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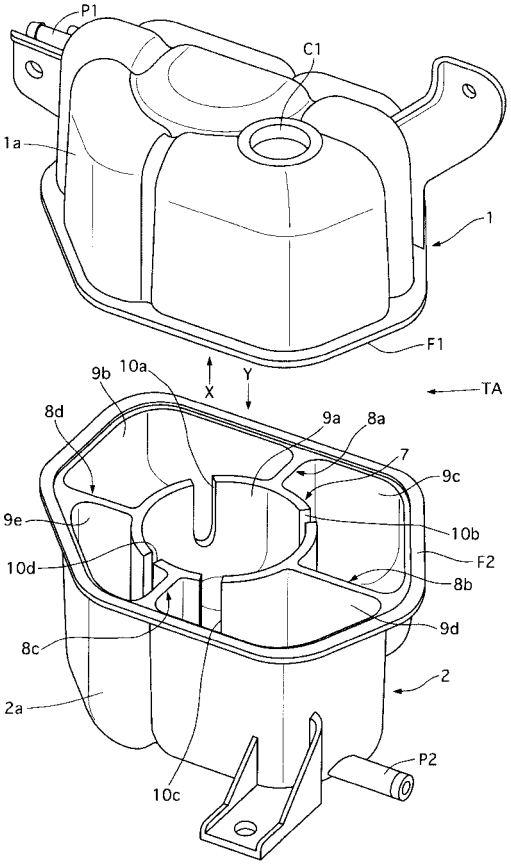
(54) HEATING-TYPE RESERVOIR TANK

(57) A pressure type reserve tank (TA) includes a liquid-tight outer circumferential wall portion (1a, 2a) hermetically containing liquid, a central wall portion (3, 7; 11), arranged in the center of an inner space of the outer circumferential wall portion (1a, 2a), having a substantially circular cylinder shape for forming a circular-cylindrical central chamber (5a, 9a), and a plurality of partition wall portions (4a to 4d, 8a to 8d; 12) radially extending from the central wall portion (3, 7; 12) to the outer circumferential wall portion (1a,2a) to define a plurality of outer circumferential chambers (5a to 5e, 9b to 9e) formed between the central wall portion (3, 7; 11) and the outer circumferential wall portion (1a, 2a) and around the central chamber (5a, 9a). A plurality of slits (6a to 6d, 10a to 10d) is provided on the central wall portion (3, 7; 11) to fluidically communicate the central chamber (5a, 9a) and the outer circumferential chambers (5a to 5e, 9b to 9e).

FIG. 3



EP 1 953 360 A1

Description

[Field of the Invention]

[0001] The present invention relates to a pressure type reserve tank, and in particular relates to a structure thereof with improved pressure resistance.

[Description of the Related Art]

[0002] Conventionally, in order to properly adjust the amount of coolant and internal pressure in a radiator used for a motor vehicle or the like, technology is known, in which a pressure type reserve tank is provided in a coolant circuit connecting an engine to the radiator. Such technology is disclosed in Japanese utility model application laying-open No. (Jikkaisho) 61 - 94232 and Japanese patent application laying-open No. (Tokkaihei) 6 - 146883.

[0003] The pressure type reserve tank of this kind is provided with a pressure cap for blocking out an inner space thereof from open air so as to apply pressure to an interior of the reserve tank, thereby obtaining a sealing structure that can perfectly seal up coolant contained therein.

Therefore, the pressure type reserve tank is different from an open type one, in that the coolant is circulated in the coolant circuit, having the pressure type reserve tank as a part thereof, in a state that the coolant is free from contact with the open air so that the coolant can be prevented from reduction in quantity due to its vaporization and also prevented from its degradation due to contact and reaction with the open air.

On the other hand, the conventional reserve tank of the latter related art is normally constructed so that an interior space of the reserve tank is defined into a plurality of chambers in a lattice arrangement by using a plurality of partition wall portions. The partition wall portions defining each chamber are formed with a slit through which the gas-liquid mixed coolant can freely flow between the adjacent chambers, so that the gas and the liquid can be separated from each other when the gas-liquid mixed coolant flows through the slit. As described above, the pressure type tank can separate the gas contained in the coolant circuit into the gas and the liquid, thereby improving gas-liquid separation performance and others compared to those obtained by using the open type one.

[Description of the Invention]

[Problem(s) to be Solved by the Invention]

[0004] The conventional pressure type reserve tank, however, encounters a problem in that stress concentration could occur in a specific portion of the partition wall portions due to application of internal pressure, because the interior space is divided into chambers arranged in the lattice arrangement by using the plurality of partition wall portions formed with the slits. This stress concentration could cause a crack and/or destruction of the partition walls.

[0005] In order to prevent such damage, one way of improving the rigidity of the partition wall portions would be to use a partition wall formed to be larger in thickness and /or to reduce the length of the slits thereof. However, the former measures causes its material cost and weight to be increased, and the latter measures causes the gas-liquid separation performance to be deteriorated, due to a lower amount of coolant that comes and goes between the adjacent chambers.

[0006] The present invention is made to prevent the above-described problems, and its object is to provide a pressure type reserve tank which can decrease stress concentration due to internal pressure in the pressure type reserve tank and improve a gas-liquid separation performance thereof.

[Means for Solving the Problem]

[0007] According to an aspect of the present invention there is provided a pressure type reserve tank, which includes a liquid-tight outer circumferential wall portion which contains liquid in a sealed state, a central wall portion which is shaped in a substantially circular cylinder to form a central chamber therein and is arranged in the center of an inner space of the outer circumferential wall portion, and a plurality of partition wall portions which radially extend from the central wall portion to the outer circumferential wall portion to define a plurality of outer circumferential chambers formed between the central wall portion and the outer circumferential wall portion and around the central chamber. A plurality of slits is provided on the central wall portion to fluidically communicate the central chamber and the outer circumferential chambers with each other.

[Effects of the Invention]

[0008] In the pressure type reserve tank of the present invention, there are provided the central wall portion, arranged in the center of the reserve tank, and the partition wall portions, radially extending from the central wall portion to the outer circumferential wall portion to define the plurality of outer circumferential chambers, slits being formed on the central wall portion to fluidically communicate the central chamber and the outer circumferential chambers. Therefore, the internal pressure to be applied can be uniformly dispersed from the central wall portion to the outer circumferential wall portions, so that the stress concentration due to the internal pressure can be avoided. In addition, the slit can be set to an optimum length, thereby increasing the gas-liquid separation performance in the pressure type reserve tank of the present invention.

[Brief Description of the Drawings]

[0009]

FIG. 1 is a plan view showing a pressure type reserve tank of a first embodiment according to the present invention;
FIG. 2 is a perspective view showing the pressure type reserve tank of the first embodiment shown in FIG. 1;
FIG. 3 is an exploded perspective view showing the pressure type reserve tank of the first embodiment shown in FIGS. 1 and 2;
FIG. 4 is a view, seen along an arrow X in FIG. 3, illustrating an interior of an upper vessel constituting the pressure type reserve tank of the first embodiment shown in FIGS. 1 to 3;
FIG. 5 is a view, seen along an arrow Y in FIG. 3, illustrating an interior of a lower vessel constituting the pressure type reserve tank of the first embodiment shown in FIGS. 1 to 3;
FIG. 6 is a schematic diagram illustrating the interior of the pressure type reserve tank;
FIG. 7 is a cross sectional view taken along a line S7 - S7 in FIG. 1; and
FIG. 8 is a diagram showing a coolant circuit which is adapted to the pressure type reserve tank of the first embodiment.

[Brief Description of Reference Numbers]

[0010]

C pressure cap
C1 pressure-cap attachment port
F1, F2 flange portion
P1 inlet port
P2 outlet port
CL coolant
CC coolant circuit
1 upper vessel
1a outer circumferential wall portion
2 lower vessel
2a outer circumferential wall portion
3 upper circular-cylinder wall portion
4a, 4b, 4c, 4d first to fourth upper partition wall portion
5a, 5b, 5c, 5d, 5e first to fifth upper tank chamber
6a, 6b, 6c, 6d, 10a, 10b, 10c, 10d slit
7 lower circular-cylinder wall portion
8a, 8b, 8c, 8d first to fourth lower partition wall portion
9a, 9b, 9c, 9d first to fifth lower tank chamber
11 circular-cylinder wall portion
12 partition wall portion
13a, 13b, 13c, 13d, 13e chamber
20 engine
21 radiator
22 thermostat
23 water pump

[Best mode for Carrying-Out the Invention]

[0011] Hereinafter, a pressure type reserve tank of an embodiment according to the present invention will be described with reference to the accompanying drawings.

[First Embodiment]

[0012] First, an entire construction of the pressure type reserve tank of the embodiment will be described.
As shown in FIGS. 1 to 3, the pressure type reserve tank of the embodiment has a tank main body TA which consists of an upper vessel 1 and a lower vessel 2.

[0013] As shown in FIGS. 3 and 4, first to five upper tank chambers 5a to 5e are defined in the upper vessel 1, where they are formed by an upper circular-cylinder wall portion 3 and first to fourth upper partition wall portions 4a to 4d. The upper circular-cylinder wall portion 3 is arranged in the center of an inner space of the upper vessel 1, and the first to fourth upper partition wall portions 4a to 4d extend radially from the upper circular-cylinder wall portion 3 to an upper outer circumferential wall portion 1a of the upper vessel 1. Specifically, in the upper vessel 1, the first upper tank chamber 5a is formed in the center of the upper vessel 1, and the second to fifth upper tank chambers 5b to 5e are arranged around the upper circular-cylinder wall portion 3. A flange portion F1 is integrally formed on a lower end portion of the upper outer circumferential wall portion 1a at its opening side. First to fourth slits 6a to 6d are formed, to be vertically long, on a lower portion of the upper circular-cylinder portion 3 at their positions which are away from portions connecting the upper circular-cylinder portion 3 and the upper partition wall portions 4a to 4d with each other, having a predetermined depth (a slit length) of the slits 6a to 6d. These first to fourth slits 6a to 6d fluidically communicate the first upper tank chamber 5a with the second to fifth upper tank chambers 5b to 5e, respectively.
An inlet port P1 is formed in the shape of a cylinder, laterally projecting from the outer circumferential wall portion 1a, so as to fluidically communicate with an interior of the second upper tank chamber 5b, and a pressure-cap attachment port C1 is formed in a shape of a cylinder, projecting upward from the outer circumferential wall portion 1a, so as to fluidically communicate with the fourth upper tank chamber 5d.

[0014] As shown in FIGS. 3 and 5, first to five lower tank chambers 9a to 9e are defined in the lower vessel 2, where they are formed by a lower circular-cylinder wall portion 7 and first to fourth lower partition wall portions 8a to 8d. The lower circular-cylinder wall portion 7 is arranged in the center of an inner space of the lower vessel 2, and the first to fourth lower partition wall portions 8a to 8d extend radially from the lower circular-cylinder wall portion 7 to a lower outer circumferential wall portion 2a of the lower vessel 2. Specifically, in the lower vessel 2, the first lower tank chamber 9a is formed in the center of

the lower vessel 2, and the second to fifth lower tank chambers 9b to 9e are arranged around the lower circular-cylinder wall portion 7. A flange portion F2 is integrally formed on a lower end portion of the lower outer circumferential wall portion 2a at its opening side.

First to fourth slits 10a to 10d are formed, to be vertically long, on an upper portion of the lower circular-cylinder portion 7 at their positions which are away from portions connecting the lower circular-cylinder portion 7 and the lower partition wall portions 8a to 8d with each other, having a predetermined depth (a slit length) of the slits 10a to 10d. These first to fourth slits 10a to 10d fluidically communicate the first lower tank chamber 9a with the second to fifth lower tank chambers 9b to 9e, respectively.

The first to fourth slits 6a to 6d of the upper vessel 1 and the first to fourth slits 10a to 10d are formed at positions where they do not overlap when the upper vessel 1 and the lower vessel 2 are coupled with each other.

An outlet port P2 is formed in a shape of a cylinder, laterally projecting from the lower outer circumferential wall portion 2a to fluidically communicate with the fourth lower tank chamber 9d.

[0015] Incidentally, the upper circular-cylinder wall portion 3 and the lower circular-cylinder wall portion 7 correspond to a central wall portion of the present invention.

[0016] The upper vessel 1 and the lower vessel 2 are made of plastic material, and they are formed by using upper and lower dies so that the tank main body TA is integrally formed by the following manufacturing processes. The flange portion F1 of the upper vessel 1 and the flange portion F2 of the lower vessel 2 face each other, and then the both flange portions F1 and F2, the upper and lower circular-cylinder wall portions 3 and 7, and the upper partition wall portions 4a-4d and 8a-8d are heated to be melted to be joined with one another at an adhesion portion PK as shown in FIG. 7.

[0017] Therefore, as schematically shown in FIG. 6, in the interior of the tank main body TA, a chamber 13a is formed inside a circular-cylinder wall portion 11 and four chambers 13b to 13e are formed by four partition wall portions 12 which are arranged around the chamber 13a, where the circular-cylinder wall portion 11 consists of the upper and lower circular-cylinder wall portions 3 and 7, and the four partition wall portions 12 consist of the upper and lower partition wall portions 4a to 4d and 8a to 8d, Incidentally, the chamber 13a corresponds to a central chamber of the present invention, and the chambers 13b to 13e correspond to outer circumferential chambers of the present invention.

[0018] As shown in FIG. 7, the slits 6a to 6d formed on the upper vessel 1 have a vertically long configuration where lower-end openings thereof are blocked off by upper end portions of the lower circular-cylinder portions 7, while the slits 10a to 10d formed on the lower vessel 2 have a vertically long configuration where upper-end openings thereof are blocked off by lower end portions of the lower circular-cylinder portions 3. Consequently, the chamber 13 fluidically communicates with the chambers 13b to 13e through the vertically long slits 6a to 6d and 10a to 10d, respectively.

[0019] Therefore, the inner space of the tank main body TA of the embodiment is divided into the plurality of chambers 13a to 13e by the upper and lower outer circumferential wall portions 1 a and 2a, the circular-cylinder wall portion 11 arranged in the center of the internal space, and the partition wall portions 12 radially extending from the circular-cylinder wall portion 11 to the outer circumferential wall portions 1a and 1b. The slits 6a to 6d and the slits 10a to 10d are provided so that the chamber 13a formed in the circular-cylinder wall portion 11 can fluidically communicate with the chambers 13b to 13e adjacent to the chamber 13a through the slits 6a to 6d and the slits 10a to 10d.

[0020] The thus-constructed pressure type reserve tank is installed, in parallel with the radiator 21, in a coolant circuit CC which fluidically connects an engine 20 and a radiator 21 with each other so as to flow coolant CL therebetween.

Specifically, the inlet port P1 of the pressure type reserve tank is fluidically connected with a coolant-discharge-side part, where the coolant CL is discharged from the engine 20, of the coolant circuit CC, while the outlet port P2 is fluidically connected with an intermediate portion, which is located between a thermostat 22 and a water pump 23, of a coolant-flow-in-side part, where the coolant CL flows in the engine, in the coolant circuit CC.

[0021] Next, the operation of the pressure type reserve tank of the embodiment will be described.

A pressure cap C attached to the pressure-cap attachment port Cl keeps the internal pressure in the inner space of the tank main body TA at approximately 1 Kg/cm^2 for example. The gas-liquid mixed coolant CL entering the chamber 13b from the inlet port P1 flows into the chamber 13a through the slits 6a and 10a, and then the coolant CL in the chamber 13a is separated and flows into the chambers 13c to 13e at the same time through the slits 6b to 6d and 10b to 10d, respectively. The gas and the liquid are substantially separated from each other while the coolant CL passes through the chambers 13a to 13e, and then the coolant CL is discharged from the outlet port P2.

[0022] In this process, the internal pressure can be uniformly dispersed at the central wall portion 11 and the outer circumferential wall portions 1a and 1b, so that the stress concentration due to the internal pressure can be avoided because the inner space of the tank main body TA is divided into the plurality of chambers 13a to 13e by the circular-cylinder wall portion 11 and the partition wall portions 12 which extend from the circular-cylinder wall portion 11 to the outer circumferential wall portions 1a and 2a.

[0023] The pressure type tank body of the embodiment has the following effects.

In the pressure type reserve tank of the embodiment, the

inner space of the tank main body TA is divided into the plurality of chambers 13a to 13e by the circular-cylinder wall portion 11, which is formed in a substantially circular cylinder and arranged in the center of the inner space, and the partition wall portions 12 which extend from the circular-cylinder wall portion 11 to the outer circumferential wall portions 1a and 2a. This can remove the stress concentration due to the internal pressure, improving the gas-liquid separation performance of the reserve tank.

[0024] In this case, although the circular-cylinder wall portion 11 tends to decrease its rigidity due to the existence of the slits 6a to 6d and 10a to 10d, its rigidity can be sufficiently improved by using the partition wall portions 12 for supporting the circular-cylinder wall portion 11. This enables the circular-cylinder wall portion 11 to be free from a crack and/or destruction therein even when the circular-cylinder wall portion 11 and the partition wall portions 12 have the same thicknesses as those of the conventional ones or when they have thicknesses smaller than those of the conventional ones.

[0025] In addition, the coolant CL in the chamber 13a flows into the chambers 13c to 13e through the slits 6b to 6d and 10b to 10d at the same time, where the gas-liquid mixed coolant CL can be gas-liquid separated more efficiently because of the simultaneous communication of the coolant CL in a gas-liquid state, as opposed to sequential communication, thereby further improving the gas-liquid separation performance.

[0026] Although the embodiment has been explained as described above, the present invention is not limited to the above-described embodiment and it includes its design change or modification.

[0027] For example, the number of divided chambers formed in the tank main body TA can be set appropriately, and the configuration, the number and positions of the slits can also be set appropriately.

In addition, although the circular-cylinder wall portion 11 might be changed into, for example, a hexagonal-cylinder wall portion or an octagonal-cylinder wall portion, it is not desirable to form angled corners because of stress concentration on the corners. In such cases, their corners are preferably formed to be rounded so as to avoid the stress concentration in the corners.

[0028] The entire contents of Japanese Patent Application No. 2005 - 318623 filed on November 1, 2005 are incorporated herein by reference.

[Industrial Applicability]

[0029] The pressure type reserve tank of the present invention is adaptable to a tank, the inner space of which is sealed and pressurized, for separating gas, such as air, from liquid medium such as coolant, where the tank is used for a radiator of a motor vehicle or the like.

Claims

1. A pressure type reserve tank comprising:

a liquid-tight outer circumferential wall portion which contains liquid in a sealed state;
a central wall portion which is shaped in a substantially circular cylinder to form a central chamber therein and is arranged in the center of an inner space of the outer circumferential wall portion; and
a plurality of partition wall portions which radially extend from the central wall portion to the outer circumferential wall portion to define a plurality of outer circumferential chambers formed between the central wall portion and the outer circumferential wall portion and around the central chamber, wherein
a plurality of slits is provided on the central wall portion to fluidically communicate the central chamber and the outer circumferential chambers with each other.

2. The pressure type reserve tank according to claim 1, wherein
the outer circumferential wall portion, the central wall portion, the partition wall portions and the slits are formed on an upper vessel and a lower vessel which are to be coupled with each other.

3. The pressure type reserve tank according to claim 2, wherein
the slits include slits formed on the upper vessel and slits formed on the lower vessel, the slits of the upper and lower vessels being arranged at positions where the slits of the upper vessel and the slits of the lower vessel can be prevented from fluidically communicating the slits of the upper and lower vessels with each other when the upper and lower vessels are coupled with each other, and
an opening end portion of the slits on the upper vessel and an opening end portion of the slits on the lower vessel are blocked off by the central wall portion formed on the lower vessel and the central wall portion formed on the upper vessel, respectively.

4. The pressure type reserve tank according to any one of claims 1 to 3, wherein
the slits are formed at positions which are away from the partition wall portions.

5. The pressure type reserve tank according to any one of claims 1 to 4, wherein
the outer circumferential wall portion, the central wall portion and the partition wall portions are integrally formed of plastic material.

FIG. 1

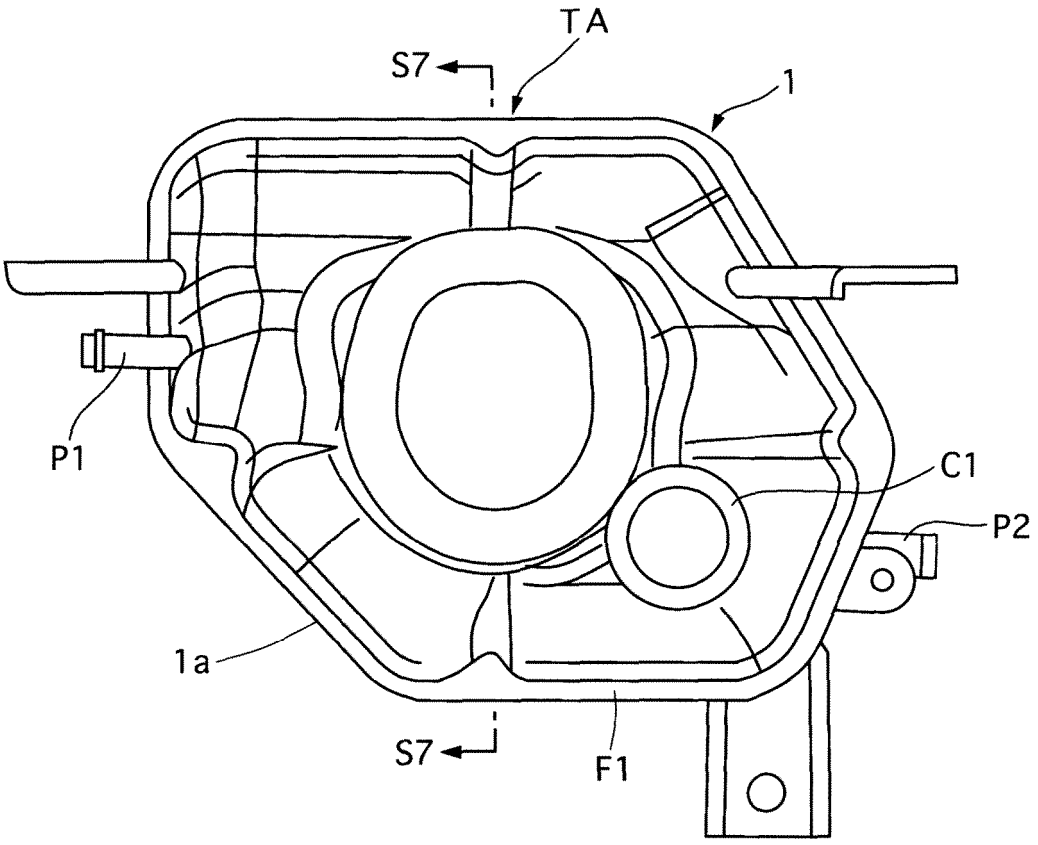


FIG. 2

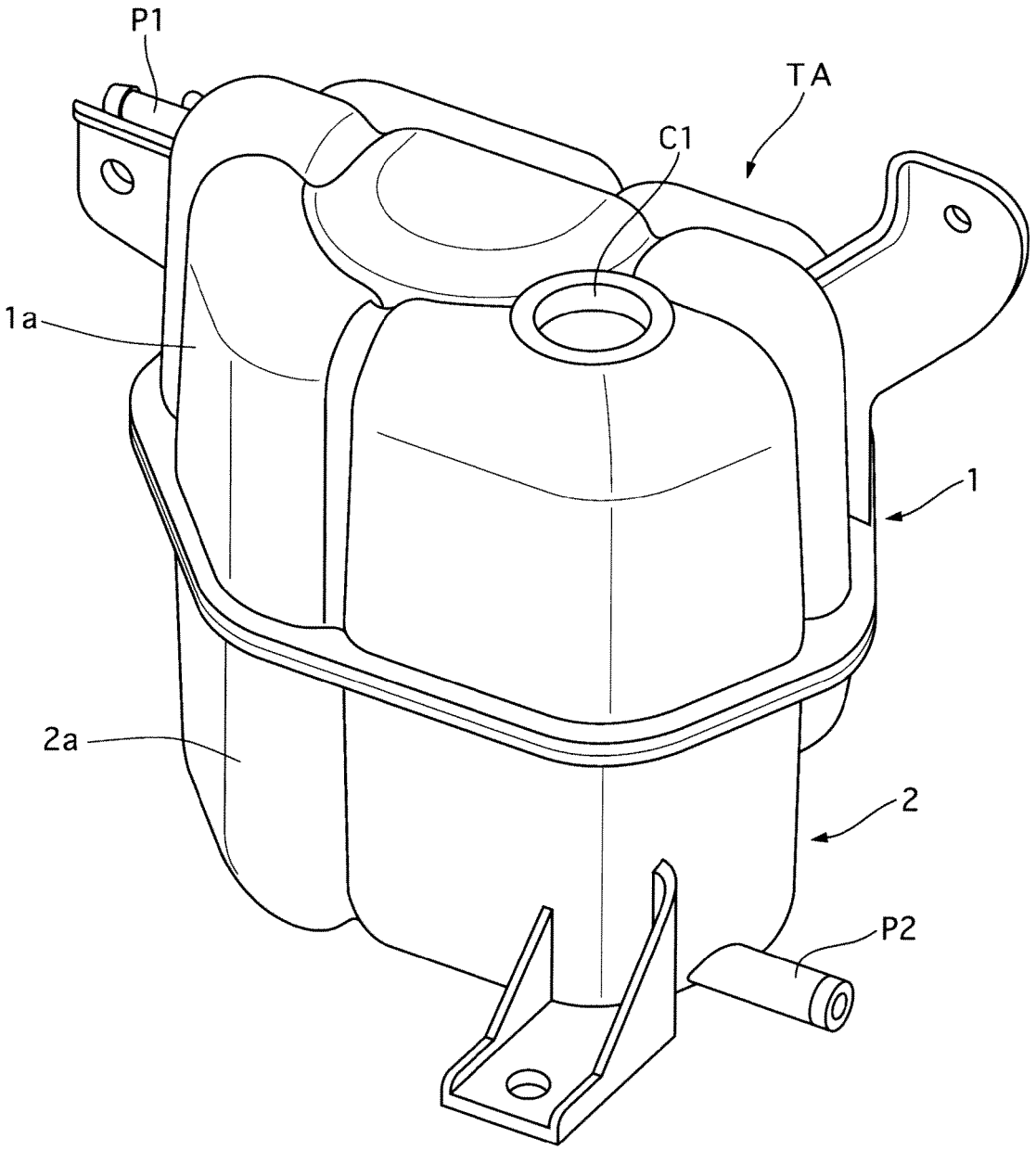
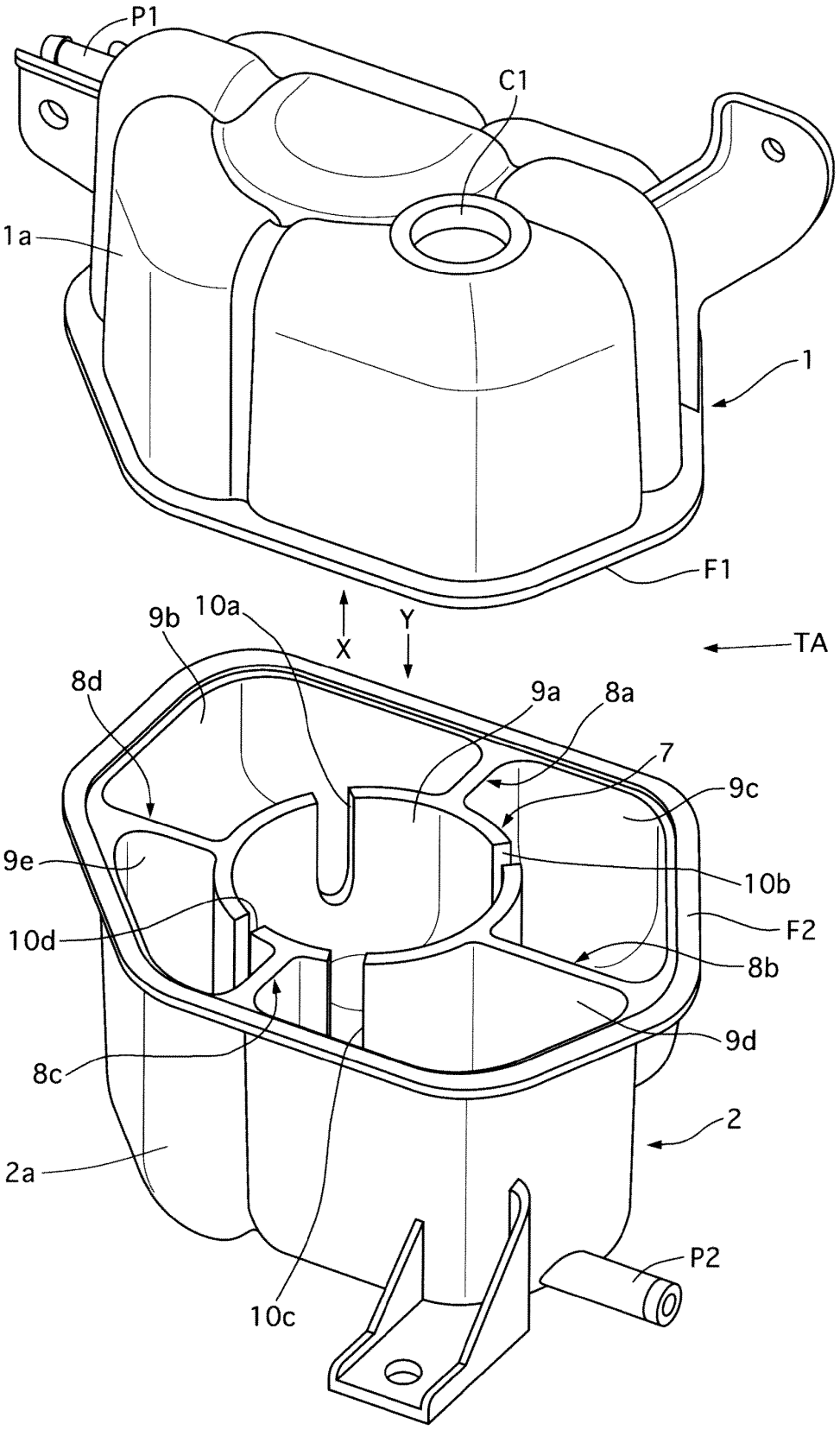


FIG. 3


P1
C1
1a
1
F1
X
Y
TA
9b
10a
8d
9a
8a
7
9c
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9d
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P2
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FIG. 4

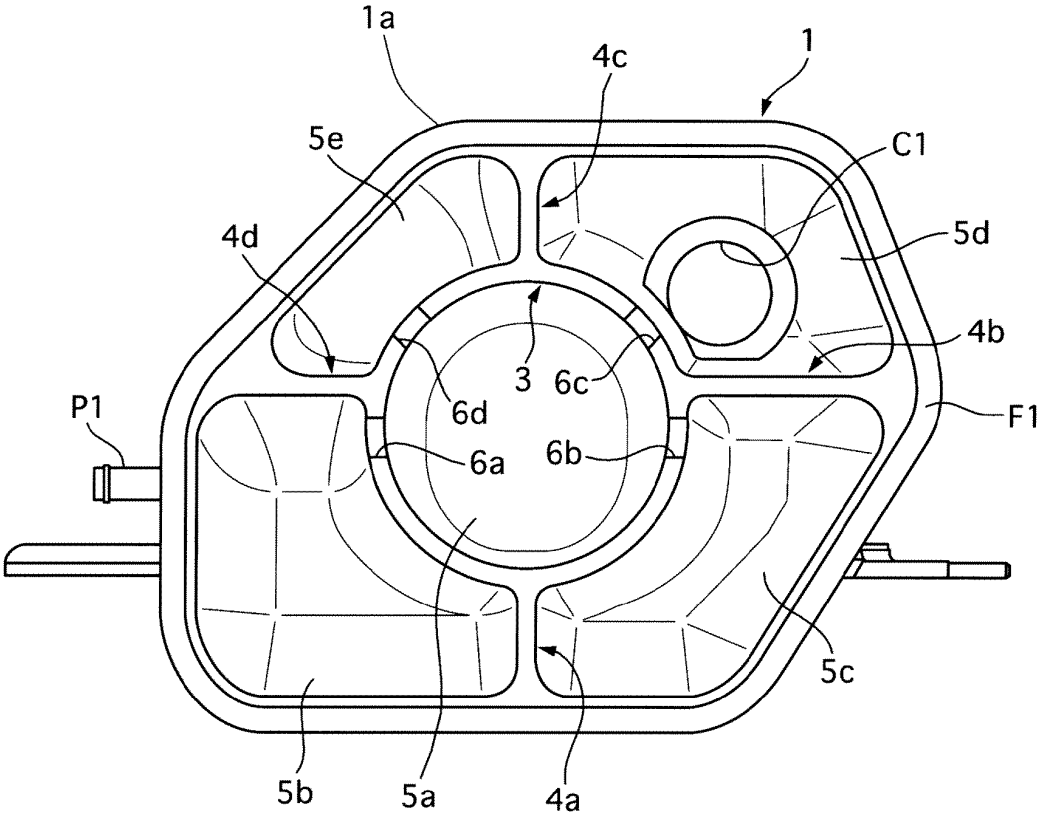


FIG. 5

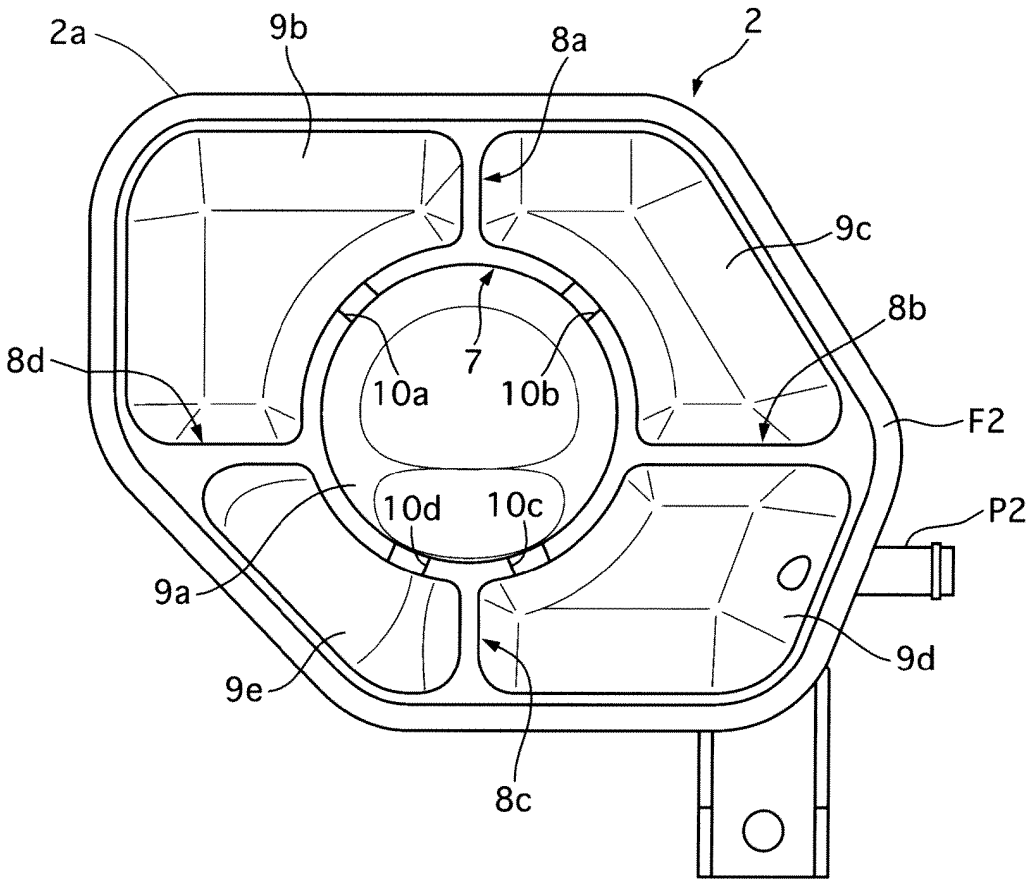


FIG. 6

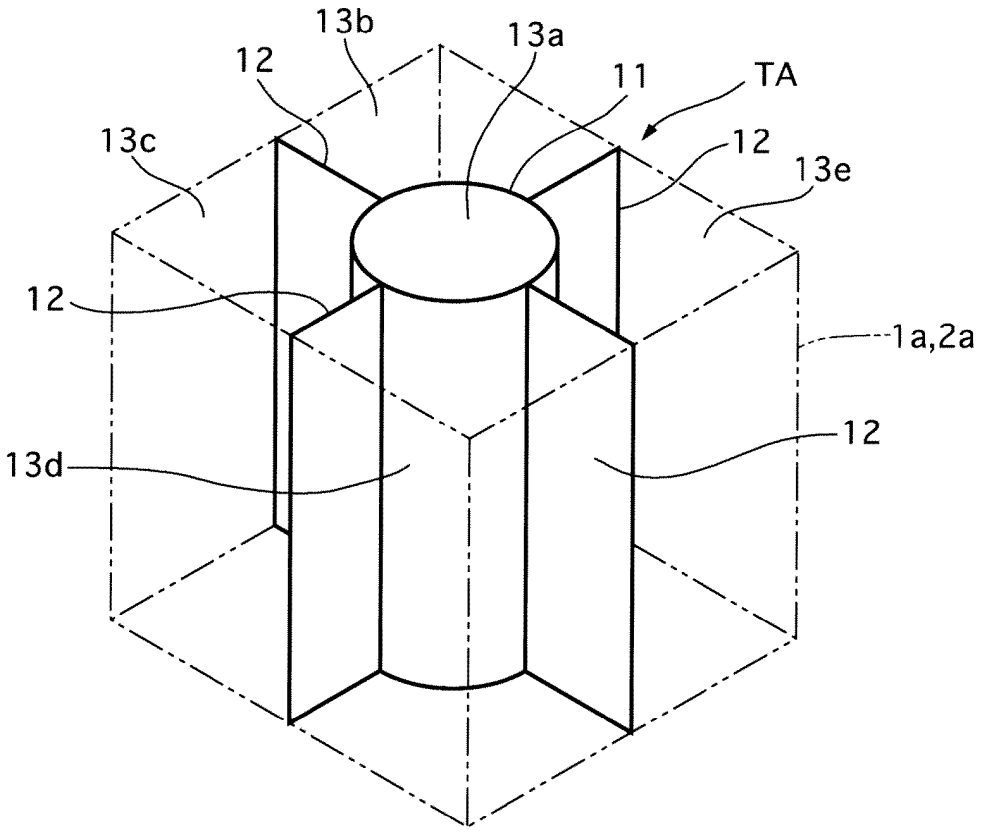


FIG. 7

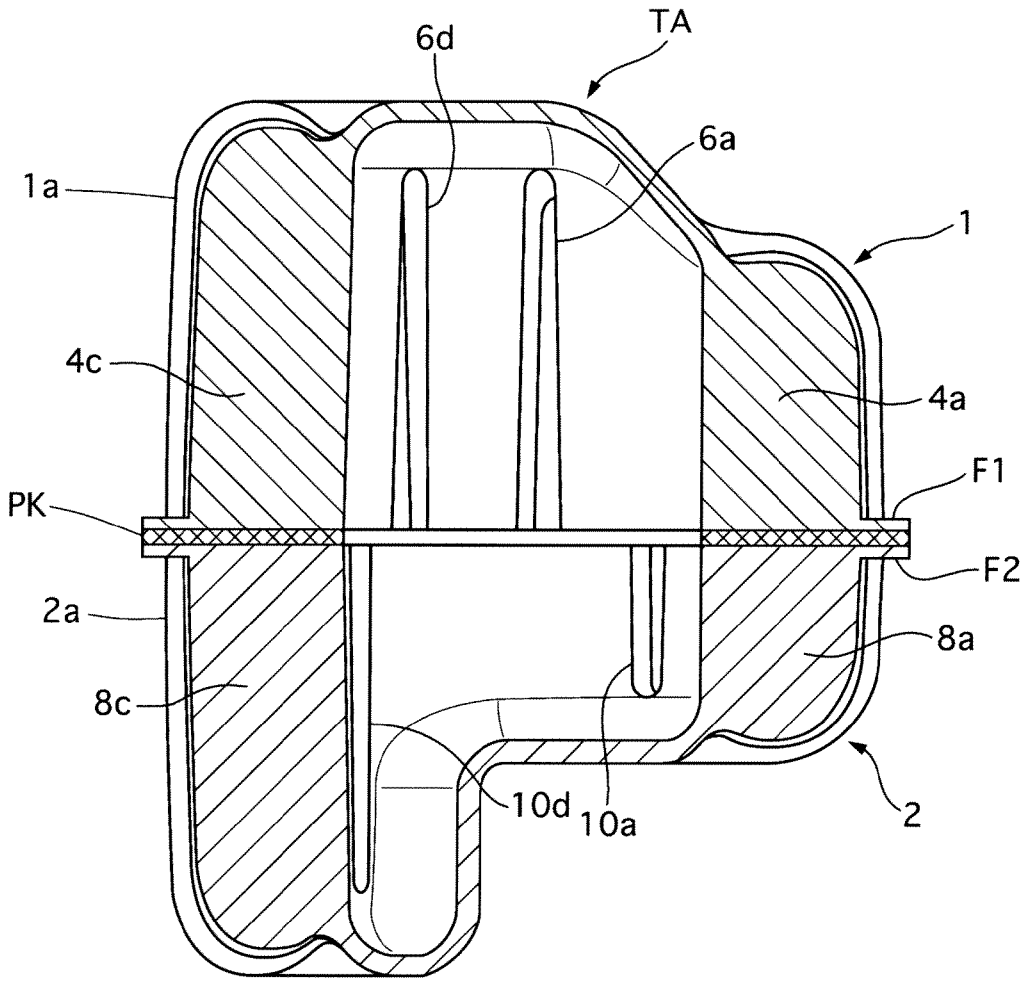
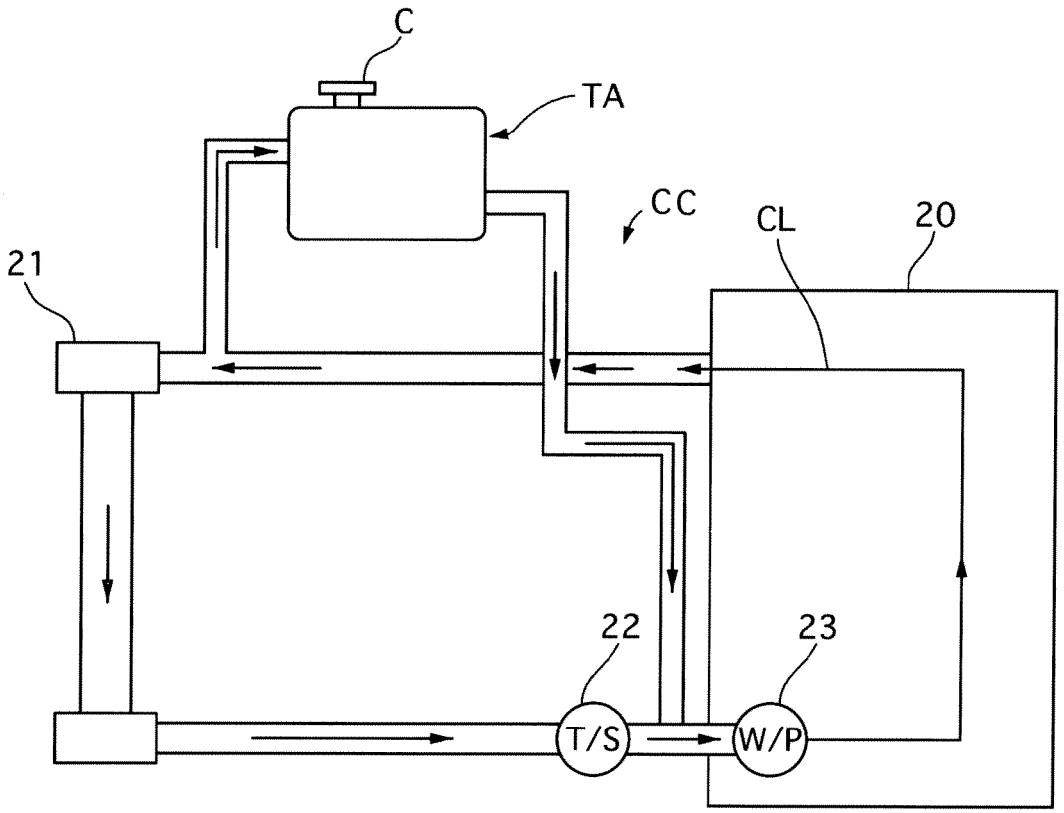


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2006/320527

A. CLASSIFICATION OF SUBJECT MATTER
F01P11/00(2006.01)i

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)
F01P11/00, B60T11/26

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 1996-2006
Kokai Jitsuyo Shinan Koho 1971-2006 Toroku Jitsuyo Shinan Koho 1994-2006

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.
A	JP 2005-248753 A (Denso Corp.), 15 September, 2005 (15.09.05), Full text (Family: none)	1-5
A	JP 2005-120906 A (Denso Corp.), 12 May, 2005 (12.05.05), Full text (Family: none)	1-5
A	JP 8-226326 A (Nissan Motor Co., Ltd.), 03 September, 1996 (03.09.96), Full text (Family: none)	1-5

☒ 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
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 October, 2006 (30.10.06)	07 November, 2006 (07.11.06)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2006/320527

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 3-111618 A (Nippon Soken, Inc., Toyota Motor Corp.), 13 May, 1991 (13.05.91), Full text & US 5111776 A	1-5

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP JIKKAISHO6194232 B **[0002]**
- JP TOKKAIHEI6146883 B **[0002]**
- JP 2005318623 A **[0028]**