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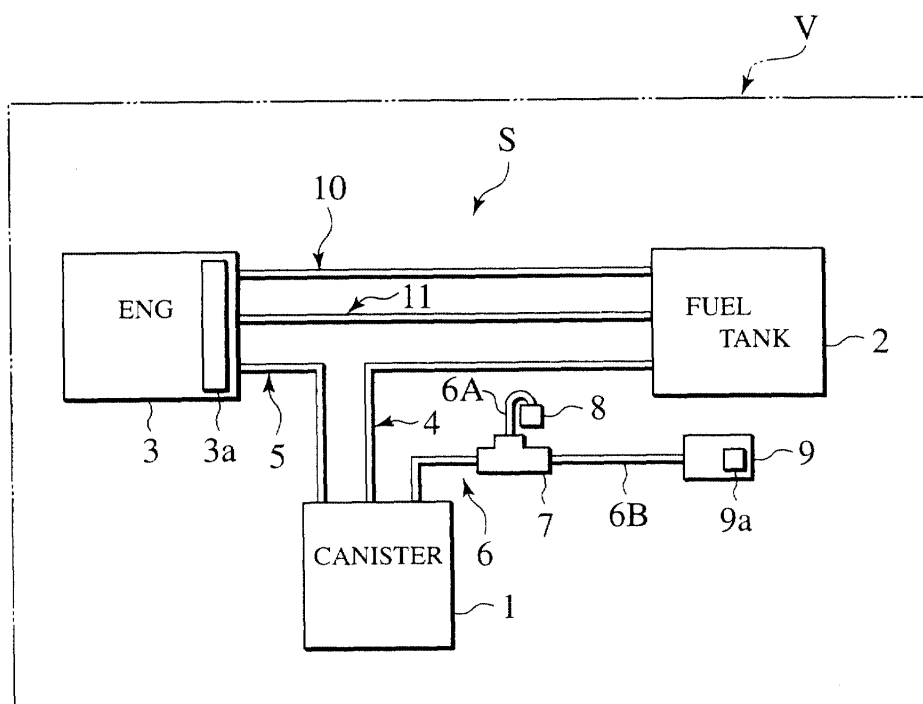
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(54) Evaporated fuel treating apparatus and method

(57) A canister (1) contains adsorbent temporarily adsorbing a fuel component in an evaporated fuel which is generated within a fuel tank for an internal combustion engine. A drain passage (6) causes the canister (1) to communicate with atmospheric air. A separator (8) ar-

ranged in an atmospheric-air-side end portion of the drain passage (8) separates and removes water from air introduced into the separator. The separator (8) communicates with the drain passage (6) above a port (16) opened to the atmospheric air and a bottom drain hole (17).

FIG.1



Description

[0001] The present invention relates to an evaporated fuel treating apparatus and an evaporated fuel treating method both of which prevent evaporated fuel generated within a fuel tank from being discharged to atmospheric air with employing a canister filled with adsorbent for temporarily adsorbing or occluding the evaporated fuel, and more particularly to a structure of a drain passage causing the canister to communicate with atmospheric air thereof.

[0002] There is an evaporated fuel treating apparatus structured such that a canister filled with adsorbent (activated carbon or the like) for temporarily adsorbing a fuel component of evaporated fuel is provided in order to prevent the evaporated fuel generated within a fuel tank from diffusing in atmospheric air, whereby the evaporated fuel is temporarily adsorbed by the adsorbent during stop of an internal combustion engine and the evaporated fuel is introduced to an intake system (an intake passage or the like) during operation of the internal combustion engine.

[0003] In particular, an evaporation passage communicating with a fuel tank, a purge passage communicating with the intake system in the internal combustion engine, and a drain passage communicating with atmospheric air are connected to the canister of the evaporated fuel treating apparatus mentioned above.

[0004] In the structure mentioned above, when a pressure within the fuel tank becomes equal to a predetermined pressure or more due to generation of the evaporated fuel at a time when the internal combustion engine is stopped, the evaporated fuel is fed to the canister via the evaporation passage, and a fuel component of the evaporated fuel is adsorbed in the adsorbent of the canister. Then, only air from which the fuel component is removed is released to atmospheric air from a port opened to atmospheric air provided in an end portion of the drain passage.

[0005] On the contrary, when the internal combustion engine is operated, the fuel component of the evaporated fuel adsorbed in the canister is sucked together with atmospheric air (so-called clean air) sucked from the drain passage due to a negative pressure of the intake passage in the internal combustion engine, and also is fed within cylinders in the internal combustion engine via the intake passage from the purge passage as purge gas.

[0006] Further, when the fuel tank is cooled due to the influence of environmental temperature or the like and the inside of the fuel tank becomes a negative pressure, the fuel component of the evaporated fuel adsorbed in the canister is returned to the fuel tank together with atmospheric air (so-called clean air) sucked from the drain passage.

[0007] In recent years, there has been proposed a structure in which adsorbing performance of the canister is increased and the port opened to atmospheric air pro-

vided in the end portion of the drain passage is arranged in a lower position of a vehicle so as to be apart from an occupant compartment as far as possible, thereby preventing the evaporated fuel from entering within the occupant compartment (refer to Japanese Patent Application Laid-Open Publication No. 6-99748).

[0008] However, in the case that the port opened to atmospheric air is provided in the lower position of the vehicle, the port opened to atmospheric air is positioned near a road surface, so that there is a drawback that water may enter into the canister via the drain passage due to splash of water at a raining time or the like.

[0009] As mentioned above, if water should enter into the canister, it is considered that the canister may be influenced regarding the evaporated fuel adsorbing performance.

[0010] Particularly, in recent years, in order to thoroughly prevent the evaporated fuel from being diffused into atmospheric air, there is employed a so-called bottom close type canister in which a lower side of the canister is closed so as to lengthen an adsorbing passage and improve adsorbing performance, so that it is required to thoroughly prevent water from entering into the canister.

[0011] Accordingly, an object of the present invention is to provide an evaporated fuel treating apparatus and an evaporated fuel treating method both of which can effectively prevent water from entering into a canister via a drain passage so as to improve evaporated fuel adsorbing performance of the canister.

[0012] In accordance with the present invention, there is provided an evaporated fuel treating apparatus comprising a canister filled with adsorbent temporarily adsorbing a fuel component in an evaporated fuel generated within a fuel tank for an internal combustion engine, a drain passage causing the canister to communicate with atmospheric air, and a separator arranged in an atmospheric air side end portion of the drain passage to separate and remove water in air introduced into the separator. The separator is provided with a connector portion communicating with the drain passage, a side wall portion having a port opened to the atmospheric air and a bottom wall portion having a drain hole.

[0013] In other words, an evaporated fuel treating apparatus of the present invention comprises a canister filled with adsorbent temporarily adsorbing a fuel component in an evaporated fuel generated within a fuel tank for an internal combustion engine, a drain passage causing the canister to communicate with atmospheric air, and a separator arranged in an atmospheric air side end portion of the drain passage to separate and remove water in air introduced into the separator. The separator is provided with first communicating means for communicating with the drain passage, second communicating means for communicating with the atmospheric air and draining means for draining water.

[0014] Beside, an evaporated fuel treating method of the present invention comprises, temporarily adsorbing

a fuel component in an evaporated fuel generated within a fuel tank for an internal combustion engine, introducing air in correspondence with a negative pressure generated in the internal combustion engine or a negative pressure generated in the fuel tank, separating and removing water of the introduced air, and sending the temporarily adsorbed fuel component to the internal combustion engine or the fuel tank together with the introduced air in which the water is separated and removed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

Fig. 1 is a diagram showing a structure of an evaporated fuel treating apparatus in accordance with an embodiment of the present invention;

Fig. 2 is a perspective view showing a structure around a canister in accordance with the embodiment; and

Fig. 3 is a cross-sectional view of a separator in accordance with the embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0016] A description will be in detail given below of an evaporated fuel treating apparatus and an evaporated fuel treating method in accordance with an embodiment of the present invention suitably with reference to the accompanying drawings by exemplifying a structure applied to an evaporated fuel treating apparatus and an evaporated fuel treating method of an internal combustion engine of a vehicle.

[0017] Fig. 1 is a system diagram of an evaporated fuel treating apparatus S in accordance with the present embodiment in the case of being applied to the internal combustion engine of the vehicle V.

[0018] In Fig. 1, reference numeral 1 denotes a canister filled with adsorbent (activated carbon or the like) for temporarily adsorbing a fuel component of an evaporated fuel generated within a fuel tank 2.

[0019] An evaporation passage 4 communicating with the fuel tank 2, a purge passage 5 communicating with an intake passage 3a of an intake system in an internal combustion engine 3, and a drain passage 6 communicating with an external portion (atmospheric air) are connected to the canister 1.

[0020] The drain passage 6 is branched into a first drain passage 6A and a second drain passage 6B arranged toward a lower portion of the vehicle relative to the first drain passage 6A so that an atmospheric-air-side end portion thereof is positioned at the lower portion of the vehicle by providing a trifurcate connector 7 in the middle of the drain passage 6.

[0021] A separator 8, mentioned below, is connected to an atmospheric-air-side end portion of the first drain passage 6A, and an atmospheric-air-side end portion of

the second drain passage 6B is arranged in the lower position of the vehicle and is connected with a drain box 9. The drain box 9 is positioned to be lower than the separator 8.

[0022] Further, a one-way valve 9a for discharging the component other than the fuel component of the evaporated fuel to atmospheric air and restricting intake of atmospheric air to the second drain passage 6B is provided in the drain box 9.

[0023] Incidentally, in Fig. 1, reference numeral 10 denotes a feed passage for supplying fuel to the internal combustion engine 3 from the fuel tank 2, and reference numeral 11 denotes a return passage for returning surplus fuel to the fuel tank 2 from the internal combustion engine 3.

[0024] A description will be in more detail given below of a structure of the drain passage 6 for causing the canister 1 to communicate with the external portion (atmospheric air) further with reference to Figs. 2 and 3.

[0025] Fig. 2 is a perspective view showing a structure around the canister 1 of the evaporated fuel treating apparatus S in accordance with the present embodiment, and Fig. 3 is a cross-sectional view particularly showing a separator 8. Incidentally, an arrow UPR in Fig. 2 indicates an upward direction of the vehicle.

[0026] In this case, the evaporation passage 4 and the purge passage 5 are connected to the canister 1 by an evaporation connector 4a and a purge connector 5a, respectively, and one end of the drain passage 6 is connected to a drain connector 6a provided on an upper surface of the canister 1.

[0027] Reference numeral 7 denotes the above-mentioned trifurcate connector provided in the middle of the drain passage 6. The trifurcate connector 7 has connector portions 7a, 7b, and 7c.

[0028] In particular, the trifurcate connector 7 is mounted to a side wall portion of the canister 1, and the connector portions 7a, 7b, and 7c are respectively connected to one end of the first drain passage 6A, one end of the second drain passage 6B, and the other end of the drain passage 6.

[0029] Then, the other end of the first drain passage 6A and the other end of the second drain passage 6B are respectively connected to a connector portion 8a of the separator 8 and the drain box 9 shown in Fig. 1.

[0030] Reference numeral 11 denotes a bracket for fixing the canister 1 to a vehicle body 12. The bracket 11 is fixed to the vehicle body 12 by clips 14, or the like.

[0031] The separator 8 has the function to separate and remove the introduced water thereinto and is mounted to the bracket 11 via a leg portion 15 integrally provided in an outer side wall thereof. In particular, the separator 8 is positioned near the bracket with keeping a predetermined gap between the lower surface of the separator 8 and the upper surface of the bracket 11.

[0032] The separator 8 is provided with a connector portion 8a connected with the first drain passage 6A so as to communicate therewith, a side wall portion 8b hav-

ing an area greater than that of the drain passage 6A, and a bottom wall portion 8c closing a lower end thereof, as shown in Fig. 3. A plurality of ports 16 opened to atmospheric air and a plurality of drain holes 17 are respectively formed in the side wall portion 8b and the bottom wall portion 8c.

[0033] Further, in particular, the connector portion 8a is set above the ports 16 opened to atmospheric air. The bracket 11 positioned below the bottom wall portion 8c is entirely overlapped with the bottom wall portion 8c as seen from an upper portion, and thus the drain holes 17 of the bottom wall portion 8c are not directly exposed downward. Further, the drain holes 17 are positioned above a lower end portion 8d of the side wall portion 8b.

[0034] Next, in the structure mentioned above, a description will be given of the operation of the evaporated fuel treating apparatus S in accordance with the present embodiment.

[0035] At first, when a pressure within the fuel tank 2 becomes equal to or more than a predetermined pressure due to generation of an evaporated fuel during stop of the internal combustion engine 3, the evaporated fuel is fed to the canister 1 via the evaporation passage 4, the fuel component of the evaporated fuel is adsorbed in the adsorbent filled in the canister 1, and only the component obtained such that the fuel component is removed from the evaporated fuel, that is, substantial air is released to the outside via the drain passage 6, that is, via the path passing through the trifurcate connector 7, the first drain passage 6A, and the separator 8, and the path passing through the trifurcate connector 7, the second drain passage 6B, and the drain box 9, respectively.

[0036] On the contrary, during operation of the internal combustion engine 3 the fuel component of the evaporated fuel adsorbed in the canister 1 is sucked from the drain passage 6, that is, sucked together with atmospheric air (so-called clean air) sucked from the first drain passage 6A via the separator 8 due to the negative pressure of the intake passage 3a of the internal combustion engine 3, and is fed within the cylinders of the internal combustion engine 3 via the intake passage 3a from the purge passage 5 as purge gas.

[0037] Further, when the fuel tank 2 is cooled due to the influence of an environmental temperature or the like and the inside of the fuel tank 2 becomes negative pressure, the fuel component of the evaporated fuel adsorbed in the canister 1 is returned to the fuel tank 1 from the drain passage 6, that is, returned together with atmospheric air (so-called clean air) sucked from the first drain passage 6A via the separator 8.

[0038] In accordance with the embodiment mentioned above, since the separator 8 for separating and removing the water in the introduced air is provided in atmospheric-air-side end portion of the first drain passage 6A, the separator 8 is provided with the connector portion 8a communicated and connected with the first drain passage 6A to communicate therewith, the side

wall portion 8b larger than the first drain passage 6A and the bottom wall portion 8c closing the lower end, a plurality of ports 16 opened to atmospheric air are provided in the side wall portion 8b of the separator 8, and the drain holes 17 are provided in the bottom wall portion 8c, it is possible to effectively remove water, as a component in the introduced air, by the separator 8 mentioned above.

[0039] Accordingly, it is possible to prevent water from accidentally entering into the canister 1 via the drain passage 6, and it is possible to effectively prevent the adsorbing performance of the evaporated fuel by the canister 1 from being influenced.

[0040] Further, since such a structure is employed such that the separated and removed water is discharged out of the separator 8 by the drain holes 17 provided in the bottom wall portion 8c in the manner mentioned above, it is possible to effectively prevent the separated and removed water from entering in the drain passage 6.

[0041] In particular, in addition to the effects mentioned above, since the connector portion 8a is positioned at least above the ports 16 opened to atmospheric air, it is possible to effectively prevent water from directly entering to the first drain passage 6A even if water enters from the ports 16 opened to atmospheric air.

[0042] Further, since the separator 8 is mounted to the bracket 11 in an approximate manner with keeping a predetermined gap between the lower surface of the separator 8 and the upper surface of the bracket 11, it is possible to effectively prevent water from entering from the drain holes 17 provided in the bottom wall portion 8c even if the lower portion of the separator 8 is subjected to water splashing or the like.

[0043] Further, since the drain passage 6 is branched into the first drain passage 6A and the second drain passage 6B arranged downward from the first drain passage 6A by the trifurcate connector 7, it is possible to securely keep communication with atmospheric air by the first drain passage 6A even if the second drain passage 6B is closed by dirt, ice, or the like.

[0044] Further, since the one-way valve 9a for restricting intake of atmospheric air is provided in the drain box 9 provided in atmospheric air side end portion of the second drain passage 6B arranged in the lower portion of the vehicle, the second drain passage 6B communicates with atmospheric air only at an exhaust time, so that it is possible to keep exhaust gas away from the inside of the occupant compartment in the vehicle and it is possible to effectively prevent water from entering from the second drain passage 6B, which is arranged in the lower portion of the vehicle and may be easily affected by water splashing or the like.

[0045] In the embodiment mentioned above, the separator 8 is fixed to the vehicle body 12 via the bracket 11, but the present invention is, of course, not limited to such a structure. For example, the separator 8 may be directly mounted to the vehicle body member or the like

by an integrally formed clip or the like.

[0046] Further, the structure in which a plurality of atmospheric air releasing holes 16 and drain holes 17 are provided is shown, but the number, the size, the shape and the like thereof may be suitably set, and only one hole may be provided for each of the holes 16 and 17 as occasion demands.

[0047] The entire contents of Patent Application No. TOKUGANHEI 11-340618 with a filing date of Nov. 30, 1999 in Japan are hereby incorporated by reference.

[0048] Although the invention has been described above by reference to a certain embodiment of the invention, the invention is not limited to the embodiment described above. Modifications and variations of the embodiment described above will occur to those skilled in the art, in light of the teachings. The scope of the invention is defined with reference to the following claims.

Claims

1. Apparatus for treating evaporated fuel, comprising:

a canister (1) containing adsorbent temporarily adsorbing a fuel component in an evaporated fuel which is generated within a fuel tank for an internal combustion engine;

a drain passage (6) causing the canister (1) to communicate with atmospheric air; and

a separator (8) arranged in an atmospheric-air-side end portion of the drain passage (6) to separate and remove water from air introduced thereinto, the separator (8) being provided with a connector portion (8a) communicating with the drain passage (6), a side wall portion (8b) having a port (16) opened to the atmospheric air, and a bottom wall portion (8c) having a drain hole (17).

2. Apparatus as claimed in claim 1, wherein the connector portion (8a) is arranged above the port (16) opened to atmospheric air.

3. Apparatus as claimed in claim 1 or 2, including a member (11) for mounting the separator (8) to a vehicle body side, the mounting member (11) being arranged near and at a lower position than the bottom wall portion (8c), and overlapping with the drain hole (17).

4. Apparatus as claimed in claim 3, wherein the mounting member (11) also mounts the canister (1) to the vehicle body side.

5. Apparatus as claimed in any preceding claim, wherein the drain passage (6) is branched into a first passage (6A) and a second passage (6B) arranged at a lower position than the first passage

(6A), and the separator (8) is provided in an atmospheric-air-side end portion of the first passage (6A).

6. Apparatus as claimed in claim 5, wherein the drain passage (6) is branched into the first passage (6A) and the second passage (6B) by a trifurcate connector (7).

7. Apparatus as claimed in claim 5 or 6, wherein an atmospheric-air-side end portion of the second passage (6B) is arranged at a lower position than the separator (8) and has a one-way valve (9a) restricting intake of atmospheric air.

8. Apparatus for treating evaporated fuel, comprising:

a canister (1) containing adsorbent temporarily adsorbing a fuel component in an evaporated fuel which is generated within a fuel tank for an internal combustion engine;

a drain passage (6) causing the canister (1) to communicate with atmospheric air; and

a separator (8) arranged in an atmospheric-air-side end portion of the drain passage (6) to separate and remove water from air introduced thereinto, the separator (8) being provided with means for communicating with the drain passage (6), means for communicating with the atmospheric air, and means for draining water.

9. A method of treating evaporated fuel, comprising:

temporarily adsorbing a fuel component in an evaporated fuel which is generated within a fuel tank for an internal combustion engine;

introducing air in correspondence with a negative pressure generated in the internal combustion engine or a negative pressure generated in the fuel tank;

separating and removing water from the introduced air; and

sending the temporarily adsorbed fuel component to the internal combustion engine or the fuel tank together with the introduced air from which the water has been separated and removed.

FIG.1

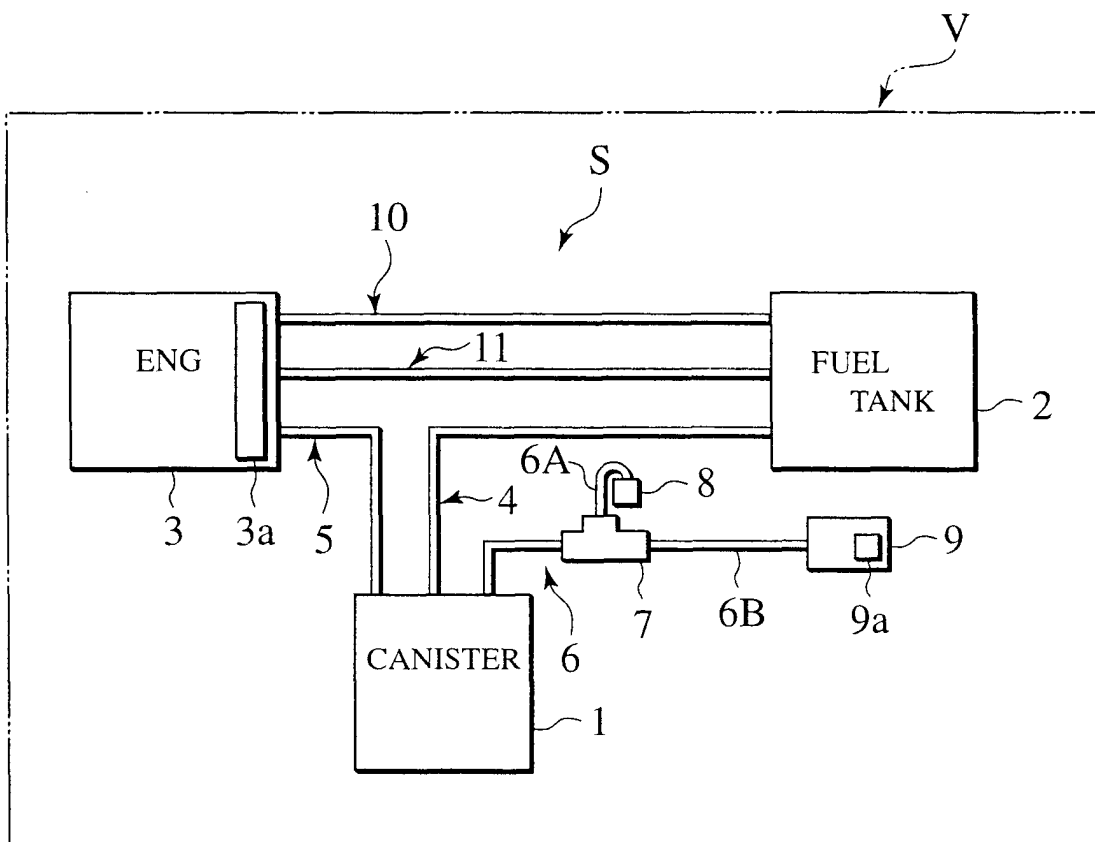


FIG.2

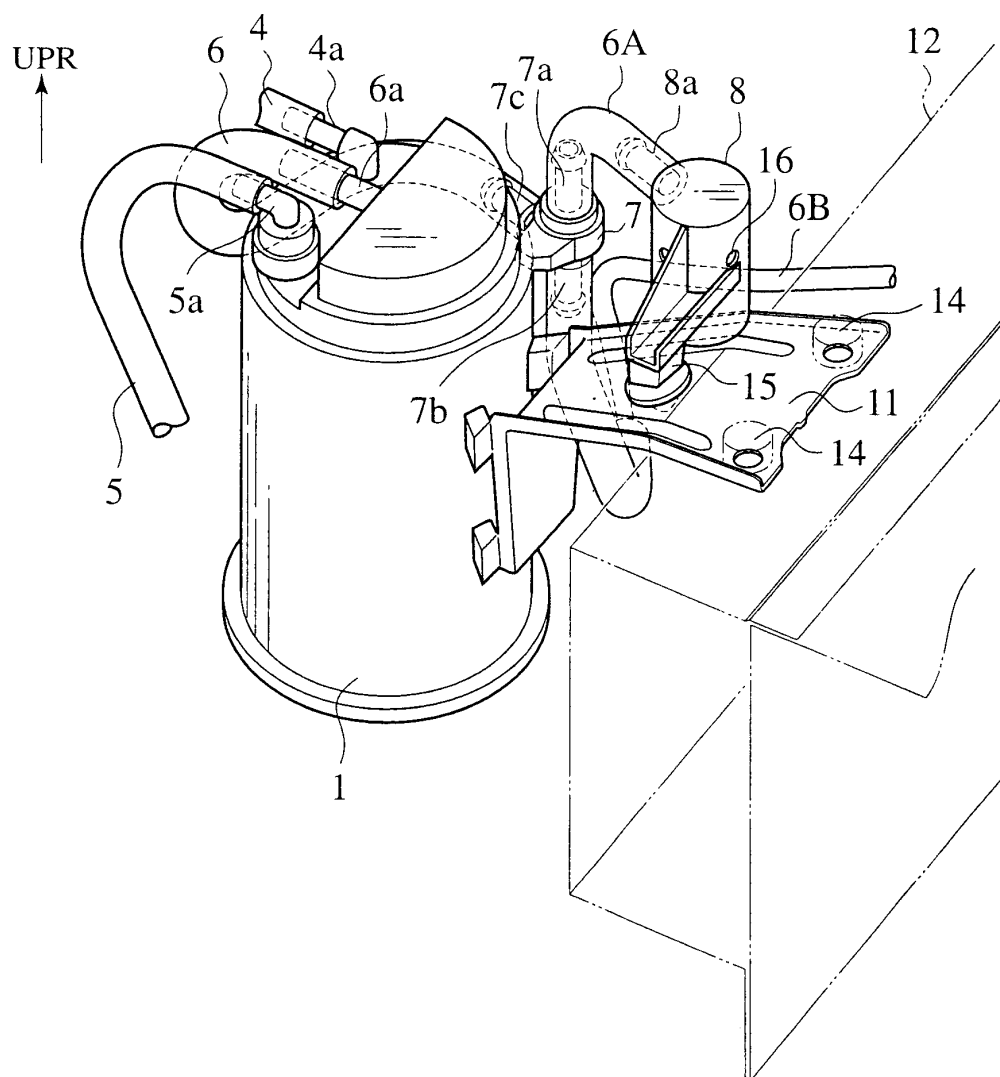


FIG.3

