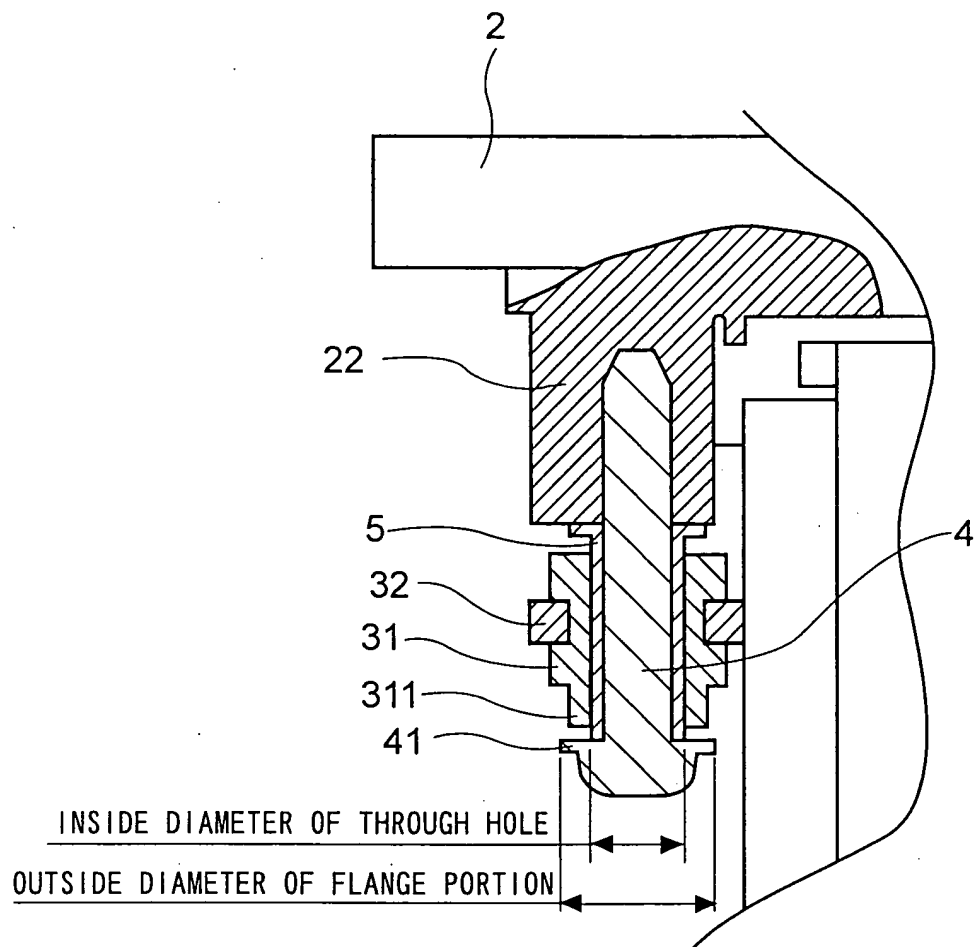


FIG.6

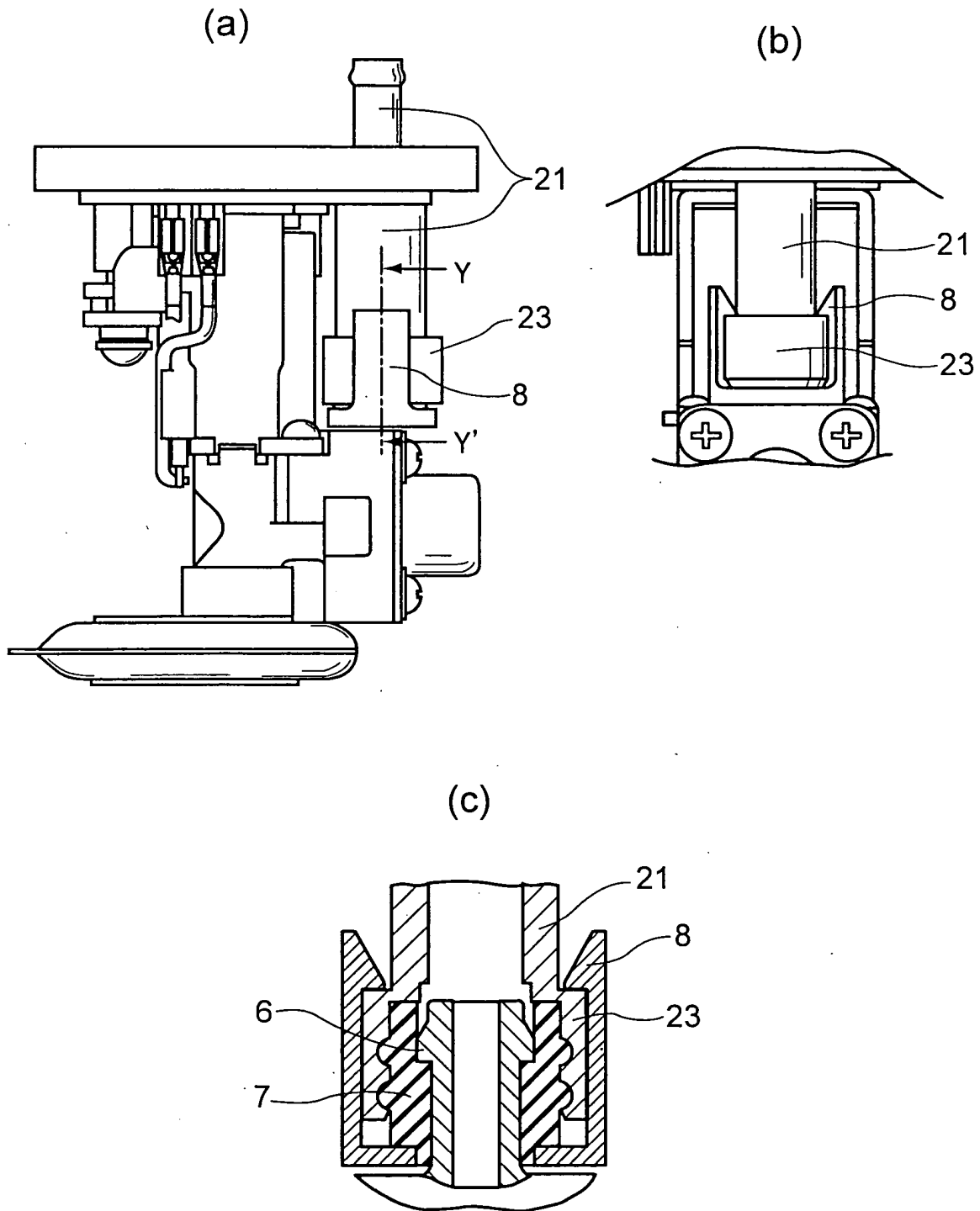
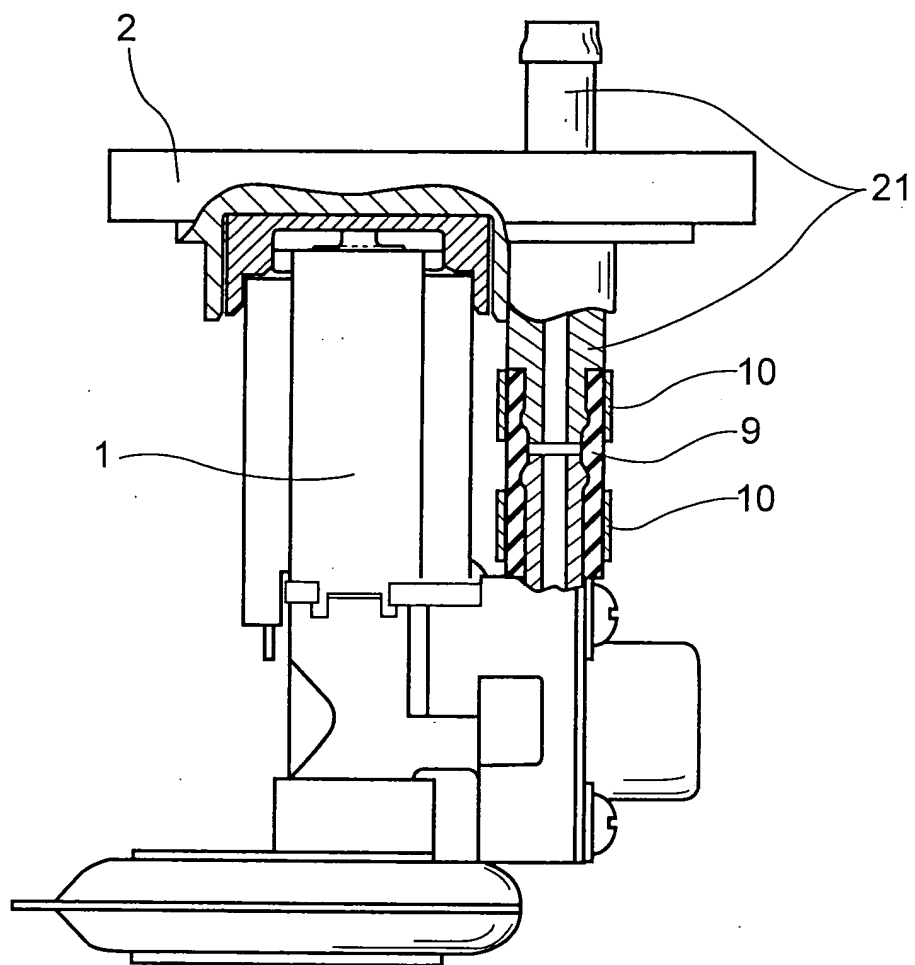


FIG.7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/13908

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl.⁷ F02M37/10, F02M37/00

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 F02M37/10, F02M37/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Toroku Jitsuyo Shinan Koho 1994-2004
Kokai Jitsuyo Shinan Koho 1971-2004 Jitsuyo Shinan Toroku Koho 1996-2004

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	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 180864/1984 (Laid-open No. 95971/1986) (Japan Electronic Control Systems Co., Ltd.), 20 June, 1986 (20.06.86), Page 2, line 2 to page 3, line 10; Figs. 3, 4 (Family: none)	1-6
Y	JP 2000-134862 A (Fujitsu General Ltd.), 12 May, 2000 (12.05.00), Full text; Figs. 2, 4, 5 (Family: none)	1-6

☒ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
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Date of the actual completion of the international search
16 January, 2004 (16.01.04)

Date of mailing of the international search report
27 January, 2004 (27.01.04)

Name and mailing address of the ISA/
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/13908

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 2651/1988 (Laid-open No. 108355/1989) (Toyoda Gosei Co., Ltd.), 21 July, 1989 (21.07.89), Page 6, lines 7 to 10; Fig. 3 (Family: none)	6

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