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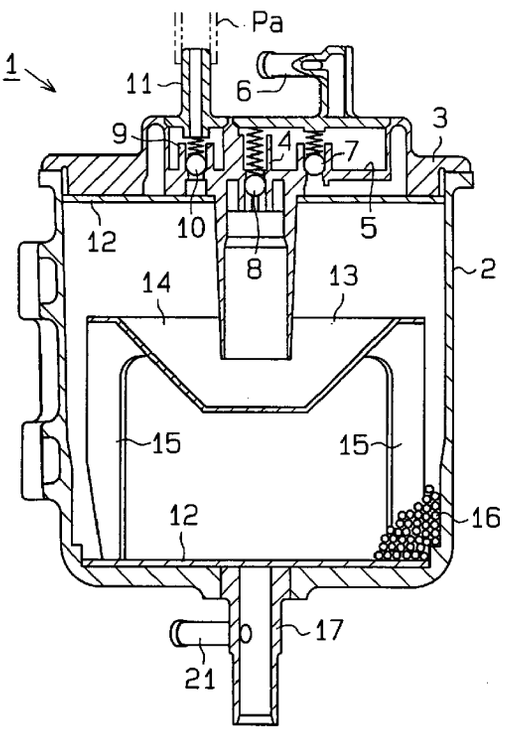
(54) Canister

(57) A case (2) of a canister (1), filled with an adsorbent (16), is provided with a vapor port (4), through which fuel vapor is drawn, a purge port (9), through which the fuel vapor is purged, and an intake port (17), through which air for purging is drawn. The intake port (17) is provided with a branch pipe (21) and an intake hose (22), which is connected to the branch pipe (21). The inner diameters of the branch pipe (21) and the intake hose (22) are small. The inner diameters of the intake port 17 and a vapor releasing hose (18), which is connected to the intake port (17), are larger than the branch pipe (21) and the intake hose (22). This increases the fluid-flow resistance of the branch pipe (21) and the intake hose (22). Thus, the release of fuel vapor from the intake hose (22) is suppressed even when the fuel vapor pressure in the case (2) has increased.

Fig.2



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Description

TECHNICAL FIELD

The present invention relates to canisters that prevent fuel vapor produced in a fuel tank from being released into the atmosphere.

RELATED BACKGROUND ART

Canisters are employed to treat fuel vapors, which are produced in a fuel tank, and prevent the vapor from being released into the atmosphere. A typical canister is provided with a case filled with adsorbent that adsorbs fuel vapor. The case has a vapor port, a purge port, and an intake port. The fuel vapor is drawn into the canister through the vapor port and purged into an engine intake passage through the purge port. Ambient air is drawn into the canister through the intake port. The fuel vapor produced in the fuel tank is temporarily collected by the adsorbent in the canister. Operation of the engine during purging causes negative pressure to separate the fuel vapor from the adsorbent and mix the vapor with the ambient air. The mixture is then drawn into the intake passage for combustion.

A hose is connected to an air hole. The hose extends through a side rail and has an opening located at the inner side of a vehicle front side member. The negative pressure produced during purging draws the ambient air into the canister through the hose. When the fuel vapor collected in the canister becomes surplus, the fuel vapor is discharged through the hose.

However, if the vehicle is driven along a flooded road and the ambient air is drawn into the canister through the hose during purging, water may be drawn into the canister through the hose when its opening is submerged. The water entering the canister may deteriorate the adsorbent in the canister and cause problems with the engine.

As shown in Fig. 6, a hose 25 provided with an intake passage 26 and a releasing passage 27 has been proposed to cope with this problem. (Toyota Technical Information, Publication No. 2178, published on July 29, 1987) The opening of the intake passage 26 is located above the opening of the releasing passage 27. A check valve 28 is provided in the intake passage 26. When the vehicle is driven through water (with the opening of the releasing passage 27 submerged), negative pressure produced in a canister case 29 opens the check valve 28 and tolerates the introduction of ambient air. Although the negative pressure draws the ambient air in the canister through the check valve 28, the difference in negative pressures in the passages 26, 27 prevents water from being drawn into the canister through the passage 27 even when its opening is submerged under water level. A pressure increase in the canister case 29 closes the check valve 28 and releases fuel vapor from the releasing passage 27.

However, providing the intake passage 26 and the releasing passage 27 separately in the releasing hose 26, and providing the check valve 28 in the intake passage 26 results in an increase in costs. The check valve 28 also requires space resulting in the large size of the apparatus. Omitting the check valve 28 for avoiding this defect causes the water to be drawn into the canister. It also causes the fuel vapor to be released into the atmosphere through the intake passage 26. This results in undesirable fuel emissions.

DISCLOSURE OF THE INVENTION

Accordingly, it is an object of the present invention to provide a canister capable of suppressing the release of fuel vapor from an intake passage without employing a check valve. It is also an object of the present invention to reduce the cost of providing a canister.

It is another object of the present invention to provide a canister capable of preventing foreign material from entering thereinto.

To achieve the above objects, a canister is provided with a case which accommodates an adsorbent, a first port for introducing fuel vapor to the case, a second port for purging the fuel vapor accumulated in the case, and a third port for introducing ambient air to the case when the fuel vapor is charged. The third port is coupled to a first passage and a second passage. Ambient air flows into the case through the first passage. The fuel vapor is released to the ambient atmosphere from the case through the second passage. The canister characterized by that the fluid-flow resistance in the first passage is larger than the fluid-flow resistance in the second passage.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the present invention that are believed to be novel are set forth with particularity in the appended claims. The invention, together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

Fig. 1 is a schematic view showing a canister according to a first embodiment of the present invention;

Fig. 2 is an enlarged front cross-sectional view of the canister;

Fig. 3 is an enlarged rear view, partially in cross-section, showing the canister;

Fig. 4 is an enlarged cross-sectional view showing an intake port;

Fig. 5 is a rear view showing a canister according to a second embodiment of the present invention; and

Fig. 6 is a front view, partially in cross-section, showing a prior art canister.

DESCRIPTION OF SPECIAL EMBODIMENTS

A first embodiment of the present invention will now be described with reference to Figs. 1 through 4.

As shown in Fig. 2, a canister 1 includes a cylindrical case 2 having a closed bottom, and a lid 3 closing the case 2. The lid 3 has a vapor port 4 for drawing fuel vapor produced in a fuel tank into the canister 1. The top end of the vapor port 4 is connected with a communication chamber 5, which is also provided in the lid 3. The communication chamber 5 is connected with a connecting pipe 6 provided at the upper section of the lid 3. The pipe 6 is connected to a fuel tank (not shown).

A check valve 7 is provided in the communication chamber 5 at the right side of the vapor port 4. Negative pressure in the fuel tank opens the relief valve 7. A check valve 8 is provided in the vapor port 4 in order to control the pressure in the tank. The check valve 8 is opened when the pressure in the fuel tank becomes greater than a predetermined value. This allows the fuel vapor produced in the fuel tank to be drawn into the case 2. The check valve 8 is closed when the pressure in the fuel tank becomes lower than the predetermined value.

A purge port 9 is provided at the left side of the vapor port 4. A check valve 10 is provided in the purge port 9. A connecting pipe 11 is provided on the lid 3 and connected to an intake system through a purge pipe Pa. A difference of pressures in the case 2 and the chamber 5 opens the control valve 10 and enables the fuel vapor in the canister 1 to be purged into the intake system through the purge pipe Pa.

Filters 12 are arranged on the bottom of the case 2 and on the lower surface of the lid 3. A baffle plate 13 is arranged in the case 2. The baffle plate 13 includes a deflecting plate 14 supported by supports 15. The baffle plate 15 is arranged to face toward the inner end of the vapor port 4. The deflecting plate 14 deflects the flow of the fuel vapor introduced through the vapor port 4 and disperses the vapor throughout the case 2. The case 2 is filled with activated charcoals 16, which collectively serve as an adsorbent. Only a small portion of the activated charcoals 16 is shown in Fig. 2.

An intake port 17, which serves to draw ambient air into the canister 1, projects downward from the bottom center of the case 2. As shown in Figs. 3 and 4, a vapor releasing hose 18 is connected to the lower end of the intake port 17. The hose 18 has an inner diameter D2 larger than an inner diameter D1 of the intake port 17. As shown in Fig. 1, the releasing hose 18 extends through a side rail 19. The outlet 20 of the hose 18 is oriented downward at the inner side of the front fender of the vehicle. However, the location of the outlet 20 is not necessarily restricted to the inner side of the front fender. It may be located within any other space defined within the construction of the vehicle. The releasing hose 18 and the intake port 17 define a fuel vapor releasing passage, or a second passage.

A branch pipe 21 horizontally projects from the intake port 17. As shown in Fig. 4, an intake hose 22 is connected to the distal end of the branch pipe 21. The intake hose 22 has an inner diameter D4 larger than an inner diameter D3 of the branch pipe 21. The intake hose 22 is bent in a substantially L-shaped manner with its inlet 23 being oriented in an upward direction (Fig. 1). The branch pipe 21 and the intake hose 22 define an air intake passage, or a first passage. The dimensional relationship between the inner diameters D1, D2, D3, D4 of the associated intake port 17, the releasing hose 18, the branch hose 21, and the intake hose 22 is represented by the inequality of D2>D1>D4>D3.

As shown in Fig. 1, the air intake passage constituted by the pipe 21 and the hose 22 has an effective length L1. The fuel vapor releasing passage constituted by the hose 18 and the port 17 has an effective length L2. As shown in Fig. 4, an axis Q of the branch pipe 21 and an axis P of the intake port 17 intersect at point O. As shown in Fig. 1, the length L1 of the air intake passage refers to the length between point O and the distal end of the inlet 23 of the intake hose 22. Length L2 of the fuel vapor releasing passage refers to the length between point O and the distal end of the inlet 20 of the releasing hose 18. The above dimensional relationship of the inner diameters D1, D2, D3, D4 is influenced by the flow rate M of the fuel vapor drawn into the canister 1 through the vapor port 4, the length L1, and the length L2.

In the preferred embodiment, the inner diameter D3 of the branch pipe 21 and the inner diameter D1 of the intake port 17 are determined based on experiments. The length L1 of the air intake passage and the length L2 of the fuel vapor releasing passage are predetermined in accordance with the dimensions required for assembly of the vehicle. To determine the inner diameters D1, D2, D3, D4, fuel vapor is delivered through the vapor port 4 into the canister 1 accommodating the activated charcoals 16 at a flow rate presumed to be maximum during actual operation. The diameter D4 where the flow rate of the fuel vapor released from the intake hose 22 becomes lower than a reference value is then confirmed to determine the inner diameters D1, D2, D3, D4.

An increase of the fuel vapor pressure in the case 2 releases the fuel vapor from the case 2 through the intake port 17 and the outlet 20 of the releasing hose 18. The fluid-flow resistance per a unit is large in the branch pipe 21 and the intake hose 22 when the fuel vapor is released since the inner diameters D3, D4 of the associated branch pipe 21 and the intake hose 22 are smaller than the diameters D1, D2 of the associated intake port 17 and the releasing hose 18. This suppresses the fuel vapor from being released into the atmosphere through the branch pipe 21 and the intake hose 22.

As a vehicle is driven through water, negative pres-

sure in the case 2 of the canister 1, which may be caused by purging, results in a negative pressure difference when the outlet of the fuel vapor releasing passage is submerged. This draws ambient air into the case 2 through the intake hose 22 and the branch pipe 21. In this state, water is prevented from entering the case 2 through the outlet 20 of the releasing hose 18.

In the above embodiment, the inner diameters D3, D4 of the branch pipe 21 and the intake hose 22 are smaller than the inner diameter D1 of the intake port 17. However, instead of this structure, a restriction may be provided in at least either the branch pipe 21 or the intake hose 22 so that the fluid-flow resistance becomes greater than the intake port 17 and the releasing hose 18.

The effective length L1 of the air intake passage 21, 22 may be extended so that it becomes longer than the effective length L2 of the fuel vapor releasing passage 17, 18. This results in the fluid-flow resistance of the air intake passage 21, 22 becoming larger than that of the fuel vapor releasing passage 17, 18. To lengthen the effective length of the air intake passage, the intake hose 22 may be spirally wound in an upward direction in a manner that its inlet 23 is located at a higher position.

A second embodiment of the present invention will now be described with reference to Fig. 5. Parts corresponding to the first embodiment will be denoted with the same reference numerals and only parts that differ from the first embodiment will be described below.

In this embodiment, the distal section of the intake hose 22 is extended in an upward direction and then curved in a manner that its inlet 23 is oriented in a downward direction. The shape of the intake hose 22 prevents foreign material from entering the hose 22. Accordingly, the structure of the second embodiment prevents water or dust from falling into the hose 22.

It is noted that an air filter may be provided in the inlet 23 of the hose 22 to prevent foreign material from entering the hose 22. The hose 22 may be either curved or linear. The curved hose 22 having the air filter at its inlet 23 optimally prevents the entrance of foreign material that tends to come in through the inlet 23.

Although only two embodiments of the present invention have been described herein, it should be apparent to those skilled in the art that the present invention may be embodied in many other specific forms without departing from the spirit or scope of the invention. Particularly, it should be understood that the present invention may be embodied in the following form.

The dimensional relationship of the inner diameters D1, D2, D3, D4 are also influenced by the shape of the passages (the number of curves and corners). Hence, these factors may also be taken into consideration when determining the dimensional relationship of the inner diameters D1, D2, D3, D4.

Accordingly, the present examples and embodiments are to be considered as illustrative and not restrictive and the invention is not to be limited to the details given herein, but may be modified within the scope of the appended claims.

Claims

1. A canister including a case (2) which accommodates an adsorbent (16), a first port (4) for introducing fuel vapor to said case (2), a second port (9) for purging the fuel vapor accumulated in the case (2) and a third port (17) for introducing ambient air to the case (2) when the fuel vapor is charged, said third port (17) being coupled to a first passage (21, 22) and a second passage (17, 18), wherein ambient air flows into the case (2) through the first passage (21, 22), and wherein said fuel vapor is released to the ambient atmosphere from the case (2) through the second passage (17, 18), said canister **characterized by that** the fluid-flow resistance in the first passage (21, 22) is larger than the fluid-flow resistance in the second passage (17, 18).

2. The canister as set forth in Claim 1, **characterized by that** said first passage (21, 22) has an inner diameter smaller than that of said second passage (17, 18).

3. The canister as set forth in Claim 2, wherein said first passage (21, 22) is shorter than said second passage (17, 18), wherein a length (L1) of the first passage (21, 22) and a length (L2) of the second passage (17, 18) are selected to keep the fluid-flow resistance in the second passage (17, 18) smaller than the fluid-flow resistance in the first passage (21, 22).

4. The canister as set forth in Claim 1, **characterized by that** said first passage (21, 22) has a restriction therein.

5. The canister as set forth in Claim 1, **characterized by that** said first passage (21, 22) is longer that the second passage.

6. The canister as set forth in any one of the preceding claims, **characterized by that** said first passage includes a branch pipe (21) projecting from the intake port (17) and an intake hose (22) coupled to the branch pipe (21).

7. The canister as set forth in any one of the preceding claims, **characterized by that** said second passage includes an intake port (17) projecting from the bottom center of the case (2) and a vapor releasing hose (18) coupled to the intake port (17).

8. The canister as set forth in Claim 7, **characterized by that** said intake port (17) has an inner diameter (D1), said vapor releasing hose (18) has an inner

diameter (D2), said branch pipe has an inner diameter (D3) and said intake hose (22) has an inner diameter (D4), wherein the dimensional relationship between the inner diameters (D1, D2, D3, D4) is represented by an inequality of D2>D1>D4>D3.

9. The canister as set forth in any one of the preceding claims, **characterized by that** said first passage (21, 22) has a filter for preventing a foreign material entering thereinto.

10. The canister as set forth in any one of the preceding claims, **characterized by that** said first passage (21, 22) has a distal end extended in an upward direction.

11. The canister as set forth in Claim 10, **characterized by that** said distal end of the first passage (21, 22) is oriented in a downward direction after being curved upward.

12. The canister as set forth in any one of the preceding claims, **characterized by that** said absorbent includes a plurality of activated charcoals (16).

Fig.2

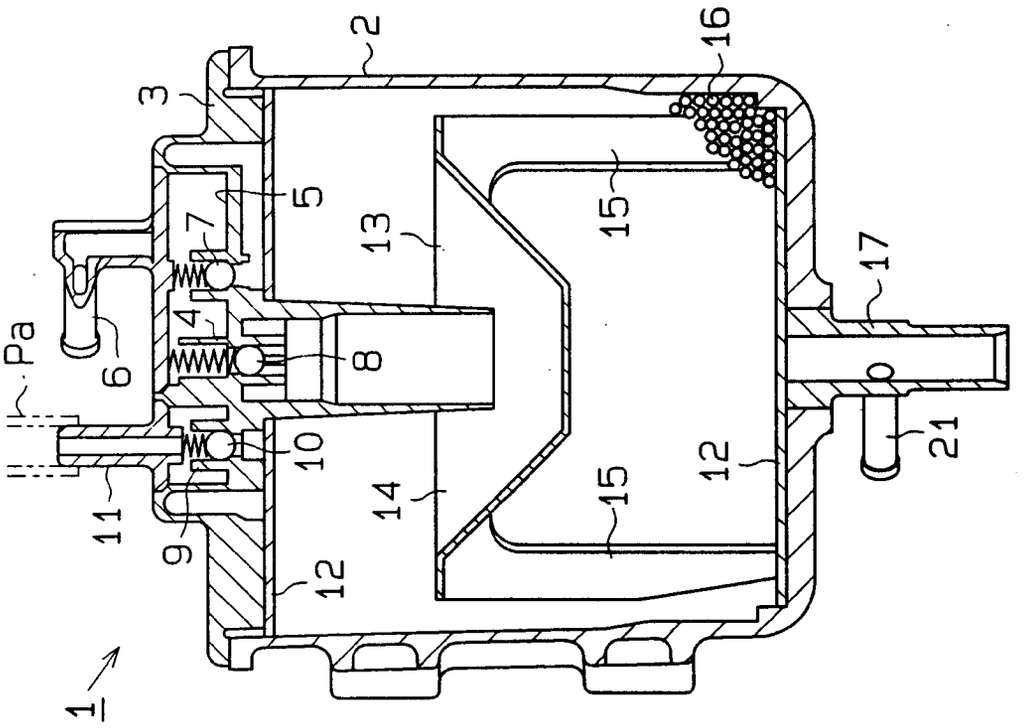

2
16
3
5
13
15
17
7
4
8
6
Pa
10
21
11
14
15
12
9
12
1

Fig.1

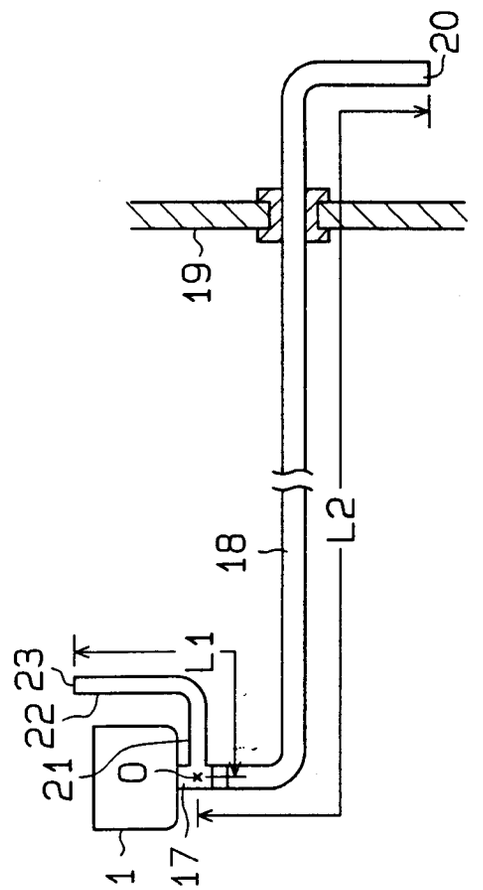

20
19
18
L2
23
L1
22
21
17
1

Fig.4

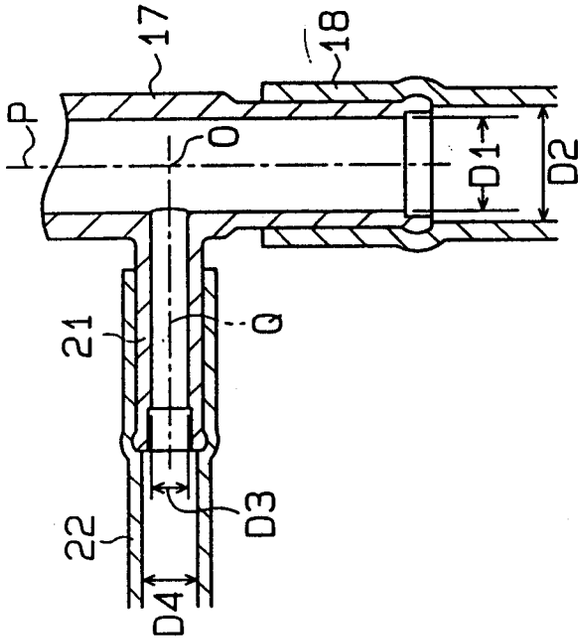


Fig.3

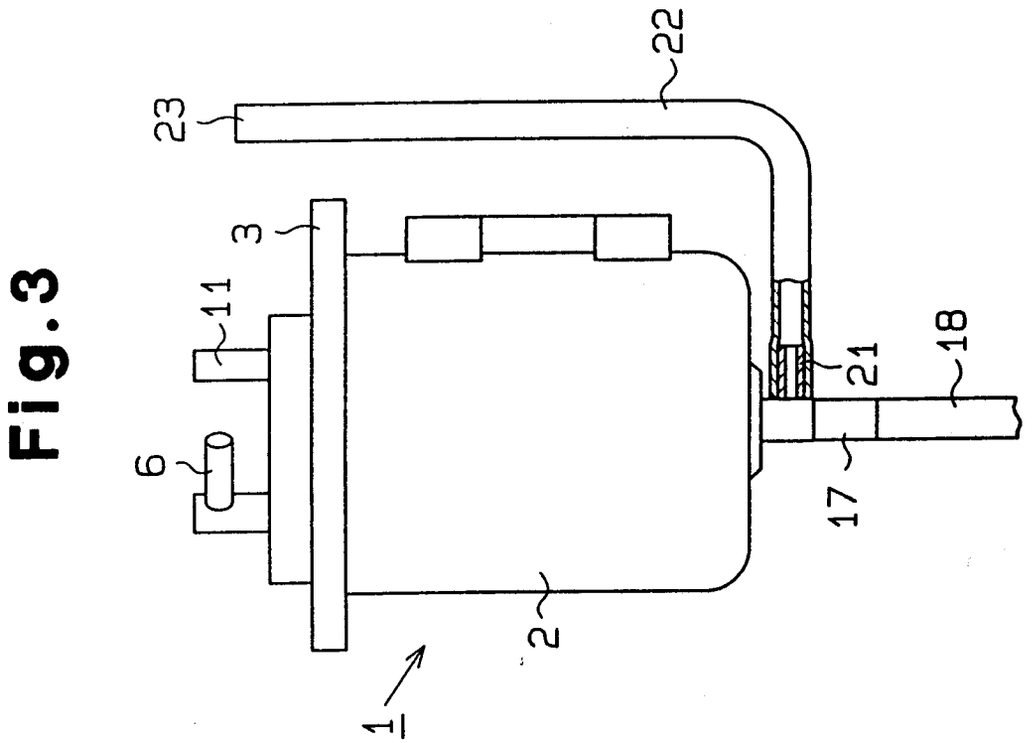


Fig.6

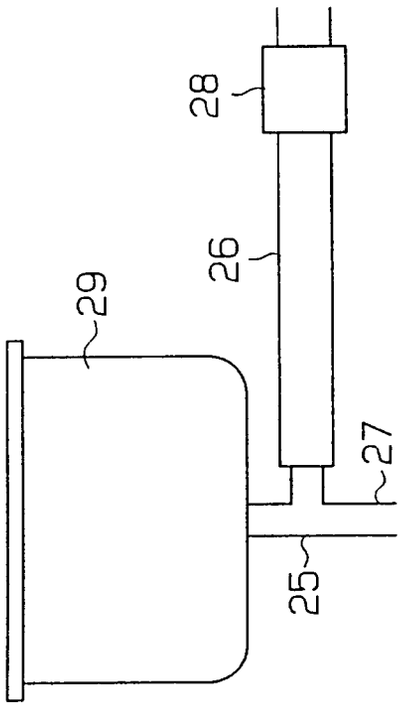
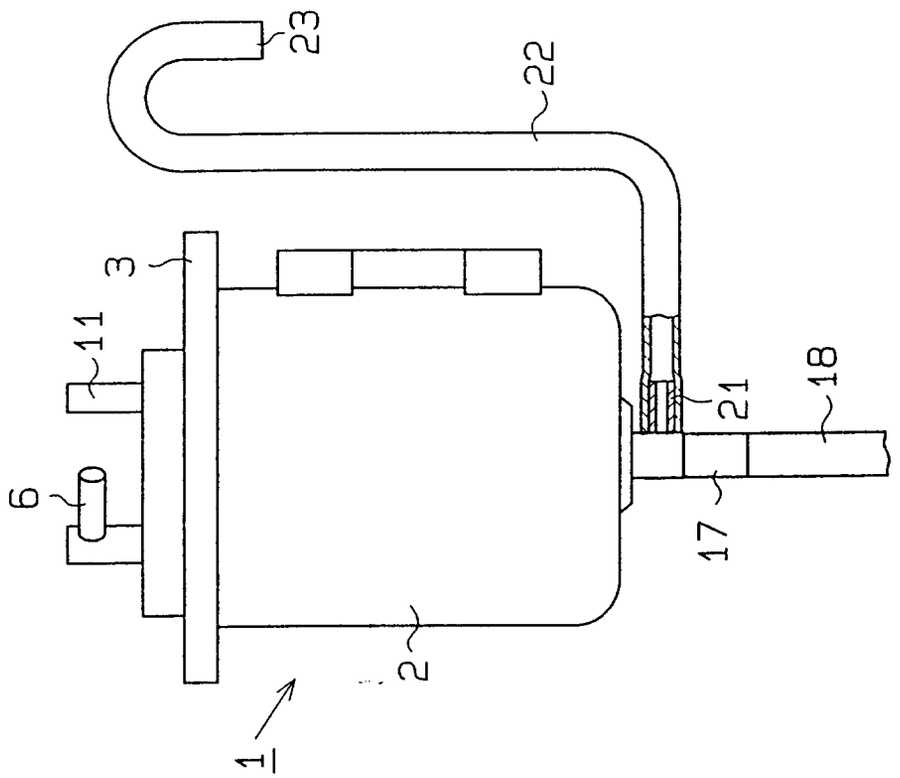


Fig.5



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EUROPEAN SEARCH REPORT

Application Number
EP 96 11 1463

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE-C-37 34 414 (AUDI) * column 1, line 33 - line 40 * * column 2, line 1 - line 11 *	1,6,7, 10,11	F02M25/08
Y	* column 2, line 15 - line 28 *	9,12	
Y	EP-A-0 604 320 (JOURNEE) * column 5, line 4 - line 9; figure 1 *	9	
Y	PATENT ABSTRACTS OF JAPAN vol. 13, no. 552 (M-903), 8 December 1989 & JP-A-01 227861 (TOYOTA), 12 September 1989, * abstract *	12	
A	US-A-5 427 076 (KOBAYASHI) * column 5, line 55 - column 6, line 44 *	1	
A	EP-A-0 425 862 (AUDI) * column 2, line 21 - column 3, line 6 *	1	
A	EP-A-0 451 313 (SIEMENS) * page 3, column 20, paragraph 27; figure 1 *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.6) F02M
A	DE-A-43 43 654 (BOSCH) * figures 2-5 *	1	
A	DE-A-39 35 209 (HOLZER) * column 2, line 38 - line 45 * * column 2, line 64 - column 3, line 2 * * column 3, line 27 - line 35 * * column 3, line 64 - column 4, line 28; figure 4 *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30 October 1996	Joris, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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