



EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:
08.02.2023 Bulletin 2023/06

(51) International Patent Classification (IPC):
F04C 29/12 ^(2006.01) **F25B 43/00** ^(1968.09)

(21) Application number: **21776677.3**

(52) Cooperative Patent Classification (CPC):
F04C 29/12; F25B 43/00

(22) Date of filing: **25.03.2021**

(86) International application number:
PCT/JP2021/012627

(87) International publication number:
WO 2021/193840 (30.09.2021 Gazette 2021/39)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **DAIKIN INDUSTRIES, LTD.**
Osaka-Shi, Osaka 530-0001 (JP)

(72) Inventor: **ERA, Shuji**
Osaka-shi, Osaka 530-8323 (JP)

(74) Representative: **Conti, Marco**
Bugnion S.p.A.
Via di Corticella, 87
40128 Bologna (IT)

(30) Priority: **26.03.2020 JP 2020056169**

(54) **ACCUMULATOR**

(57) There is the issue of large vibrations of an accumulator. An accumulator (10) includes a main body casing (15), a first outlet pipe (14a), a second outlet pipe (14b), and a coupling portion (13). The main body casing (15) includes an upper body portion (16) and a lower body portion (18). The first outlet pipe (14a) and the second outlet pipe (14b) penetrate through the lower body portion (18) from the main body casing (15) and extend toward the first compression unit and the second compression unit, respectively. The coupling portion (13) is coupled to an upper end (14a1) of the first outlet pipe (14a) and an upper end (14b1) of the second outlet pipe (14b). A joining portion (13a) of the coupling portion (13) joins the refrigerants flowing upward through the first outlet pipe (14a) and the second outlet pipe (14b). The extension portion (13b) of the coupling portion (13) has a tubular shape extending upward from the joining portion (13a).

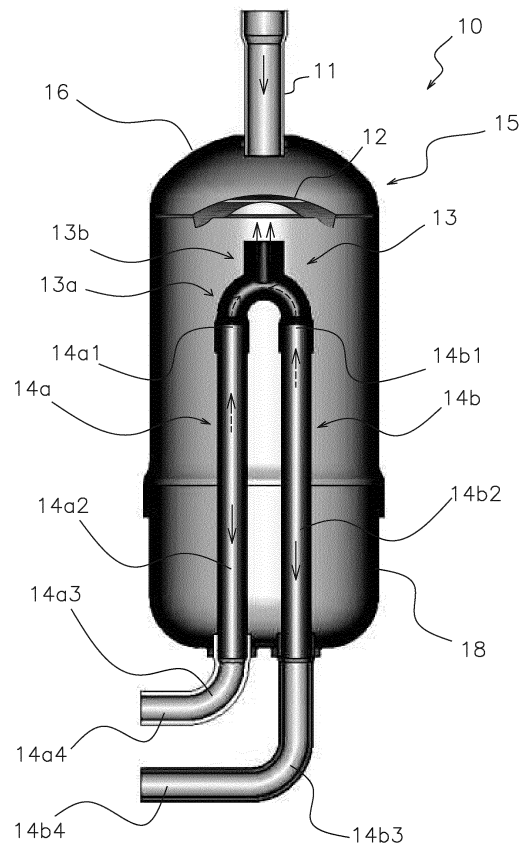


FIG. 2A

Description

Technical Field

[0001] The present disclosure relates to an accumulator.

Background Art

[0002] Conventionally, as discussed in Patent Literature 1 (Japanese Unexamined Patent Publication No. 2005-54741), an outlet pipe of an accumulator for a twin rotary compressor has an inverted U-shape, an upper portion is bent, and two lower portions are coupled to respective inlet pipes of the compressor. An upper portion of the outlet pipe is cut at the bent portion housed in the internal space of the accumulator in order to suction the refrigerant.

Summary of Invention

Technical Problem

[0003] Typically, the refrigerant passing through the outlet pipe of the accumulator flows downward from an opening in the upper portion toward the compressor. However, in some state of the compressor and a refrigerant circuit, the refrigerant may flow backward through the two outlet pipes from the compressor. At this point, the refrigerant flows upward through the two lower portions of the outlet pipes, joins at the upper portion of the outlet pipes, and is discharged from the cut opening into the internal space of the accumulator. This discharged refrigerant causes the issue of large vibrations of the accumulator.

Solution to Problem

[0004] An accumulator according to a first aspect is an accumulator arranged on an inlet side of a rotary compressor including a first compression unit and a second compression unit. The accumulator includes a main body casing, a first outlet pipe, a second outlet pipe, and a coupling portion. The main body casing includes an upper body portion and a lower body portion. The first outlet pipe and the second outlet pipe penetrate through the lower body portion from the main body casing and extend toward the first compression unit and the second compression unit, respectively. The coupling portion is coupled to an upper end of the first outlet pipe and an upper end of the second outlet pipe in the main body casing. The coupling portion is provided with a joining portion and an extension portion. The joining portion joins refrigerants flowing upward through the first outlet pipe and the second outlet pipe. The extension portion has a tubular shape extending upward from the joining portion.

[0005] In the accumulator according to the first aspect, even in the case of occurrence of the phenomenon where

the refrigerants flow upward through the first outlet pipe and the second outlet pipe, the refrigerants join at the joining portion, pass through the extension portion, and are discharged from the upper end of the extension portion into the internal space of the accumulator. Therefore, the refrigerant is straightened in the process of passing through the extension portion. As a result, the accumulator is not largely vibrated.

[0006] The accumulator according to a second aspect is the accumulator according to the first aspect, and each of the first outlet pipe and the second outlet pipe is a circular pipe. A height dimension of the extension portion is greater than an inner diameter of the first outlet pipe and greater than an inner diameter of the second outlet pipe.

[0007] In the accumulator according to the second aspect, the height dimension of the extension portion is greater than the inner diameter of the first outlet pipe and greater than the inner diameter of the second outlet pipe.

Accordingly, the height dimension of the extension portion is ensured to some extent. As a result, the refrigerants flowing upward through the first outlet pipe and the second outlet pipe are further straightened in the extension portion.

[0008] The accumulator according to a third aspect is the accumulator according to the first aspect or the second aspect, and the coupling portion is a T-shaped joint or a Y-shaped joint.

[0009] In the accumulator according to the third aspect, the coupling portion is a T-shaped joint or a Y-shaped joint. Thus, a general-purpose component may be used for the coupling portion.

[0010] The accumulator according to a fourth aspect is the accumulator according to any of the first aspect to the third aspect, and a center of the extension portion is located on an inner side of a virtual circle. The virtual circle has a center at a midpoint of a first line that is a line connecting centers of the upper ends of the first outlet pipe and the second outlet pipe, respectively, in planar view and has a diameter that is a length of the first line.

[0011] In the accumulator according to the fourth aspect, the center of the extension portion is located on the inner side of the virtual circle. Accordingly, the refrigerants flowing backward and upward through the first outlet pipe and the second outlet pipe and discharged from the upper end of the extension portion are discharged near the center axis of the accumulator. As a result, the accumulator is further less likely to be vibrated.

[0012] The accumulator according to a fifth aspect is the accumulator according to the fourth aspect, and the midpoint of the first line matches the center of the extension portion.

[0013] In the accumulator according to the fifth aspect, the midpoint of the first line matches the center of the extension portion. Accordingly, the refrigerants flowing backward and upward through the first outlet pipe and the second outlet pipe and discharged from the upper end of the extension portion are discharged on the center

axis of the accumulator. As a result, the accumulator is further less likely to be vibrated.

Brief Description of Drawings

[0014]

FIG. 1 is a cross-sectional view of an accumulator and a compressor.

FIG. 2A is a longitudinal sectional view of the accumulator.

FIG. 2B is a longitudinal sectional view of the vicinity of a coupling portion of the accumulator.

FIG. 3 is a longitudinal sectional view of a conventional accumulator.

FIG. 4 is a diagram illustrating dimensions of the accumulator and the conventional accumulator.

FIG. 5A is a diagram illustrating the distribution of pressures acting on the accumulator.

FIG. 5B is a diagram illustrating the distribution of pressures acting on the conventional accumulator.

FIG. 6A is a diagram illustrating the state of vibration of the accumulator.

FIG. 6B is a diagram illustrating the state of vibration of the conventional accumulator.

FIG. 7 is a diagram illustrating evaluation points to verify the effect of the present disclosure.

FIG. 8 is a graph illustrating acceleration levels of the accumulator and the conventional accumulator.

FIG. 9 is a graph illustrating noise levels of the accumulator and the conventional accumulator.

FIG. 10 is a top view and a cross-sectional view of an extension portion of the accumulator.

Description of Embodiments

[0015] FIG. 2A is a longitudinal sectional view of an accumulator 10. Expressions such as "upper" and "lower" may be used to describe the directions and arrangements of the accumulator 10 below and, unless otherwise specified, the expressions such as "upper" and "lower" are used with reference to FIG. 2.

(1) Overall Configuration

[0016] The accumulator 10 is a device that separates a refrigerant in a gas-liquid two-phase state into a gas refrigerant and a liquid refrigerant in a refrigeration apparatus including a refrigeration cycle in which the refrigerant is circulated. As illustrated in FIG. 1, the accumulator 10 is arranged on the inlet side of a compressor 30 including a first compression unit 31a and a second compression unit 31b in an outdoor unit of an air-conditioning apparatus as a refrigeration apparatus. The accumulator 10 forms part of a refrigerant circuit of the air-conditioning apparatus. Solid arrows indicate the flow of the refrigerant in the refrigeration cycle.

[0017] The compressor 30 is what is called a twin rotary

compressor, primarily including the first compression unit 31a, the second compression unit 31b, a first inlet pipe 32a, a second inlet pipe 32b, a first cylinder 33a, a second cylinder 33b, a first piston 34a, a second piston 34b, a casing 35, a motor 36, a discharge pipe 37, and a crankshaft 38.

[0018] By the refrigeration cycle, the refrigerants flowing from a first outlet pipe 14a and a second outlet pipe 14b of the accumulator 10 are suctioned into the first compression unit 31a and the second compression unit 31b through the first inlet pipe 32a and the second inlet pipe 32b. The first cylinder 33a and the first piston 34a constitute the first compression unit 31a. The second cylinder 33b and the second piston 34b constitute the second compression unit 31b. When the motor 36 is driven, the crankshaft 38 rotates. When the crankshaft 38 rotates, the first piston 34a and the second piston 34b make a rotary movement inside the first cylinder 33a and the second cylinder 33b. When the first piston 34a and the second piston 34b make a rotary movement, the refrigerants filled in the gap between the first cylinder 33a and the first piston 34a and in the gap between the second cylinder 33b and the second piston 34b are compressed. The compressed refrigerant flows upward in an internal space of the casing 35 and is discharged through the discharge pipe 37.

[0019] The accumulator 10 primarily includes a main body casing 15, the first outlet pipe 14a, the second outlet pipe 14b, and a coupling portion 13.

(2) Detailed Configuration

(2-1) Main Body Casing

[0020] As illustrated in FIG. 2A, the main body casing 15 includes an upper body portion 16 and a lower body portion 18.

(2-2) Inlet Pipe

[0021] As illustrated in FIG. 2A, an inlet pipe 11 is a pipe penetrating through an upper surface of the upper body portion 16. An end portion of the inlet pipe 11 in the internal space of the accumulator 10 has an opening facing downward. An end portion of the inlet pipe 11 outside the accumulator 10 is coupled to the refrigerant circuit.

(2-3) Baffle

[0022] The refrigerant passing through the inlet pipe 11 and flowing into the internal space of the main body casing 15 is a refrigerant in a gas-liquid two-phase state. As illustrated in FIG. 2A, the baffle 12 is a member that prevents the liquid refrigerant included in the refrigerant in a gas-liquid two-phase state from flowing into the first outlet pipe 14a and the second outlet pipe 14b. Thus, the accumulator 10 prevents the liquid refrigerant from being suctioned into the first compression unit 31a and the sec-

and compression unit 31b of the compressor 30.

[0023] Specifically, the refrigerant in a gas-liquid two-phase state flows into the internal space of the main body casing 15 through the inlet pipe 11 and then collides with the baffle 12. The liquid refrigerant included in a gas-liquid two-phase state adheres to the surface of the baffle 12. The liquid refrigerant adhering to the baffle 12 flows on the surface of the baffle 12 toward an outer edge portion, falls down in the internal space of the main body casing 15, and is stored in a bottom portion of the main body casing 15. Conversely, the gas refrigerant included in the refrigerant in a gas-liquid two-phase state flows into the first outlet pipe 14a and the second outlet pipe 14b via the coupling portion 13 in the internal space of the main body casing 15.

(2-4) First Outlet Pipe and Second Outlet Pipe

[0024] As illustrated in FIG. 2A, the first outlet pipe 14a and the second outlet pipe 14b are pipes penetrating through a lower surface of the lower body portion 18 from the main body casing 15 and extending toward the first compression unit 31a and the second compression unit 31b.

[0025] The first outlet pipe 14a includes an upper end 14a1, a vertical portion 14a2, a curved portion 14a3, and a horizontal portion 14a4. The second outlet pipe 14b includes an upper end 14b1, a vertical portion 14b2, a curved portion 14b3, and a horizontal portion 14b4. The first outlet pipe 14a and the second outlet pipe 14b are coupled to a joining portion 13a of the coupling portion 13 at the upper end 14a1 and the upper end 14b1, respectively. Further, the first outlet pipe 14a and the second outlet pipe 14b are coupled to the first inlet pipe 32a and the second inlet pipe 32b of the compressor 30 at the left ends of the horizontal portion 14a4 and the horizontal portion 14b4, respectively.

[0026] The first outlet pipe 14a and the second outlet pipe 14b are preferably general-purpose circular pipes.

[0027] In the refrigeration cycle, the refrigerant flowing into the first outlet pipe 14a and the second outlet pipe 14b is suctioned into the first compression unit 31a and the second compression unit 31b of the compressor 30. However, in some state of the compressor 30 and the refrigerant circuit, the refrigerant may flow backward from the compressor 30. At this point, the refrigerant flows upward through the first outlet pipe 14a and the second outlet pipe 14b. Dashed arrows in FIG. 2A indicate the flow of the refrigerant flowing backward.

(2-5) Coupling Portion

[0028] As illustrated in FIG. 2A, the coupling portion 13 is coupled to the upper end 14a1 of the first outlet pipe 14a and the upper end 14b1 of the second outlet pipe 14b in the main body casing 15. The coupling portion 13 includes the joining portion 13a and an extension portion 13b.

[0029] The coupling portion 13 may be a T-shaped joint or a Y-shaped joint instead of the member having the shape illustrated in FIG. 2A.

5 (2-5-1) Joining Portion

[0030] As illustrated in FIG. 2A, the joining portion 13a is a portion that joins the refrigerants flowing upward through the first outlet pipe 14a and the second outlet pipe 14b.

[0031] As illustrated in FIG. 2B, the joining portion 13a includes a joining space 13a1, a pre-joining space 13a2, and a space forming portion 13a3. The space forming portion 13a3 forms the joining space 13a1 and the pre-joining space 13a2.

[0032] The refrigerants flowing upward through the first outlet pipe 14a and the second outlet pipe 14b pass through the respective pre-joining spaces 13a2 and join in the joining space 13a1.

20 (2-5-2) Extension Portion

[0033] As illustrated in FIG. 2A, the extension portion 13b has a tubular shape extending upward from the joining portion 13a.

[0034] As illustrated in FIG. 2B, the extension portion 13b includes a flow straightening space 13b1 and a space forming portion 13b2. The space forming portion 13b2 forms the flow straightening space 13b1.

[0035] After flowing upward through the first outlet pipe 14a and the second outlet pipe 14b and joining in the joining space 13a1, the refrigerant is straightened in the process of passing through the flow straightening space 13b1.

[0036] Here, the first outlet pipe 14a and the second outlet pipe 14b are circular pipes, and a height dimension D1 of the extension portion 13b is greater than the inner diameter of the first outlet pipe 14a and greater than the inner diameter of the second outlet pipe 14b.

40 (3) Feature

[0037] (3-1)

As illustrated in FIG. 3, an outlet pipe of an accumulator 20 for a conventional twin rotary compressor has an inverted U-shape. The outlet pipe is bent at an upper portion. A first outlet pipe 24a and a second outlet pipe 24b, which are two lower portions of the outlet pipe, are coupled to the first inlet pipe 32a and the second inlet pipe 32b, respectively, of the compressor 30. The upper portion of the outlet pipe is cut at the bent portion housed in the internal space of the accumulator 20 in order to suction the refrigerant. The refrigerant flowing backward from the compressor 30 flows upward through the first outlet pipe 24a and the second outlet pipe 24b and is discharged from a corresponding cut portion 23.

[0038] The timings in which the refrigerants flowing upward through the first outlet pipe 24a and the second

outlet pipe 24b reach the cut portion 23 are different in the first outlet pipe 24a and the second outlet pipe 24b. Therefore, as indicated in the dashed arrows in FIG. 3, the refrigerant is discharged obliquely upward from the cut portion 21. As a result, an acoustic mode in the circumferential direction of the accumulator 20 is excited, and the accumulator 20 is largely vibrated in the radial direction. Here, the radial direction is a direction connecting the centers of the compressor 30 and the accumulator 20 in planar view.

[0039] In the accumulator 10 according to the present embodiment, as illustrated in FIG. 2B, even when the timings in which the refrigerants flowing upward through the first outlet pipe 14a and the second outlet pipe 14b reach the joining space 13a1 of the joining portion 13a are different, the refrigerant is straightened in the flow straightening space 13b1 of the extension portion 13b. Therefore, as indicated in the dashed arrows in FIG. 2B, the refrigerant discharged from the upper end of the extension portion 13b flows substantially upward. As a result, the acoustic mode in the circumferential direction of the accumulator 10 is hardly excited, and the accumulator 10 is not largely vibrated in the radial direction.

[0040] (3-2)

The first outlet pipe 14a and the second outlet pipe 14b of the accumulator 10 are circular pipes. Further, the height dimension D1 of the extension portion 13b is greater than the inner diameter of the first outlet pipe 14a and greater than the inner diameter of the second outlet pipe 14b. Accordingly, the height dimension D1 of the extension portion 13b is ensured to some extent. As a result, the refrigerants flowing upward through the first outlet pipe 14a and the second outlet pipe 14b are further straightened in the flow straightening space 13b1 of the extension portion 13b.

[0041] (3-3)

Instead of the member having the shape illustrated in FIG. 2A, a general-purpose T-shaped joint or Y-shaped joint may be used for the coupling portion 13 of the accumulator 10. Thus, a general-purpose component may be used for the coupling portion 13, which may reduce the cost of the accumulator 10.

(4) Verification Result

[0042] In this verification, the acceleration level and the noise level of the accumulator 10 according to the present embodiment and the conventional accumulator 20 are compared. The difference between the accumulator 10 and the accumulator 20 is basically only the structure of the upper end portion of the outlet pipe.

(4-1) Dimensions of Accumulator

[0043] The dimensions of the accumulator 10 and the accumulator 20 used in this verification will be described with reference to FIG. 4. The outlet pipes of the accumulator 10 and the accumulator 20 used in this verification

are circular pipes. In this verification, the accumulator 10 and the accumulator 20 having, at the minimum, a body outer diameter D2 of $\Phi 75$, an outlet pipe outer diameter D3 of $\Phi 9.5$, and an outlet pipes distance D4 of 21 mm were used. Furthermore, the accumulator 10 and the accumulator 20 having, at the maximum, the body outer diameter D2 of $\Phi 89.1$, the outlet pipe outer diameter D3 of $\Phi 16$, and the outlet pipes distance D4 of 33 mm were used. Further, the coupling portion 13, the baffle 12, the cut portion 21, and the like, are omitted from FIG. 4.

(4-2) Distribution of Pressures Acting on Accumulator

[0044] FIGS. 5A and 5B illustrate the distributions of the pressures acting on the accumulator 10 and the accumulator 20 due to the periodic back-flow of the refrigerant. The scales in FIGS. 5A and 5B indicate the values of the amplitude. Both pressure pulsations have a frequency of approximately 1630 Hz.

[0045] FIG. 5A illustrates the distribution of the pressures acting on the accumulator 10. The amplitudes in the positive direction are concentrated at the upper portion and the lower portion of the accumulator 10. Conversely, the amplitudes in the negative direction are concentrated at the central portion of the accumulator 10. Therefore, the accumulator 10 as a whole is not vibrated in the radial direction.

[0046] FIG. 5B illustrates the distribution of the pressures acting on the accumulator 20. The amplitudes in the positive direction are concentrated at the upper left portion and the lower right portion of the accumulator 20. Conversely, the amplitudes in the negative direction are concentrated in the upper right portion and the lower left portion of the accumulator 20. Therefore, the accumulator 20 as a whole is vibrated in the radial direction.

(4-3) Natural Frequency of Accumulator in Radial Direction

[0047] The natural frequencies of the accumulators 10, 20 in the radial direction primarily depends on the weights of the accumulators 10, 20, the structure of the area where the accumulators 10, 20 are coupled to the compressor 30, and the structure of the area where the accumulators 10, 20 themselves are fixed. The difference between the accumulator 10 and the accumulator 20 is basically only the structure of the upper end portions of the two outlet pipes. As a result, the natural frequencies of the accumulator 10 and the accumulator 20 in the radial direction are substantially the same.

[0048] As a result of verification, it has been found that the natural frequencies of the accumulator 10 and the accumulator 20 in the radial direction include approximately 1630 Hz.

(4-4) Summary

[0049] As described in (4-2), the periodic back-flow of

the refrigerant causes a pressure pulsation in the circumferential direction at approximately 1630 Hz in the accumulator 20. Although the pressure pulsation of approximately 1630 Hz also occurs in the accumulator 10, it is not a pressure pulsation in the circumferential direction.

[0050] Conversely, as described in (4-3), the natural frequencies of the accumulator 10 and the accumulator 20 in the radial direction include approximately 1630 Hz.

[0051] As a result, the accumulator 20 is largely vibrated and largely oscillates in the radial direction as the acoustic mode in the circumferential direction is excited. Conversely, the accumulator 10 is not largely vibrated and does not largely oscillate in the radial direction as the acoustic mode in the circumferential direction is not excited.

[0052] FIGS. 6A and 6B illustrate the states of vibrations of the accumulator 10 and the accumulator 20 under the same condition. It is clearly understood that the oscillation of the conventional accumulator 20 illustrated in FIG. 6B is larger.

[0053] FIG. 8 illustrates the acceleration levels of the accumulator 10 and the accumulator 20. The vertical axis is an acceleration level, and the horizontal axis is a frequency [Hz]. As illustrated in FIG. 7, the evaluation point for the acceleration level is a point P1 in the lower portion of the main body casing 15 on the opposite side of the compressor 30. As illustrated in FIG. 8, it is understood that, at approximately 1630 Hz, the acceleration peak level of the accumulator 10 is significantly reduced compared to the acceleration peak level of the accumulator 20.

[0054] FIG. 9 illustrates the noise levels of the accumulator 10 and the accumulator 20. The vertical axis is a noise level [dB], and the horizontal axis is a frequency [Hz]. As illustrated in FIG. 7, the evaluation point for the noise level is a point P2 away from the center in the height direction of the main body casing 15 by 30 cm in the direction opposite to the compressor 30. As illustrated in FIG. 9, it is understood that, at approximately 1630 Hz, the noise peak level of the accumulator 10 is reduced by approximately 25 dB from the noise peak level of the accumulator 20.

(5) Modification

(5-1) Modification 1A

[0055] According to the present embodiment, the position of the extension portion 13b of the accumulator 10 is not described in particular. However, it is preferable that the center of the extension portion 13b of the accumulator 10 is located on the inner side of a virtual circle CR illustrated in FIG. 10. Here, the virtual circle CR is a circle that has a center at a midpoint C3 of a first line LI that is the line connecting centers C1, C2 of the upper ends 14a1, 14b1 of the first outlet pipe 14a and the second outlet pipe 14b, respectively, in planar view, and that has a diameter that is the length of the first line LI.

[0056] Accordingly, the refrigerant flowing backward and upward through the first outlet pipe 14a and the second outlet pipe 14b and discharged from the upper end of the extension portion 13b is discharged near the center axis of the accumulator 10. As a result, the accumulator 10 is less likely to be vibrated in the radial direction.

[0057] Furthermore, here, the first outlet pipe 14a and the second outlet pipe 14b are arranged such that the center axis of the accumulator 10 matches the midpoint C3 of the first line LI. In other words, the midpoint C3 of the first line LI matches the center of the extension portion 13b. Accordingly, the refrigerant flowing backward and upward through the first outlet pipe 14a and the second outlet pipe 14b and discharged from the upper end of the extension portion 13b is discharged on the center axis of the accumulator 10. As a result, the accumulator 10 is further less likely to be vibrated in the radial direction.

[0058] (5-2)

Although the embodiment of the present disclosure has been described above, it is understood that various changes may be made to forms and details without departing from the spirit and scope of the present disclosure described in claims.

Reference Signs List

[0059]

10	Accumulator
13	Coupling portion
13a	Joining portion
13b	Extension portion
14a	First outlet pipe
14b	Second outlet pipe
15	Main body casing
16	Upper body portion
18	Lower body portion
30	Compressor
31a	First compression unit
31b	Second compression unit
D1	Height dimension of extension portion

Citation List

Patent Literature

[0060] [Patent Literature 1] Japanese Unexamined Patent Publication No. 2005-54741

Claims

1. An accumulator (10) arranged on an inlet side of a rotary compressor (30) including a first compression unit (31a) and a second compression unit (31b), the accumulator (10) comprising:

a main body casing (15) including an upper body

portion (16) and a lower body portion (18);
 a first outlet pipe (14a) and a second outlet pipe
 (14b) penetrating through the lower body portion
 from the main body casing and extending toward
 the first compression unit and the second com- 5
 pression unit, respectively; and
 a coupling portion (13) coupled to an upper end
 (14a1) of the first outlet pipe and an upper end
 (14b1) of the second outlet pipe in the main body
 casing, wherein 10
 the coupling portion is provided with a joining
 portion (13a) that joins refrigerants flowing
 through the first outlet pipe and the second outlet
 pipe and a tubular extension portion (13b) ex- 15
 tending upward from the joining portion.

2. The accumulator (10) according to claim 1, wherein

each of the first outlet pipe and the second outlet
 pipe is a circular pipe, and 20
 a height dimension (D1) of the extension portion
 is greater than an inner diameter of the first outlet
 pipe and greater than an inner diameter of the
 second outlet pipe.

3. The accumulator (10) according to claim 1 or 2,
 wherein
 the coupling portion is a T-shaped joint or a Y-shaped
 joint.

4. The accumulator (10) according to any of claims 1
 to 3, wherein

a center of the extension portion is located on
 an inner side of a virtual circle (CR), and 35
 the virtual circle has a center at a midpoint (C3)
 of a first line (LI) that is a line connecting centers
 (C1, C2) of the upper ends of the first outlet pipe
 and the second outlet pipe, respectively, in pla-
 nar view and has a diameter that is a length of 40
 the first line.

5. The accumulator (10) according to claim 4, wherein
 the midpoint of the first line matches the center of
 the extension portion. 45

50

55

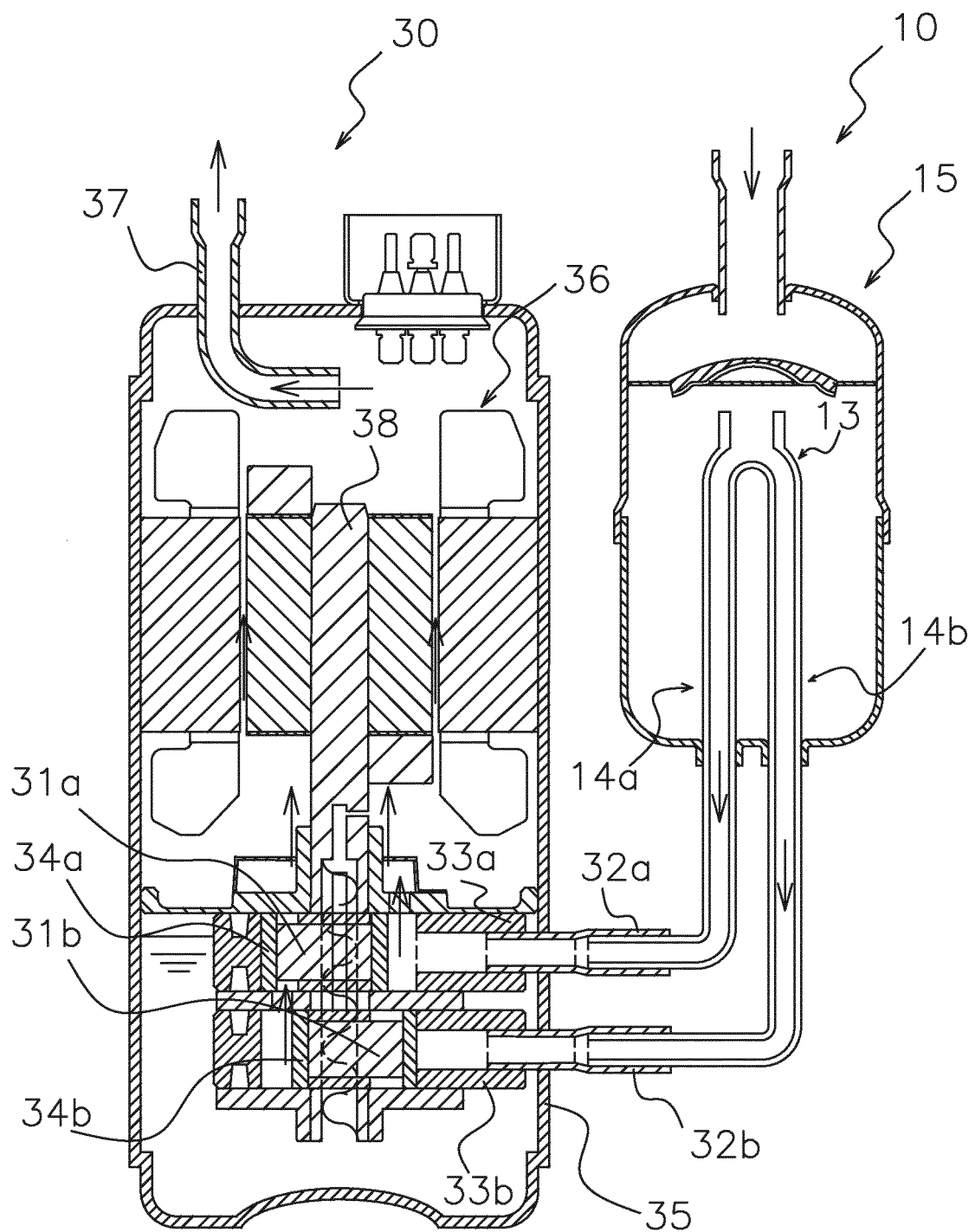


FIG. 1

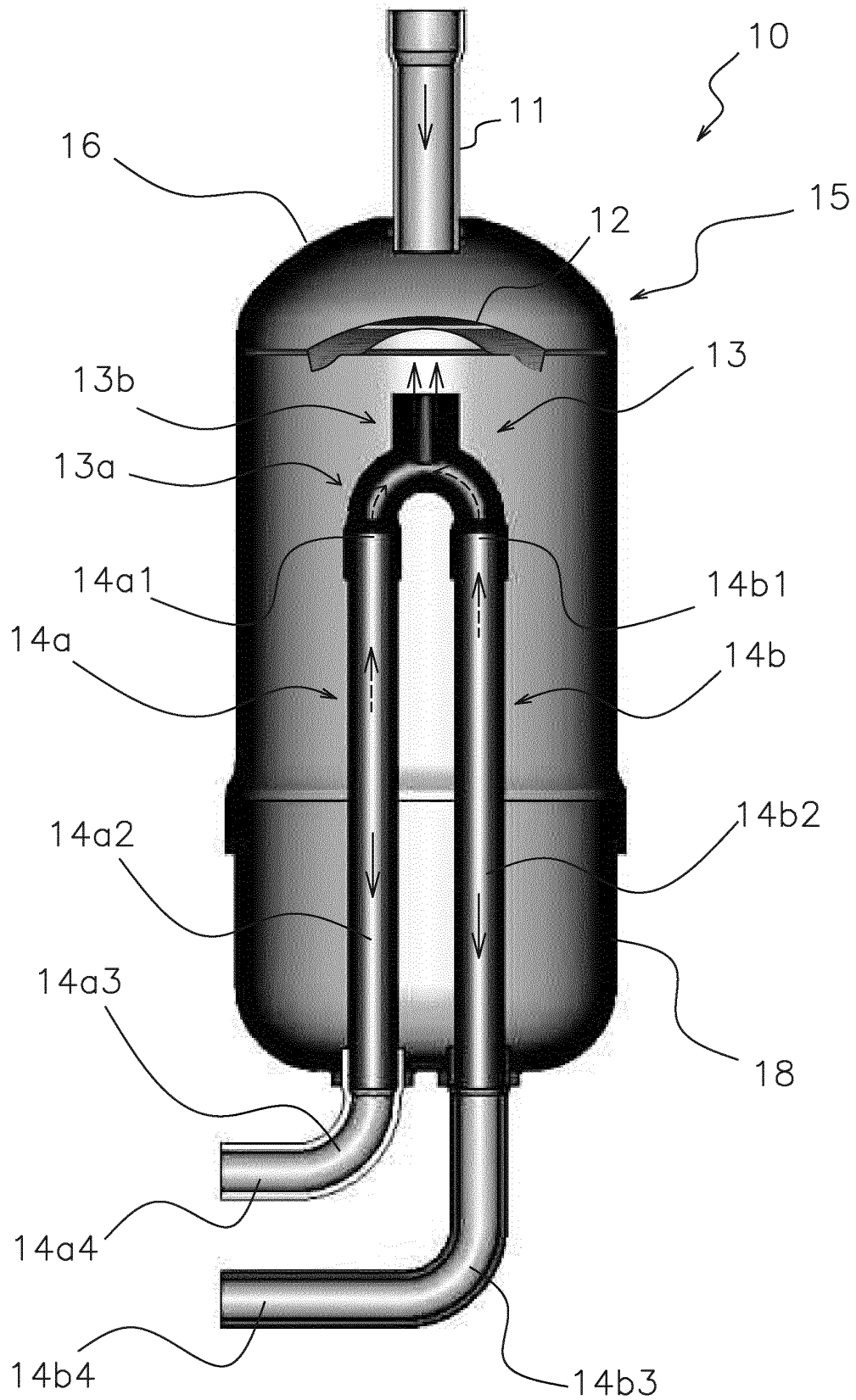


FIG. 2A

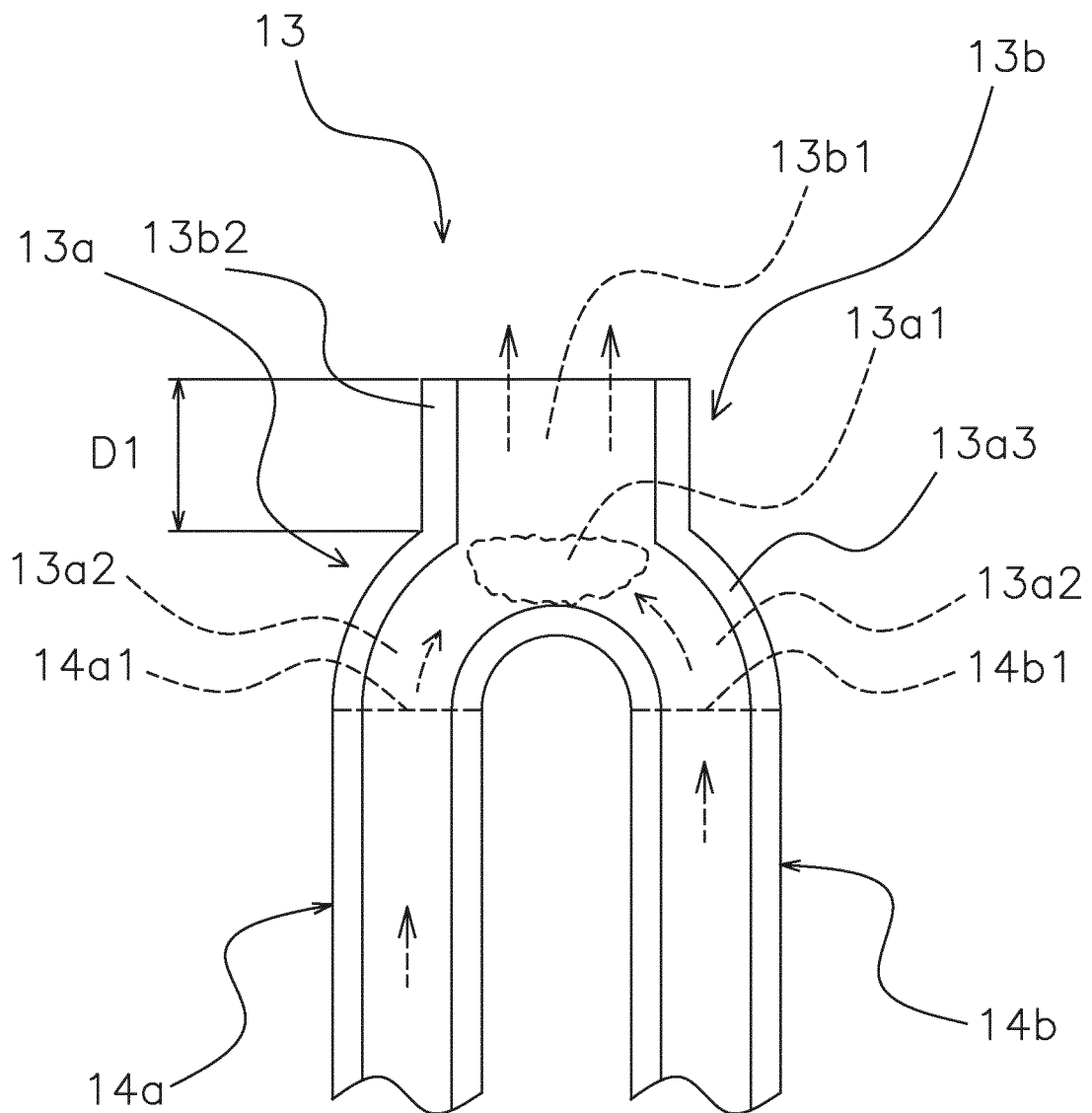


FIG. 2B

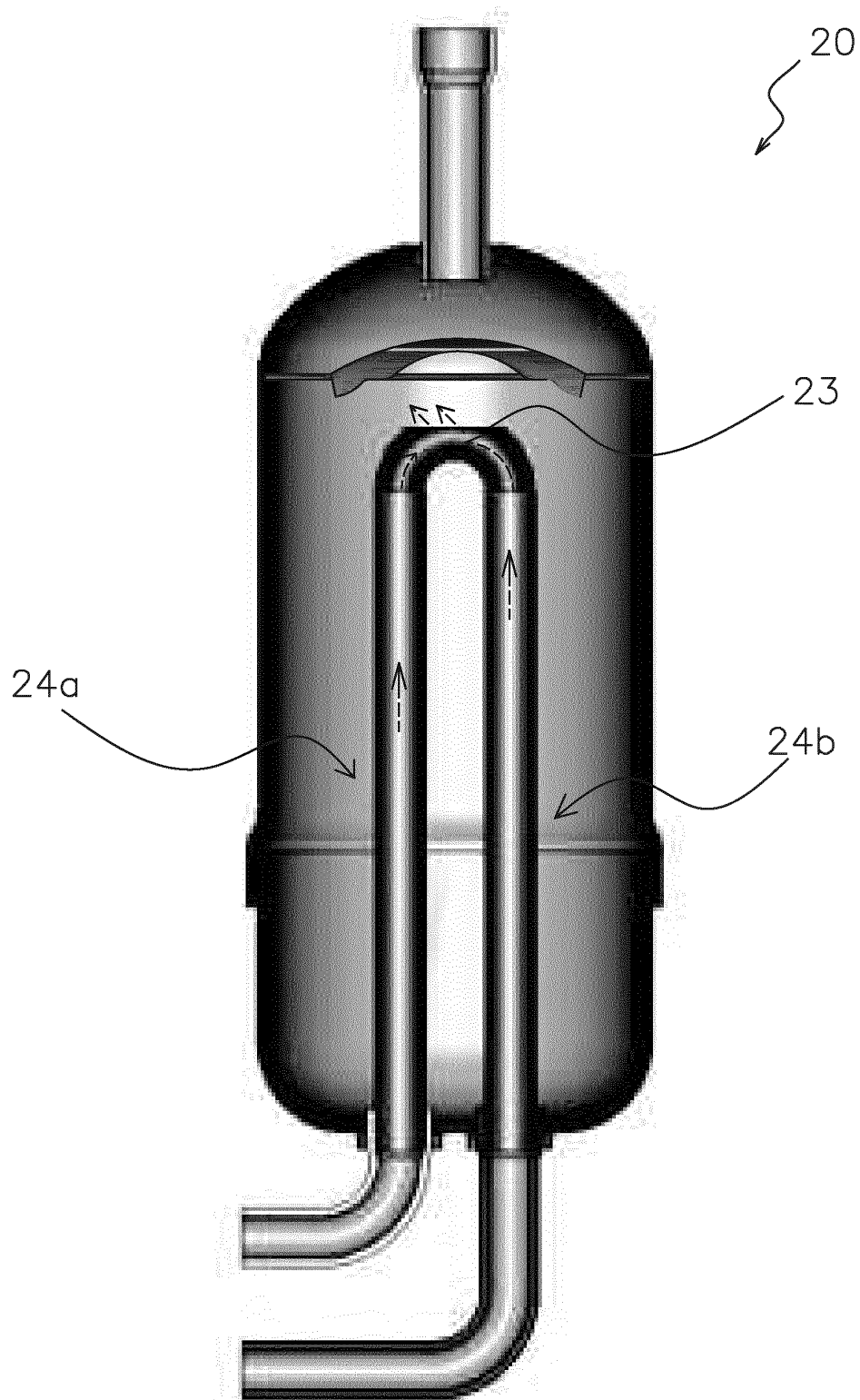


FIG. 3

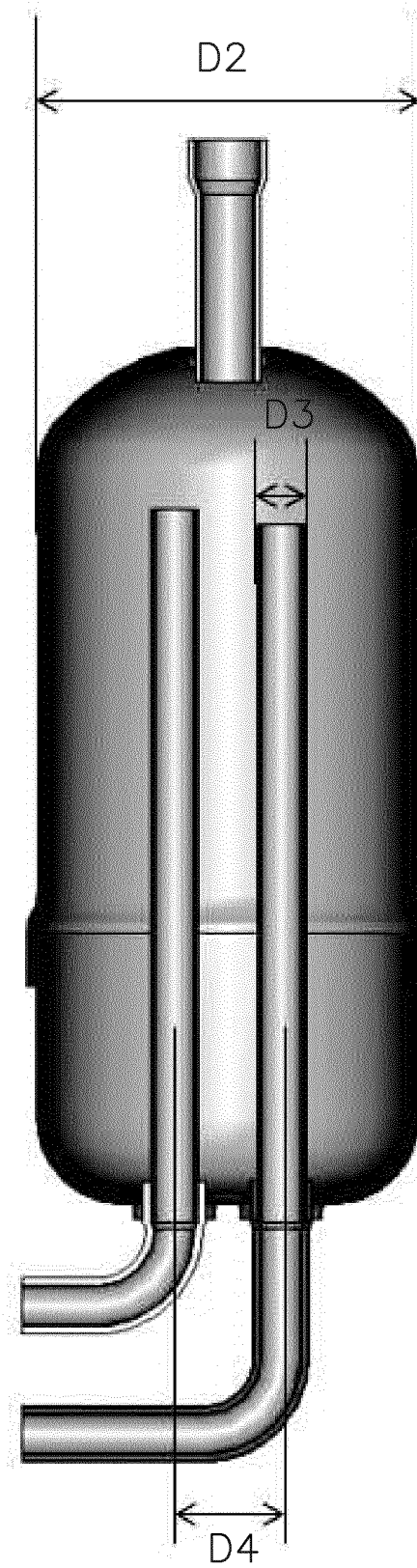


FIG. 4

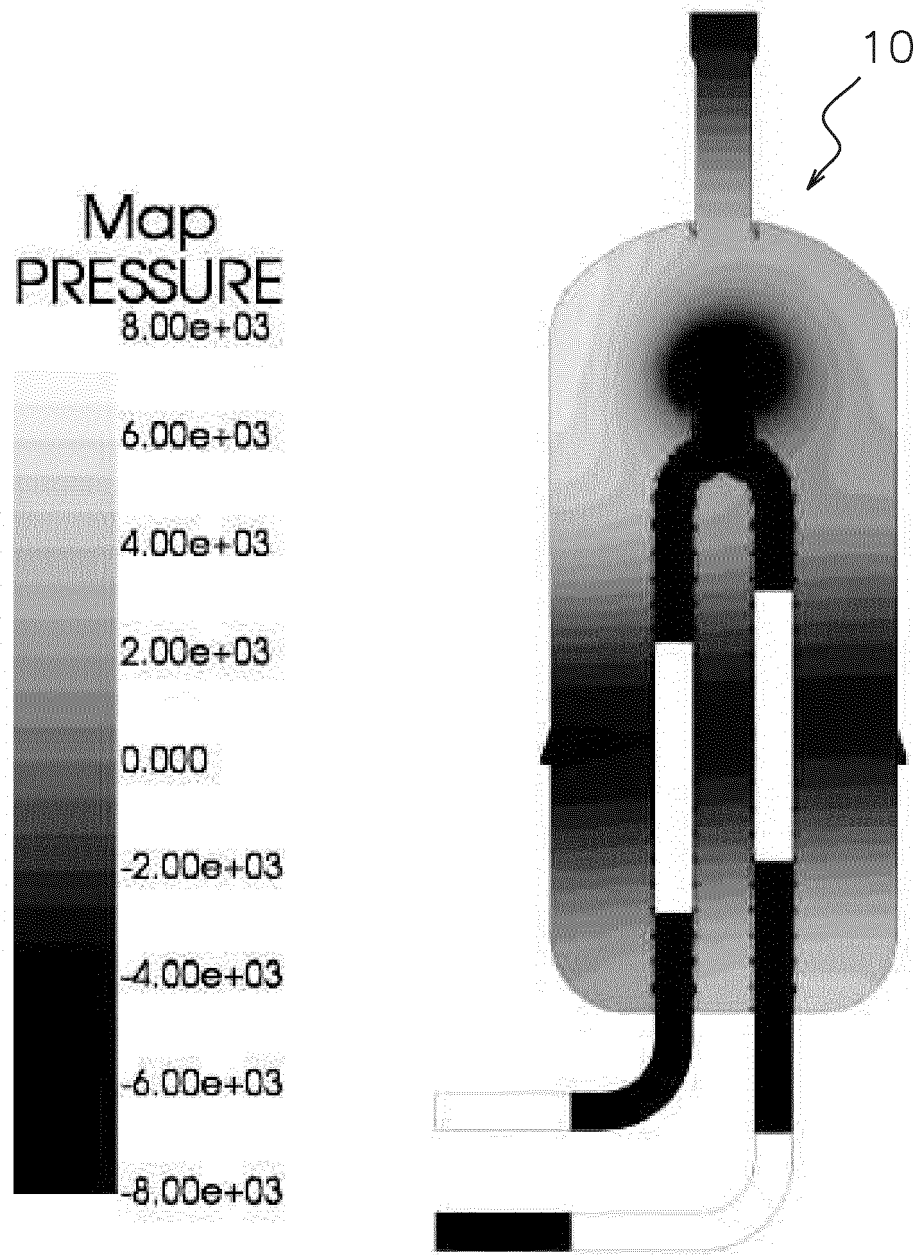


FIG. 5A

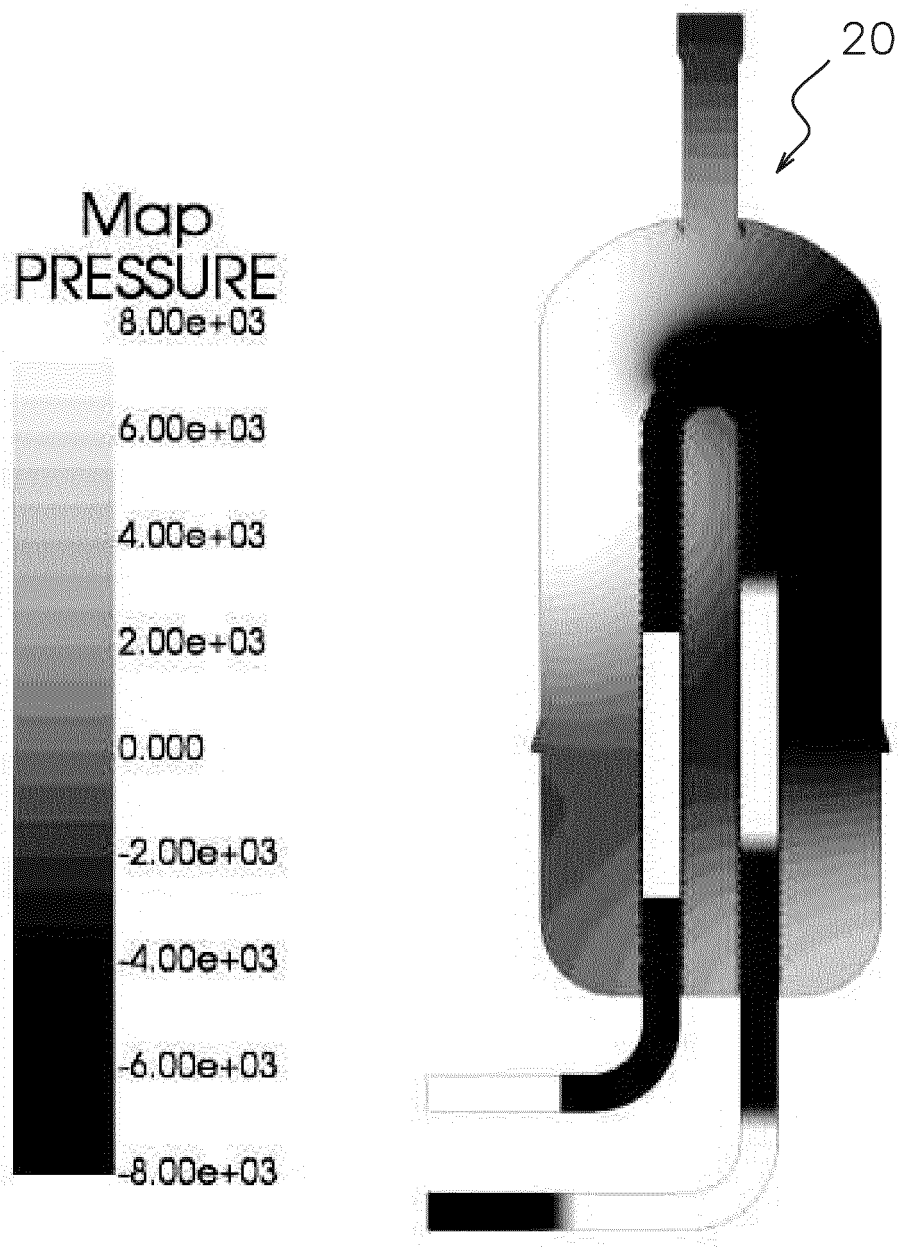


FIG. 5B

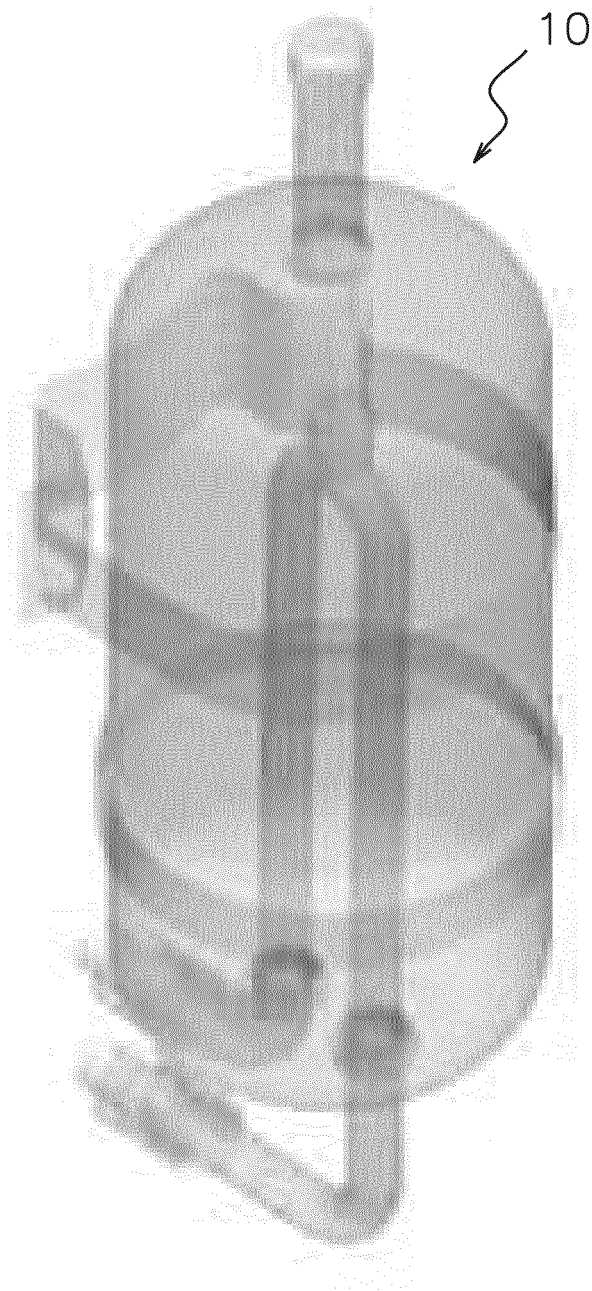


FIG. 6A

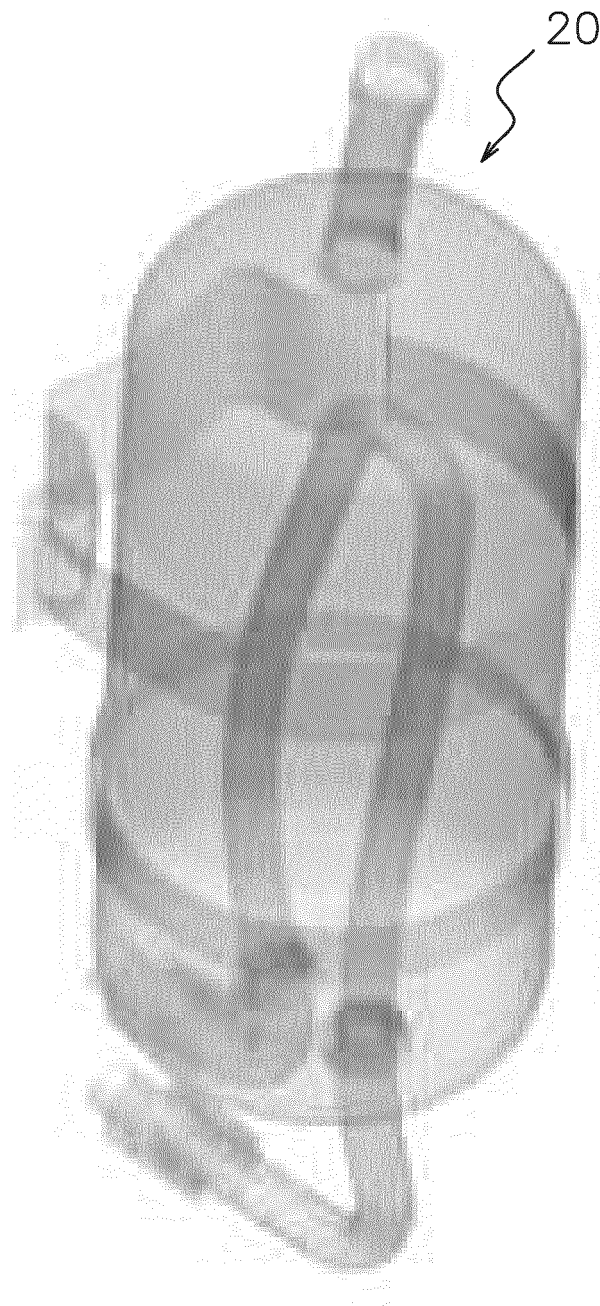


FIG. 6B

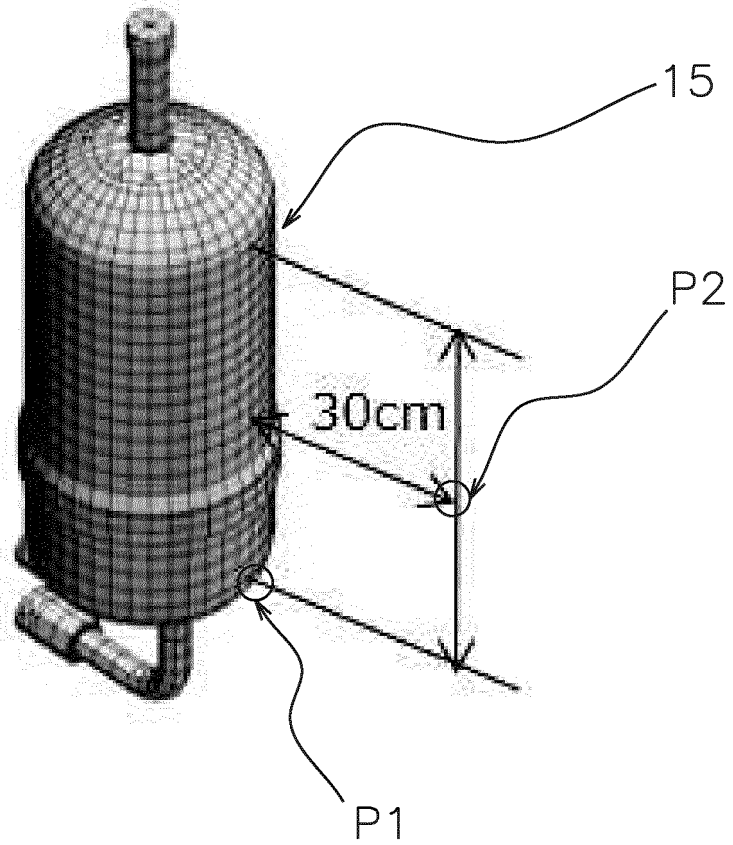


FIG. 7

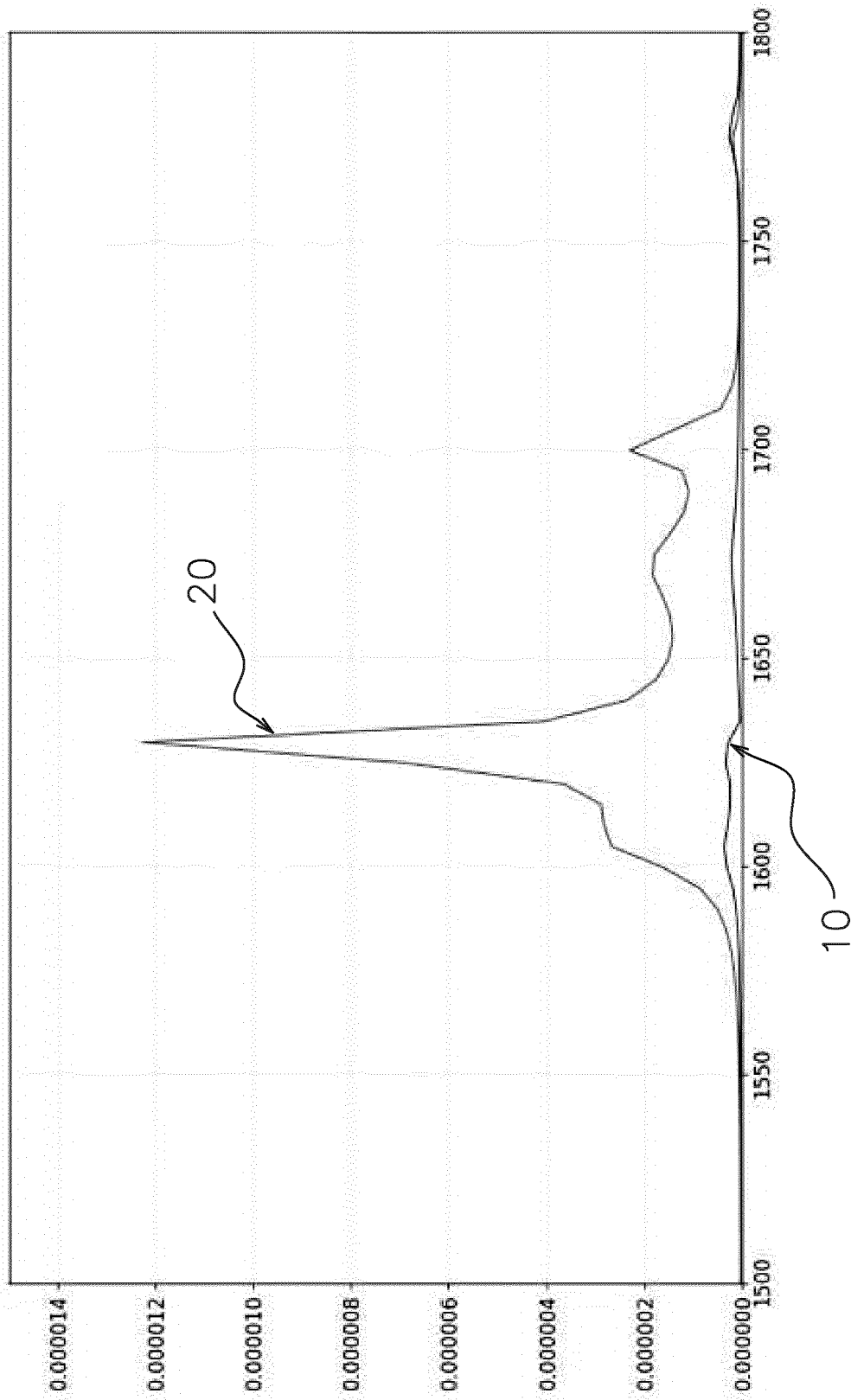


FIG. 8

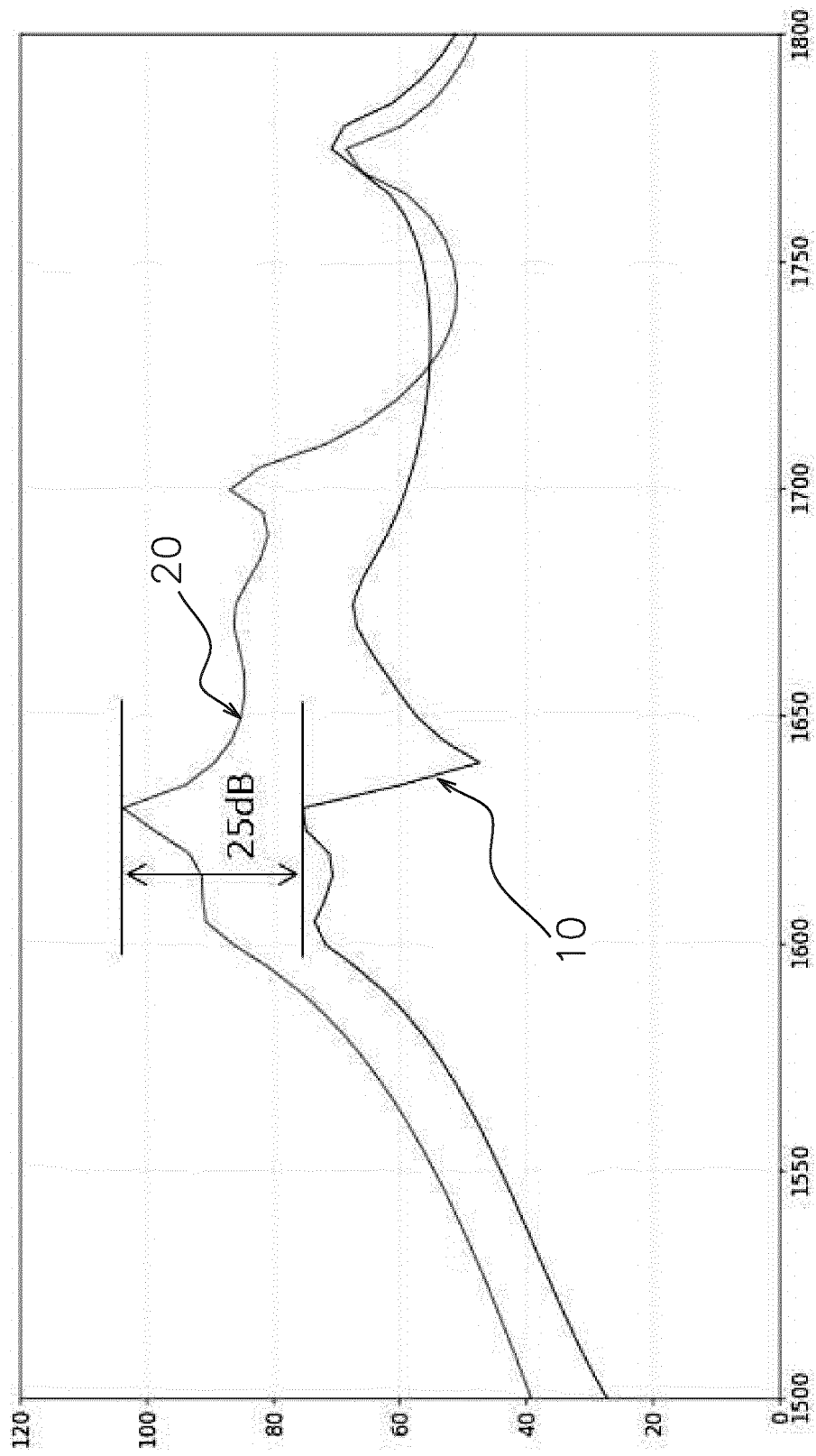


FIG. 9

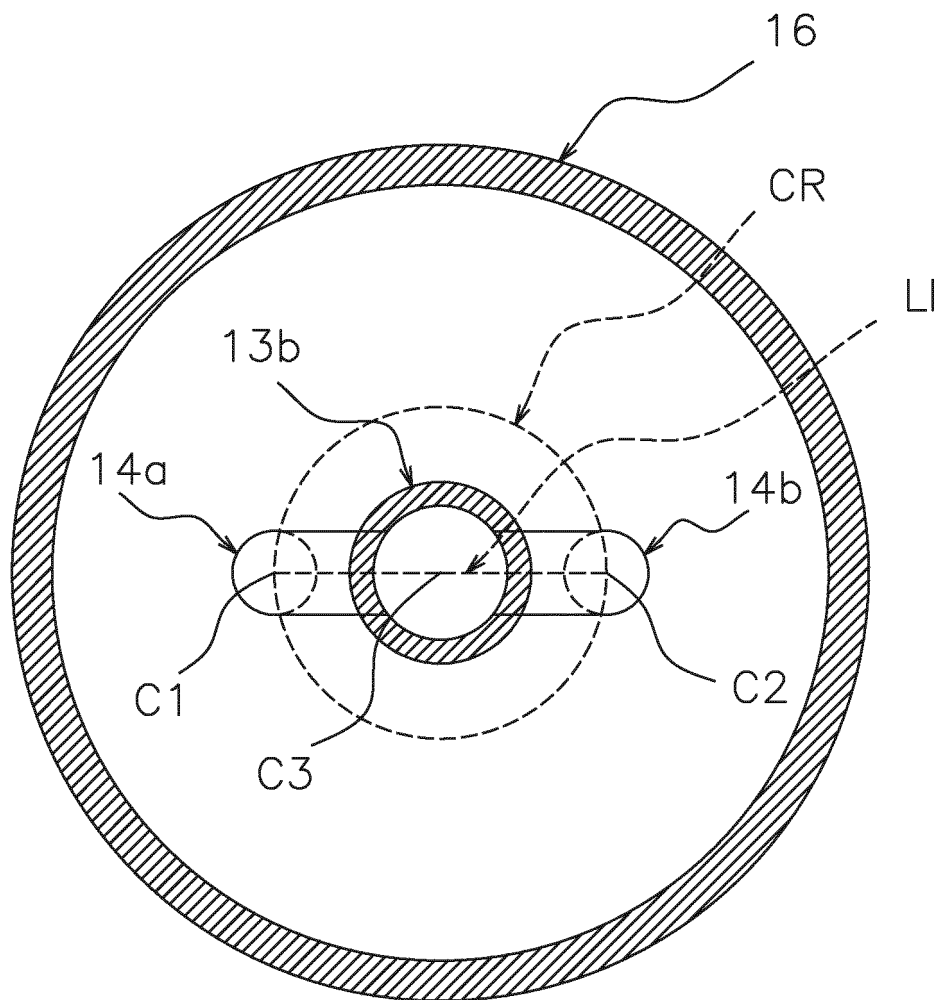


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2021/012627

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. F04C29/12 (2006.01) i, F25B43/00 (2006.01) i

FI: F04C29/12 C, F25B43/00 E

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int. Cl. F04C29/12, 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 1971-2021

Registered utility model specifications of Japan 1996-2021

Published registered utility model applications of Japan 1994-2021

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.
X	KR 20-0382995 Y1 (LG ELECTRONICS INC.) 28 April 2005, p. 3, line 46 to p. 4, line 54, fig. 4, 5	1-5
X	JP 2-67473 A (TOSHIBA CORP.) 07 March 1990, p. 3, upper left column, line 3 to p. 4, lower right column, line 9, fig. 2, 5, 6	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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

22.04.2021

Date of mailing of the international search report

11.05.2021

Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/JP2021/012627

Patent Documents referred to in the Report	Publication Date	Patent Family	Publication Date
KR 20-0382995 Y1	28.04.2005	(Family: none)	
JP 2-67473 A	07.03.1990	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2005054741 A [0002] [0060]