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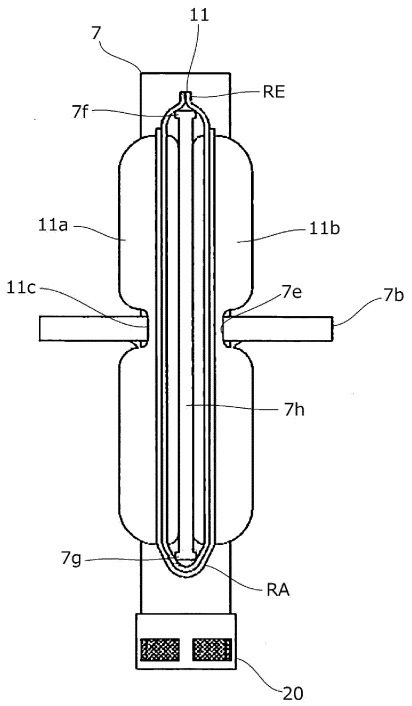
(54) **ACCUMULATOR**

(57) Provided is an accumulator having superior assembly property and capable of ensuring functions of a refrigeration cycle even when subjected to vibration. The accumulator includes a body, a pipe disposed in an inner side of the body, a hook portion disposed to extend from an outer circumference of the pipe, and a desiccant accommodating body including two bag portions configured to accommodate a desiccant, and a connecting portion configured to connect the bag portions, wherein the desiccant accommodating body is attached by hooking the connecting portion on the hook portion.

FIG. 7



EP 4 394 282 A1

Description

[Technical Field]

[0001] The present invention relates to an accumulator.

[Background Art]

[0002] Receiver tanks, accumulators and the like are used to store a refrigerant, which is circulated within a refrigeration cycle, in a gas-liquid separated manner. One type of such accumulators is equipped with a tank for separating the refrigerant flown therein into a gas phase refrigerant and a liquid phase refrigerant and storing the liquid phase refrigerant therein, wherein a desiccant is accommodated in the tank to remove moisture from the refrigerant.

[0003] If an entirety of the desiccant is soaked in the liquid phase refrigerant, rapid boiling of refrigerant (bumping phenomenon) originated by the desiccant may occur by the interior of the tank being decompressed when a compressor is started, causing pressure to generate in the tank and the tank may be vibrated, which may lead to generation of abnormal noise.

[0004] Meanwhile, if the entirety of the desiccant is not soaked in the liquid phase refrigerant, the above-mentioned problem of generation of abnormal noises during starting of the compressor will not occur, but if the desiccant is positioned along a dripping passage of the liquid phase refrigerant having flown into the tank, the liquid phase refrigerant dripping in the tank may collide against the desiccant and splash, which may cause the liquid phase refrigerant to be sucked in through a suction port of the gas phase refrigerant, and there is a risk that the liquid phase refrigerant may be sucked into the compressor.

[0005] Therefore, according to the accumulator illustrated in Patent Literature 1, a portion or an entirety of the desiccant is arranged above a highest liquid level position (Lmax) of the liquid phase refrigerant within the tank when the compressor is stopped, and the desiccant is arranged at a position avoiding the dripping passage of the liquid phase refrigerant.

[Citation List]

[Patent Literature]

[0006] [PTL 1] Japanese Patent Laid-Open Publication No. 2014-52139

[Summary of Invention]

[Technical Problem]

[0007] According to the accumulator of Patent Literature 1, the bag accommodating the desiccant is wound around a circumference of a suction piping and secured by being tied thereto using a string-like fixing means such as a tying band. Therefore, it was time-consuming to assemble the accumulator, and the number of components was increased.

[0008] It may be an idea to secure the bag accommodating the desiccant without using a tying band, etc. However, if the accumulator is vibrated in a vehicle-mounted state, for example, the bag accommodating the desiccant may move up and down, casing the load of the movement to crush a portion of the desiccant into powder, and the powder may flow into the piping as foreign matter and cause deterioration of the functions of the refrigeration cycle.

[0009] Therefore, the present invention aims at providing an accumulator that has a superior assembly property and that enables to ensure the functions of the refrigeration cycle even when subjected to vibration.

[Means to Solve the Problem]

[0010] In order to achieve the above-mentioned object, the accumulator according to the present invention characterizes in including

a body,
a pipe disposed in an inner side of the body,
a hook portion disposed to extend from an outer circumference of the pipe, and
a desiccant accommodating body including two bag portions configured to accommodate a desiccant, and a connecting portion configured to connect the bag portions,
wherein the desiccant accommodating body is attached by hooking the connecting portion on the hook portion.

[Effects of Invention]

[0011] The present invention enables to provide an accumulator that has a superior assembly property and that enables to ensure the functions of the refrigeration cycle even when subjected to vibration.

[Brief Description of Drawings]

[0012]

[FIG. 1] FIG. 1 is a vertical cross-sectional view of an accumulator according to a first embodiment.
[FIG. 2] FIG. 2 is a lateral cross-sectional view of the accumulator in planar view taken at line A-A of FIG. 1.
[FIG. 3] FIG. 3 is a side view of an outer pipe.
[FIG. 4] FIG. 4 is a top view of the outer pipe.
[FIG. 5] FIG. 5 is a plan view illustrating a material prior to sewing of a desiccant accommodating body.
[FIG. 6] FIG. 6 is a plan view illustrating a state of the material during sewing of the desiccant accom-

modating body.

[FIG. 7] FIG. 7 is a front view illustrating a state in which the desiccant accommodating body is assembled to the outer pipe.

[FIG. 8] FIG. 8 is a vertical cross-sectional view of an accumulator according to a second embodiment.

[FIG. 9] FIG. 9 is a lateral cross-sectional view of the accumulator in planar view taken at line B-B of FIG. 8.

[FIG. 10] FIG. 10 is a front view illustrating a state in which the desiccant accommodating body is assembled to the outer pipe.

[Description of Embodiments]

[0013] An accumulator 1 according to an embodiment of the present embodiment will be described below with reference to the drawings.

(First Embodiment)

[0014] FIG. 1 is a vertical cross-sectional view of the accumulator 1 according to a first embodiment. FIG. 2 is a lateral cross-sectional view of the accumulator 1 in planar view taken at line A-A of FIG. 1. The accumulator 1 includes a tank main body 2, a double pipe 5 disposed within the tank main body 2, and a desiccant accommodating body 11 accommodating a desiccant (moisture absorbent) DA.

[0015] The tank main body 2 is composed of a body 3 having a bottomed cylindrical shape with a top end opened, and a header 4 joined by girth welding to the body 3 via a weld portion 10 to seal an opening end of the body 3. The body 3 and the header 4 are both formed of a metal such as an aluminum alloy. In the present specification, the side having the header 4 is referred to as an upper side, and a bottom side of the body 3 is referred to as a lower side.

[0016] The header 4 formed in an approximately disk-like shape has a refrigerant inlet port 8 and a refrigerant outlet port 9 that are formed to pass therethrough in a vertical direction. An inner pipe 6 that extends to a vicinity of an inner bottom portion of the body 3 is connected to the refrigerant outlet port 9. A double pipe 5 is formed by externally attaching an outer pipe (hereinafter also simply referred to as pipe) 7 to an outer side of the inner pipe 6.

[0017] Below the header 4 is provided a gas-liquid separation member 16 having a cylindrical shape with a top that separates a mixed refrigerant (refrigerant in which a gas phase refrigerant and a liquid phase refrigerant are mixed) flowing in through the refrigerant inlet port 8 into a liquid phase refrigerant having a high density including compressor oil (hereinafter referred to as oil), and a gas phase refrigerant having a low density.

[0018] The inner pipe 6 is formed of a metal such as an aluminum alloy, having a lower end portion thereof opened and an upper end portion thereof connected to the refrigerant outlet port 9 of the header 4. Further, a lower portion of the inner pipe 6 is inserted to an inner side of a plurality of pipe ribs 7a (FIG. 2) disposed to protrude from an inner circumference surface of the outer pipe 7, by which the inner pipe 6 is held stably within the outer pipe 7.

[0019] The outer pipe 7 is formed of synthetic resin, and it is attached within the body 3 with the upper end portion opened. A strainer 20 having a cylindrical shape and including a mesh member 21 formed by insert-molding metal or resin is disposed in a bottom portion of the outer pipe 7, and the strainer 20 is placed on an inner bottom surface of the body 3.

[0020] FIG. 3 is a side view of the outer pipe 7, and FIG. 4 is a top view of the outer pipe 7. In FIGs. 3 and 4, the outer pipe 7 includes a collar-shaped portion 7b that extends outward in a radial direction at an outer circumference in an intermediate position in a longitudinal direction. The collar-shaped portion 7b fit to the body 3 includes a rib 7c for reinforcement, an opening 7d for a flow channel surrounded by the rib 7c, and a cutout portion 7e that extends from an outer circumference of the collar-shaped portion 7b to the outer pipe 7.

[0021] Further according to FIG. 4, the outer pipe 7 includes an upper side hook portion 7f and a lower side hook portion 7g that extend parallelly with the cutout portion 7e from the outer circumference of the outer pipe 7 at approximately equal distances at upper and lower positions from the collar-shaped portion 7b, and a plate-shaped portion 7h having a rectangular shape consecutively connected across the upper side hook portion 7f, the lower side hook portion 7g, and the outer pipe 7. With reference to FIG. 7 described below, when viewed in the radial direction of the outer pipe 7, the widths of the upper side hook portion 7f and the lower side hook portion 7g are wider than a thickness of the plate-shaped portion 7h. It is preferable that the upper side hook portion 7f, the lower side hook portion 7g, and the tips of the plate-shaped portion 7h are in an assembled state before coming into contact with an inner circumference of the body 3.

[0022] The plate-shaped portion 7h includes an upper side opening 7i formed between the upper side hook portion 7f and the collar-shaped portion 7b, and a lower side opening 7j formed between the collar-shaped portion 7b and the lower side hook portion 7g.

[0023] Next, the desiccant accommodating body 11 will be described. FIG. 5 is a plan view illustrating a material prior to sewing of the desiccant accommodating body 11. FIG. 6 is a plan view illustrating a state of the material during sewing of the desiccant accommodating body 11.

[0024] First, as illustrated in FIG. 5, a cloth-like body FT such as felt having air permeability, water permeability, and necessary shape retaining property is cut into an approximately rectangular shape. Thereafter, the cloth-like body FT is folded back at a center line WC in the width direction, and a desiccant DA is accommodated in the inner side thereof. Thereafter, a circumference of the cloth-like body FT is sewn along a sewing line SL illustrated by a dotted line in FIG. 6, and the desiccant DA is

independently sealed inside each of bag portions 11a and 11b of the desiccant accommodating body 11 formed in the shape of a bag. The desiccant DA is not inputted in the areas outside the sewing line SL of the desiccant DA, which are a center region (a second connecting portion in the example) RA that connects the bag portions 11a and 11b and end regions (first connecting portions in the example) RE, where the cloth-like body FT is in a superposed state.

[0025] Next, the desiccant accommodating body 11 is folded in half along a center line LC that passes through a center region RA, and joined by sewing with the end regions RE united. Thereby, the desiccant accommodating body 11 having the bag portions 11a and 11b containing the desiccant DA is formed in the shape of an endless belt.

[0026] FIG. 7 is a front view illustrating a state in which the desiccant accommodating body 11 is assembled to the outer pipe 7. The desiccant DA is not accommodated in a completely filled state in the interior of the bag portions 11a and 11b, and a certain margin is provided in the capacity of the bag portions 11a and 11b. Therefore, a dented portion 11c is formed by denting a center of the bag portions 11a and 11b along a width direction, and the desiccant DA is moved to both ends thereof.

[0027] In this state, the side having the end regions RE is oriented toward the upper side, the side having the center region RA is oriented toward the lower side, and the dented portion 11c is positioned to correspond (fit) to the cutout portion 7e of the collar-shaped portion 7b, wherein a joined portion of the end regions RE is hooked to the upper side hook portion 7f, and a folded back portion of the center region RA is hooked to the lower side hook portion 7g. By pressing the desiccant accommodating body 11 into the outer pipe 7 while maintaining the above-described state, the desiccant accommodating body 11 is attached to the outer pipe 7.

[0028] Thereafter, as illustrated in FIG. 7, the outer pipe 7 is assembled to the body 3 by attaching the strainer 20 to a lower end of the outer pipe 7 and having the outer circumference of the collar-shaped portion 7b fit to the inner circumference of the body 3. The outer pipe 7 and the body 3 are disposed eccentrically in the state assembled to the body 3, and the desiccant accommodating body 11 is disposed in a widest space between the outer circumference of the outer pipe 7 and the inner circumference of the body 3.

[0029] The operation of the accumulator 1 configured as above will be described with reference to FIG. 1. In the following description, a configuration is illustrated as an example where the accumulator 1 is arranged between an evaporator and a compressor of the refrigeration cycle and where a gas refrigerant is generated by removing moisture contained in the refrigerant flowing in from the evaporator, and the gas refrigerant is returned to the compressor.

[0030] In a state where the refrigerant is discharged from the evaporator, the refrigerant is conveyed to the accumulator 1 through a connecting piping (not shown). The refrigerant having reached the accumulator 1 is flown to the inner side of the body 3 through the refrigerant inlet port 8, collided against the gas-liquid separation member 16, and separated into a high-density liquid phase refrigerant including oil and a low-density gas phase refrigerant (gas refrigerant).

[0031] The liquid phase refrigerant and oil after being subjected to gas-liquid separation is pooled within the body 3 by its own weight. In the process, the separation of the liquid phase refrigerant and oil advances, and oil is pooled below the liquid phase refrigerant. In this state, liquid level of the liquid phase refrigerant reaches a height position where a portion (approximately center) of the desiccant accommodating body 11 accommodating the desiccant is immersed. Therefore, both the moisture contained in the liquid phase refrigerant and the hygroscopic moisture contained in the gas phase refrigerant are absorbed by the desiccant DA.

[0032] Meanwhile, the gas phase refrigerant having been subjected to gas-liquid separation flows in through the opening portion on the upper end of the outer pipe 7 and descends within the outer pipe 7. Thereafter, the gas phase refrigerant turns back at the bottom portion of the outer pipe 7 and flows into the inner pipe 6, ascends within the inner pipe 6 and is guided to the refrigerant outlet port 9. In this state, oil pooled at the bottom of the body 3 is sucked in through an oil return hole (not shown), where it turns into a gas phase refrigerant containing abundant oil component, which is supplied from the refrigerant outlet port 9 through the connecting piping (not shown) to the compressor.

[0033] According to the present embodiment, the desiccant accommodating body 11 formed in the shape of an endless belt may be attached easily by hooking to the upper side hook portion 7f and the lower side hook portion 7g without using tying bands and the like, and by pulling the desiccant accommodating body 11 in the up-down direction and reliably retaining the same, the up and down movement of the desiccant accommodating body 11 may be suppressed. Therefore, the number of components of the accumulator 1 may be cut down, and the number of manufacturing steps may be reduced. Since the desiccant accommodating body 11 is disposed across approximately the entire length of the outer pipe 7, the amount of desiccant DA that is not immersed in the liquid refrigerant is increased, such that the bumping phenomenon may be suppressed.

[0034] The force transmitted from the desiccant accommodating body 11 to the upper side hook portion 7f and the lower side hook portion 7g is supported by the plate-shaped portion 7h, such that stress of the upper side hook portion 7f and the lower side hook portion 7g may be suppressed from becoming excessive. Further, by having the dented portion 11c fit to the cutout portion 7e, the bag portions 11a and 11b are separated in half into upper and lower parts, such that it becomes difficult for the desiccant DA accommodated in the inner side

thereof to move up and down beyond the dented portion 11c. Therefore, even when the accumulator 1 is subjected to vibration, the desiccant may be suppressed from being crushed.

[0035] Further, as illustrated in FIG. 2, opposing surfaces of the bag portions 11a and 11b of the desiccant accommodating body 11 are exposed through the upper side opening 7i and the lower side opening 7j of the plate-shaped portion 7h arranged between the upper side hook portion 7f and the lower side hook portion 7g. Thereby, the moisture contained in the liquid phase refrigerant or the gas phase refrigerant passing through the upper side opening 7i and the lower side opening 7j may also be absorbed efficiently by the desiccant DA.

[0036] Further, when viewed in the direction of FIG. 7 in a state where the desiccant accommodating body 11 is hooked to the upper side hook portion 7f, the upper portion of the desiccant accommodating body 11 is retained in a mountain-like shape, such that the liquid phase refrigerant dripping thereto from the upper side falls on an inclined surface of the desiccant accommodating body 11 and flows toward the side, such that the refrigerant may be prevented from splashing upward. Further, by hooking a joined portion of the end regions RE to the upper side hook portion 7f, as illustrated in FIG. 7, a cut edge of the cloth forming the cloth-like body is oriented toward the upper side and functions as a cushion, such that the splashing of the liquid phase refrigerant dripping thereto from the upper side may be prevented.

(Second Embodiment)

[0037] FIG. 8 is a vertical cross-sectional view of an accumulator 1A according to a second embodiment. FIG. 9 is a lateral cross-sectional view of the accumulator 1A in planar view taken at line B-B of FIG. 8. The accumulator 1A differs from the above-described embodiment in that a configuration formed on an outer side of an outer pipe 7A differs. The other configurations are denoted with the same reference numbers and detailed descriptions thereof are omitted.

[0038] As illustrated in FIG. 9, three support beams 7Ab that are disposed on the outer circumference of the outer pipe 7A extend toward the outer side in a radial direction, and outer ends thereof are in contact with an inner circumference of the body 3. Further, one side edges of a pair of support plates 7Ac are consecutively connected to two support beams 7Ab arranged opposite to each other interposing the outer pipe 7. The support plates 7Ac extend parallelly with an axial line of the outer pipe 7A, and the other side edges thereof come into contact with an inner circumference of the body 3. The outer pipe 7A is positioned on the body 3 by the support beams 7Ab and the support plates 7Ac. The space between the support beams 7Ab and the support plates 7Ac serves as a flow channel.

[0039] An upper side hook portion 7Af is formed to extend parallelly with the support plates 7Ac from the outer circumference of the outer pipe 7A in the area between the pair of support plates 7Ac and on the upper side of the support plates 7Ac. Further, a plate-shaped portion 7Ah having a rectangular shape is consecutively connected to a lower end side of the upper side hook portion 7Af and an outer circumference of the outer pipe 7A.

[0040] FIG. 10 is a front view illustrating a state in which a desiccant accommodating body 11A is assembled to the outer pipe 7A. A pair of lower side locking plates 7Ag that extend parallelly with the support plates 7Ac from the outer circumference of the outer pipe 7A is disposed with a gap formed therebetween at an area between the pair of support plates 7Ac and near the lower end of the support plates 7Ac. The upper side hook portion 7Af, the plate-shaped portion 7Ah, and the tip of the lower side locking plate 7Ag are preferably assembled before coming into contact with the inner circumference of the body 3. An opening may be formed on the plate-shaped portion 7Ah.

[0041] In the present embodiment, the desiccant accommodating body 11A is formed by a similar process as the process illustrated in FIGs. 5 and 6, but without a dented portion formed at the center, and wherein the desiccant DA is approximately completely filled and accommodated in bag portions 11Aa and 11Ab.

[0042] When assembling the desiccant accommodating body 11A, according to the present embodiment, the side having a center region (the first connecting portion in this example) RA is oriented toward the upper side, the side having an end region (the second connecting portion in this example) RE is oriented toward the lower side, a folded back portion of the center region RA is hooked on the upper side hook portion 7Af, and a joined portion of the end regions RE is inserted to an area between the pair of lower side locking plates 7Ag. By pressing the desiccant accommodating body 11A toward the outer pipe 7A along the support plates 7Ac while maintaining the above-described state, the desiccant accommodating body 11A may be attached to the outer pipe 7A.

[0043] In this state, the plate-shaped portion 7Ah extends between the bag portions 11Aa and 11Ab from the upper end to a vicinity of the center position, and the bag portions 11Aa and 11Ab contact each other below the plate-shaped portion 7Ah. Further, outer side surfaces of the bag portions 11Aa and 11Ab are in contact with and are retained by the support plates 7Ac.

[0044] According to the present embodiment, the desiccant accommodating body 11A formed in the shape of an endless belt may be attached easily by hooking onto the upper side hook portion 7Af and the lower side locking plate 7Ag without using a tying band or the like, and the desiccant accommodating body 11A may be retained reliably by pulling the same in the upper and lower directions. Moreover, since the desiccant DA accommodated in the bag portions 11Aa and 11Ab may not be communicated between the respective bag portions, and since the outer side surfaces of the bag portions 11Aa and 11Ab are in contact with and retained by the support

plates 7Ac, the crushing of the desiccant may be suppressed even when the accumulator 1A is subjected to vibration.

[0045] The present embodiment has been illustrated above with reference to the embodiments, but the present invention is not limited to the above-mentioned embodiments, and various modifications are enabled within the scope of the invention.

[Reference Signs List]

[0046]

1, 1A accumulator
2 tank main body
3 body
4 header
5, 5A double pipe
6 inner pipe
7, 7A outer pipe
8 refrigerant inlet port
9 refrigerant outlet port
11, 11A desiccant accommodating body
20 strainer

Claims

1. An accumulator comprising:

a body;
a pipe disposed in an inner side of the body;
a hook portion disposed to extend from an outer circumference of the pipe; and
a desiccant accommodating body including two bag portions configured to accommodate a desiccant, and a connecting portion configured to connect the bag portions,
wherein the desiccant accommodating body is attached by hooking the connecting portion on the hook portion.

2. The accumulator according to claim 1,

wherein the hook portion includes an upper side hook portion and a lower side hook portion,
wherein the desiccant accommodating body has an endless shape including a first connecting portion that connects one end portions of the bag portions and a second connecting portion that connects the other end portions of the bag portions, and
wherein the first connecting portion is hooked on the upper side hook portion and the second connecting portion is hooked on the lower side hook portion.

3. The accumulator according to claim 2,

further comprising a collar-shaped portion formed to an outer circumference of the pipe and including a cutout portion, and
wherein the dented portion formed on the desiccant accommodating body is fit to the cutout portion.

4. The accumulator according to claim 2 or claim 3,

wherein a plate-shaped portion is disposed between the upper side hook portion and the lower side hook portion, the plate-shaped portion including an opening, and
wherein the bag portions of the desiccant accommodating body are disposed on both sides of and interposing the plate-shaped portion.

5. The accumulator according to claim 1,

wherein the hook portion includes an upper side hook portion and a pair of lower side locking plates,
wherein the desiccant accommodating body has an endless shape including a first connecting portion that connects one end portions of the bag portions and a second connecting portion that connects the other end portions of the bag portions, and
wherein the first connecting portion is hooked on the upper side hook portion and the second connecting portion is inserted between the lower side locking plates.

6. The accumulator according to claim 5,

wherein a plate-shaped portion is formed from the upper side hook portion toward the lower side locking plate,
wherein a pair of support plates connected to the pipe is formed parallelly with the plate-shaped portion, and
wherein the bag portions of the desiccant accommodating body are disposed in a manner interposing the plate-shaped portion and each being in contact with the support plate.

FIG. 1

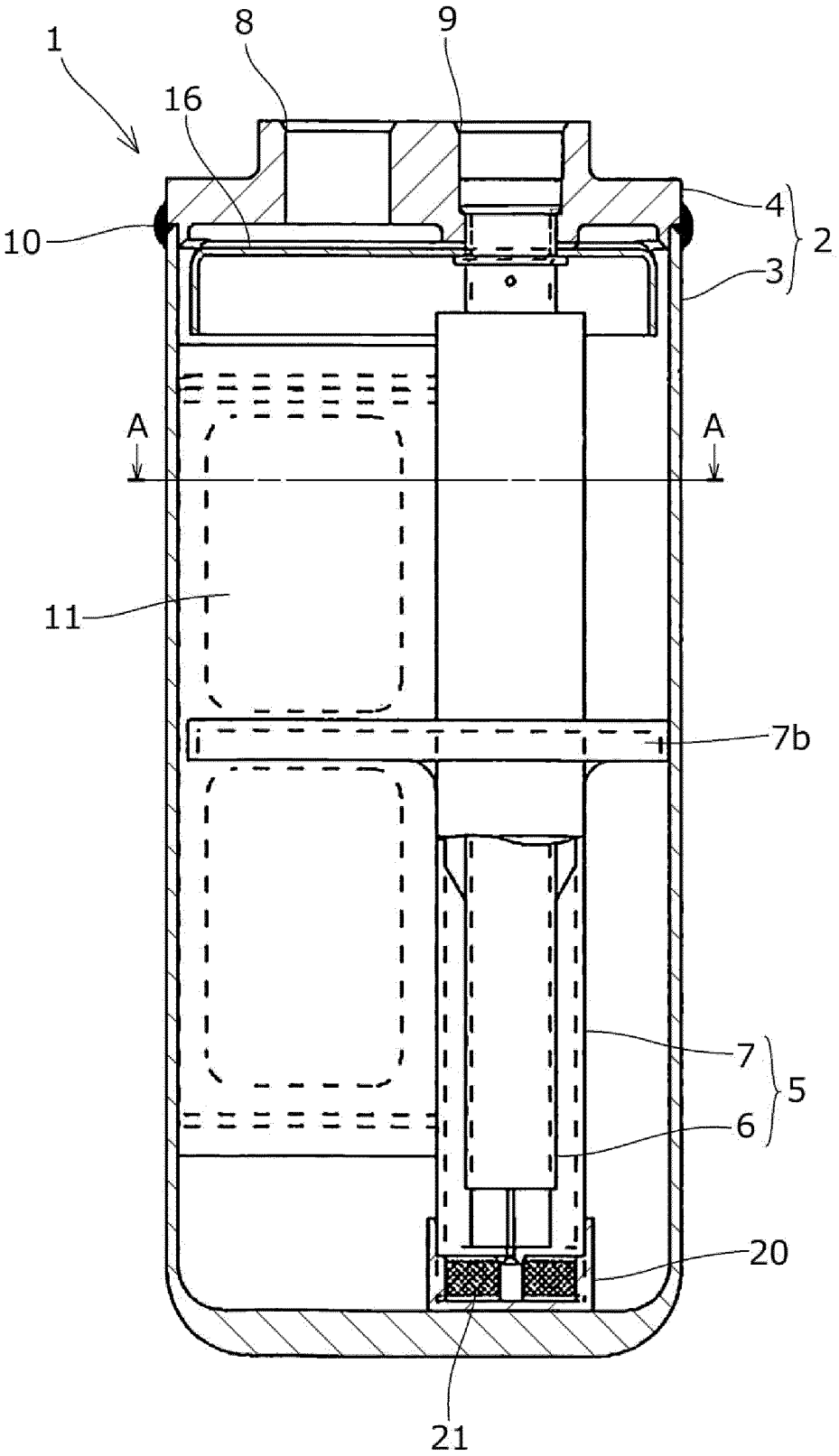


FIG. 2

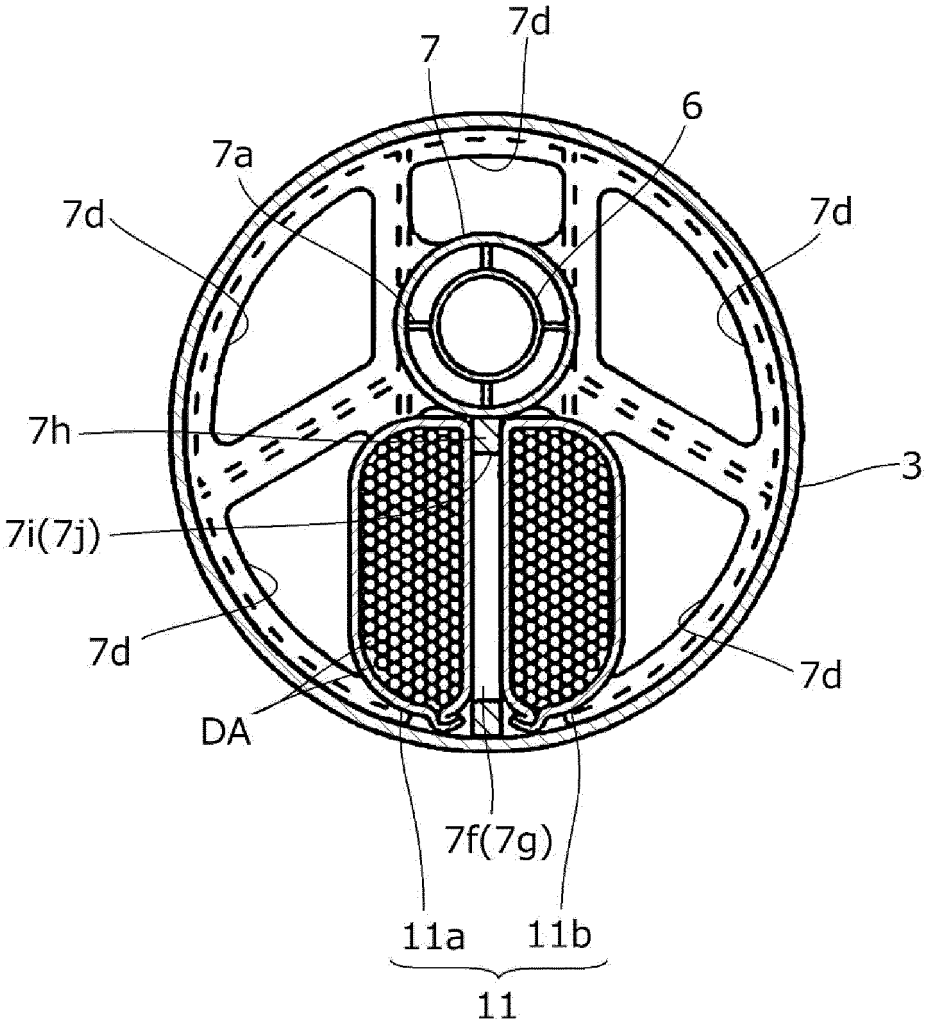


FIG. 3

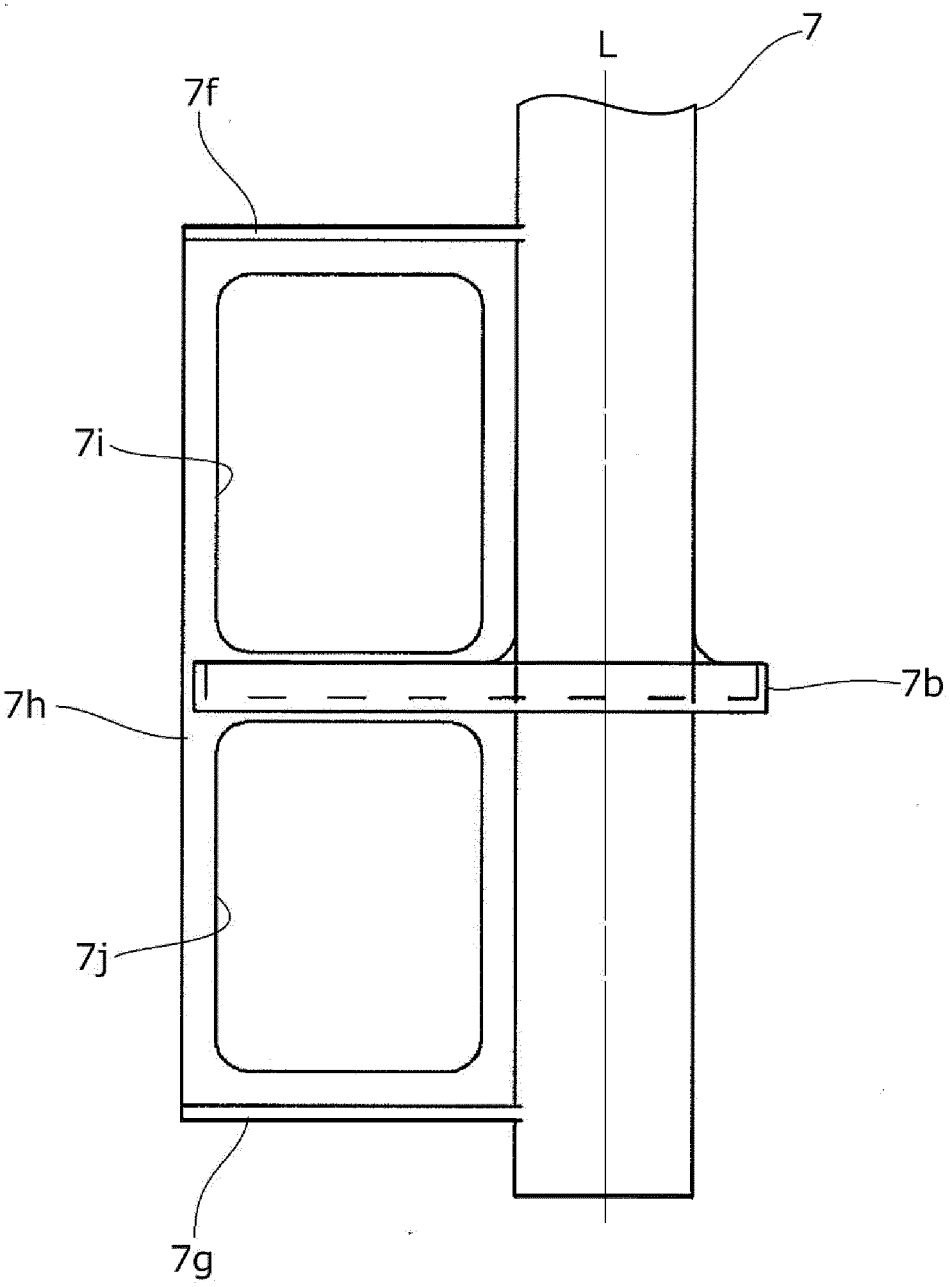


FIG. 4

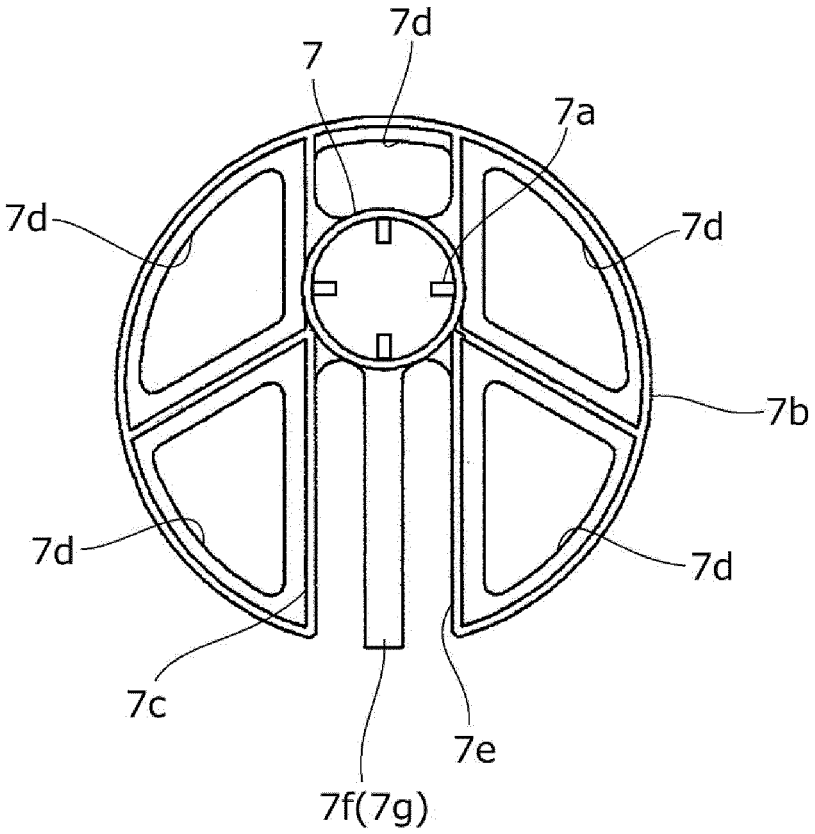


FIG. 5

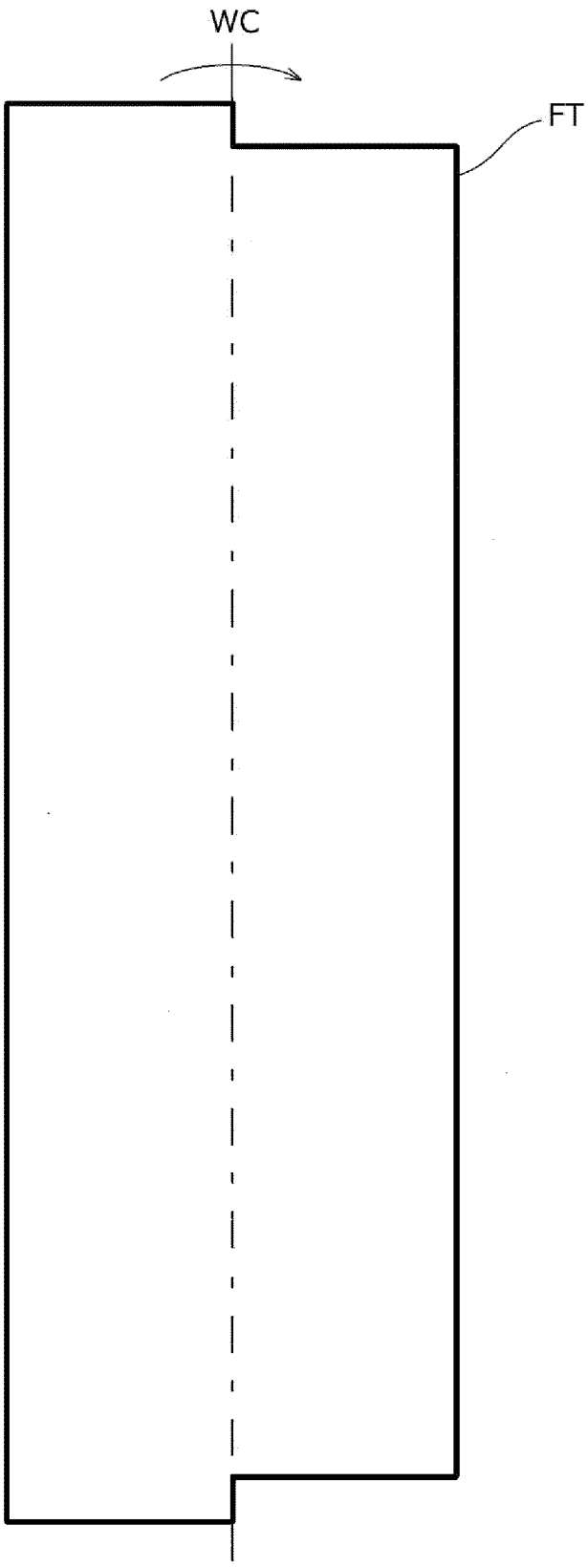


FIG. 6

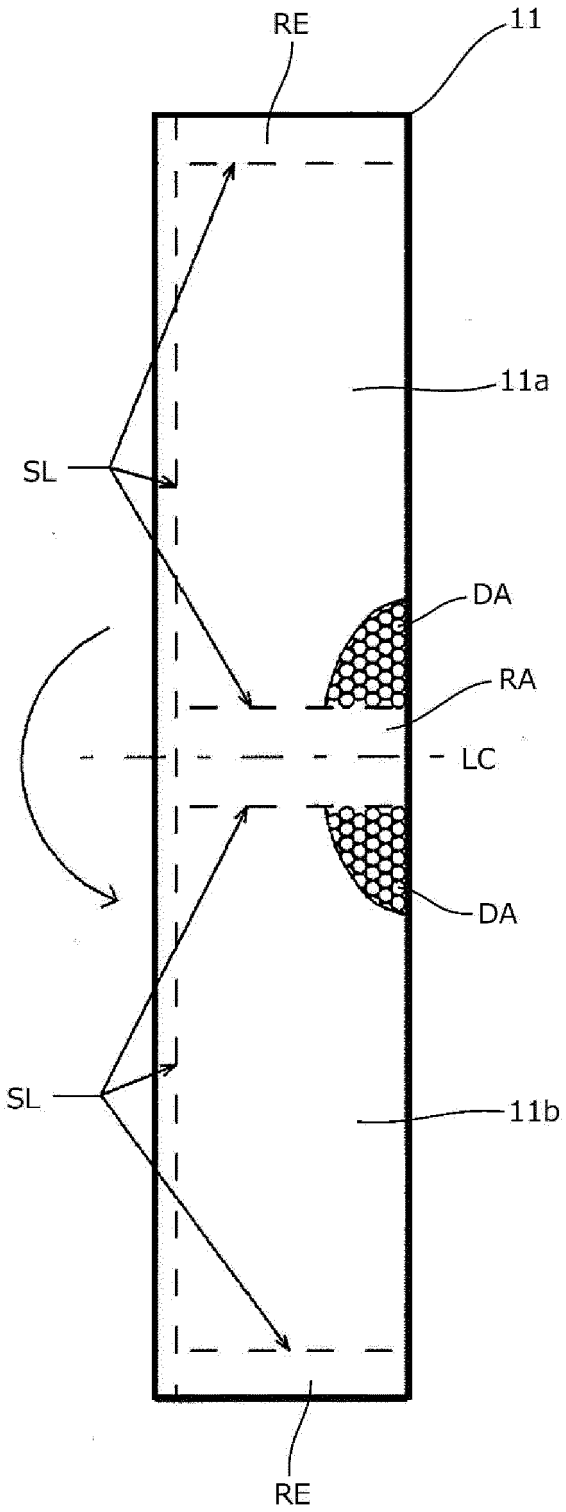


FIG. 7

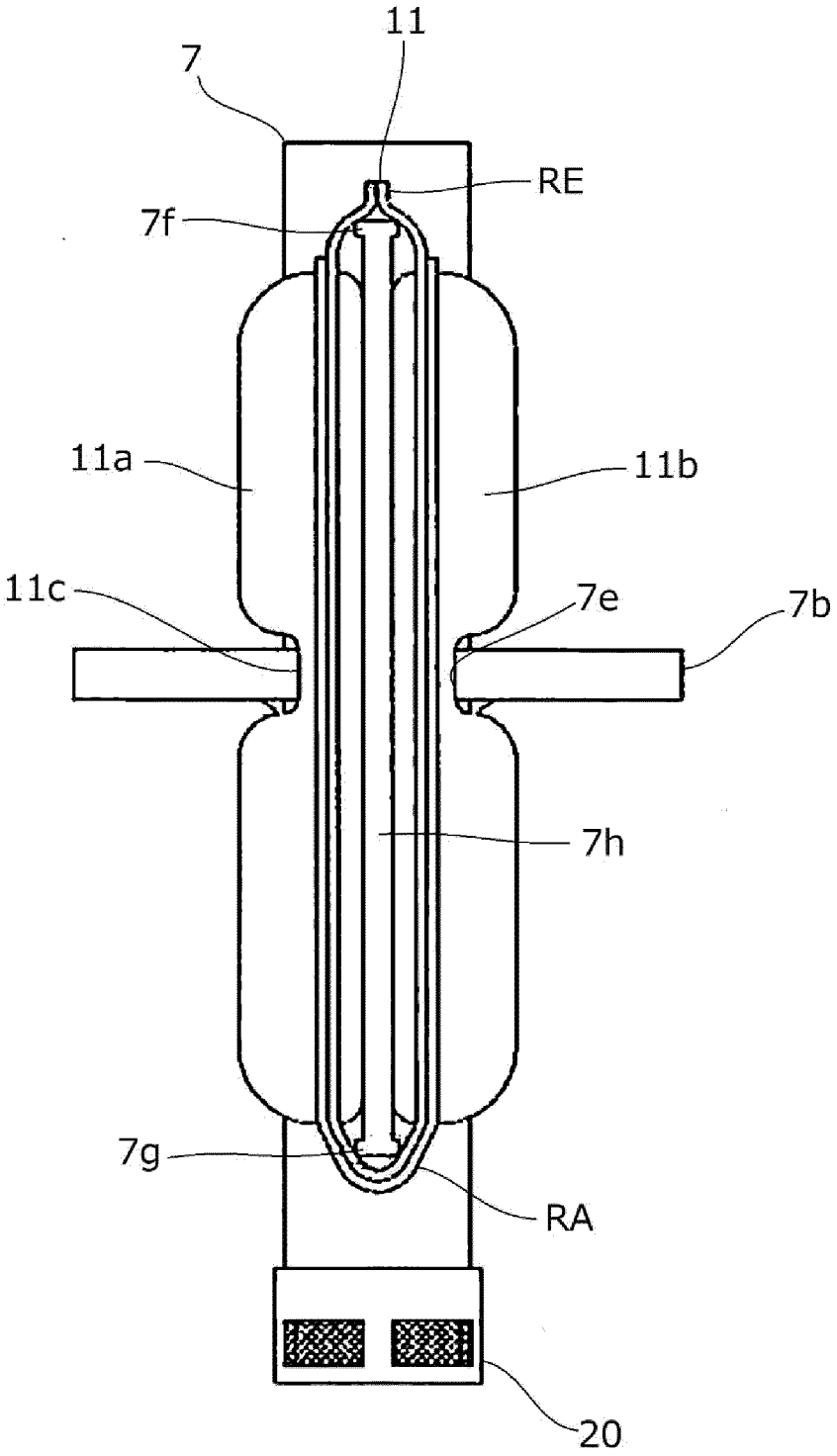


FIG. 8

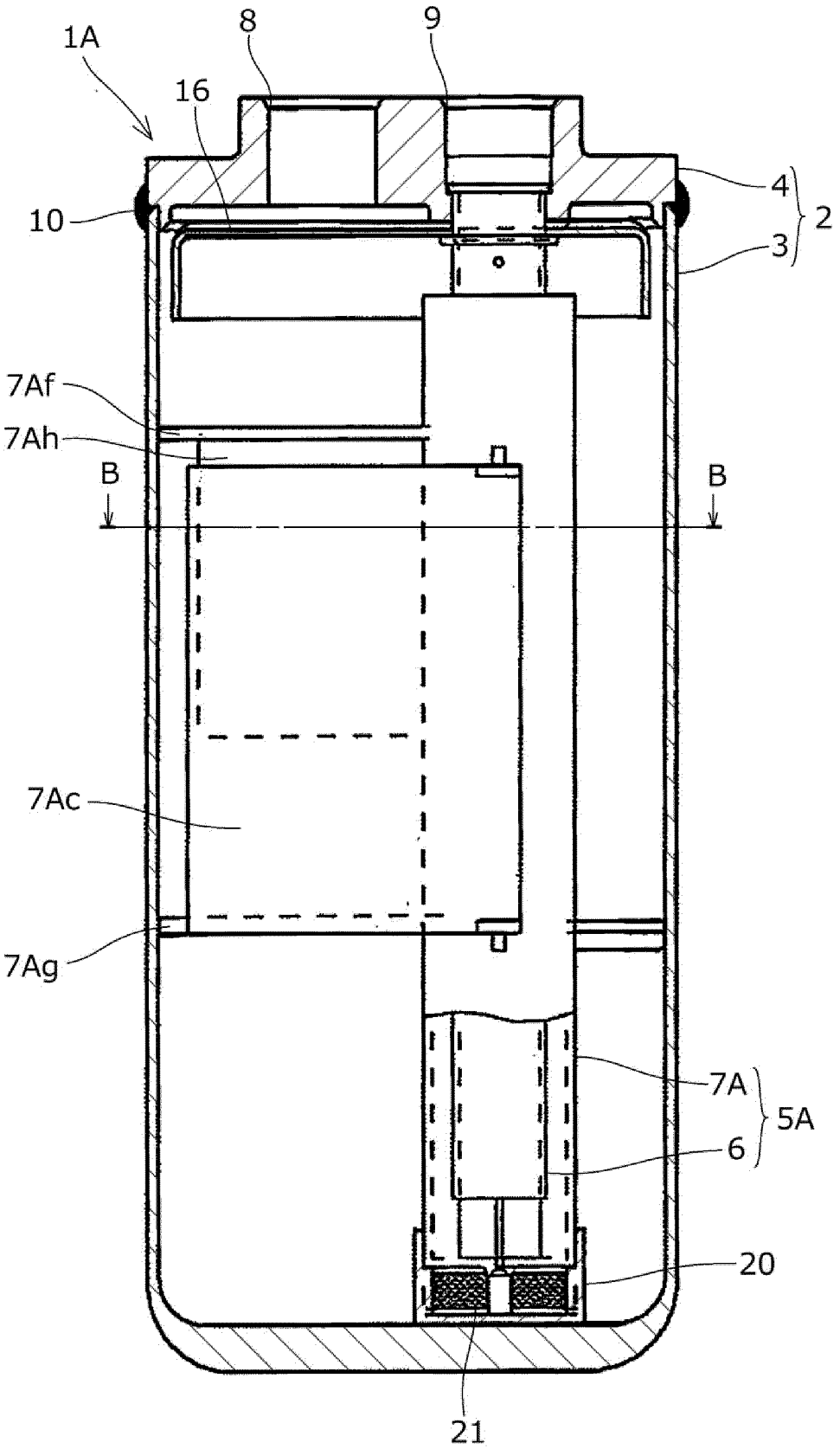


FIG. 9

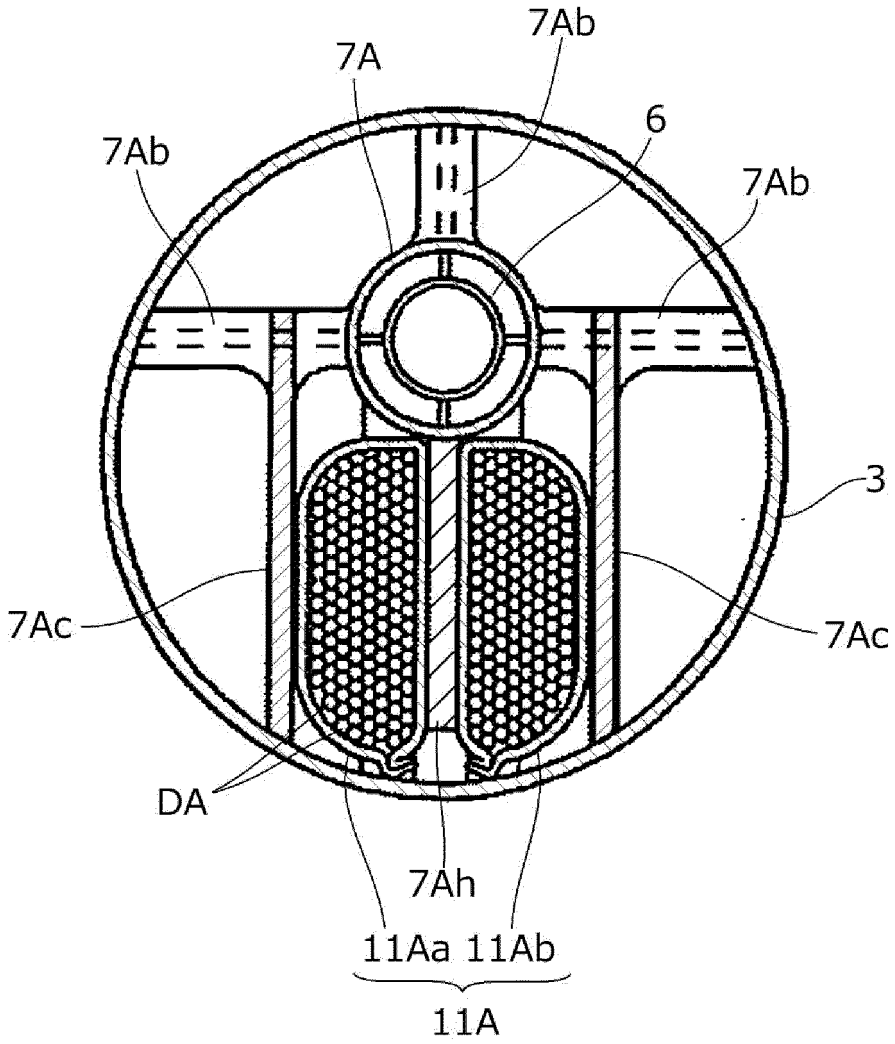
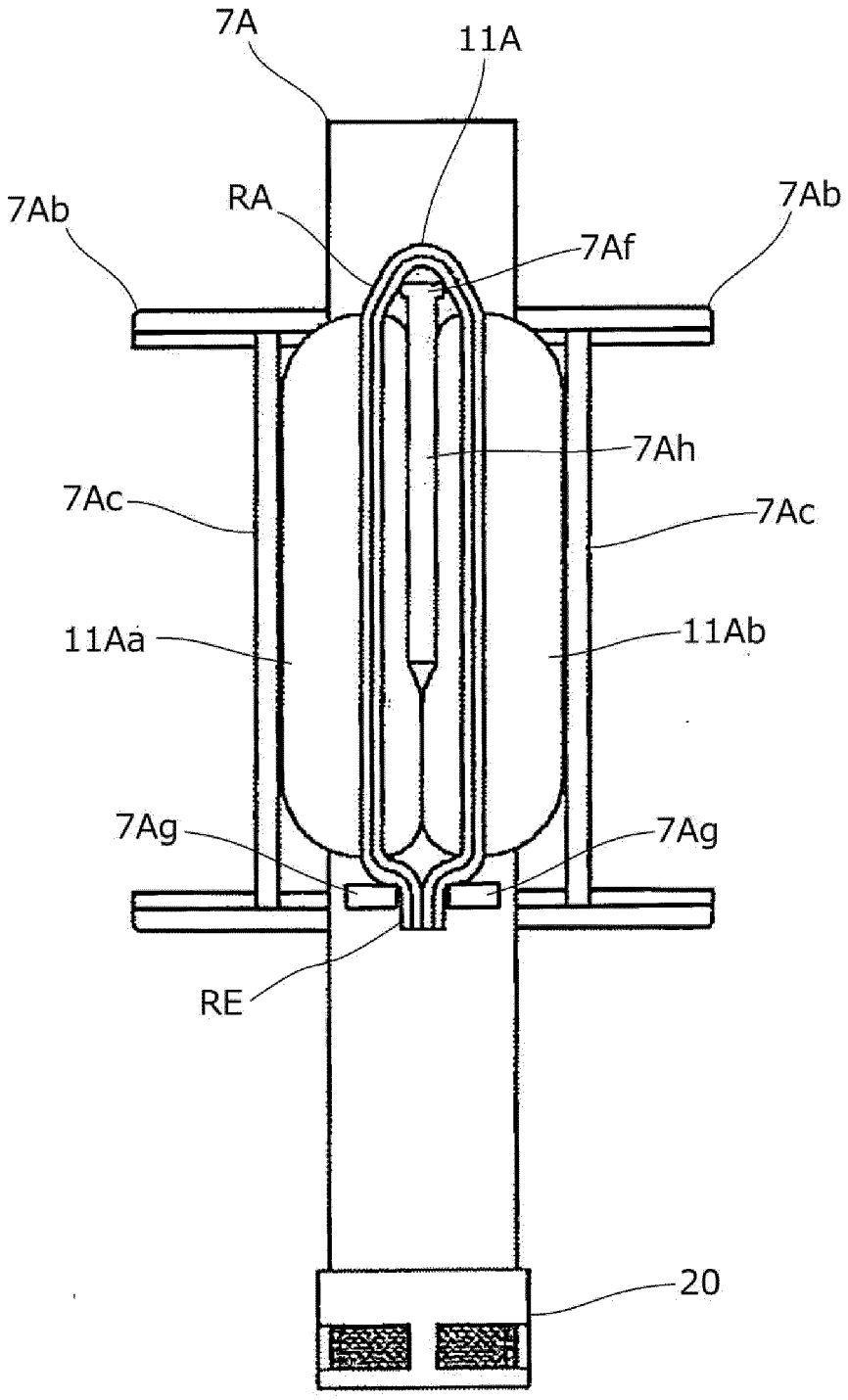


FIG. 10



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/030860

A. CLASSIFICATION OF SUBJECT MATTER

F25B 43/00(2006.01)i
FI: F25B43/00 D; F25B43/00 H

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)

F25B1/00; F25B43/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2022
Registered utility model specifications of Japan 1996-2022
Published registered utility model applications of Japan 1994-2022

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	JP 2016-61543 A (FUJI KOKI CORP.) 25 April 2016 (2016-04-25) paragraphs [0017]-[0026], fig. 1-4	1
A		2-6
Y	JP 2012-189313 A (DELPHI TECHNOLOGIES, INC.) 04 October 2012 (2012-10-04) paragraphs [0019], [0020], fig. 4-6	1
A		2-6
A	JP 2014-52139 A (DENSO CORP.) 20 March 2014 (2014-03-20) entire text, all drawings	1-6

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
30 August 2022	**13 September 2022**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2022/030860

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2014052139 A **[0006]**