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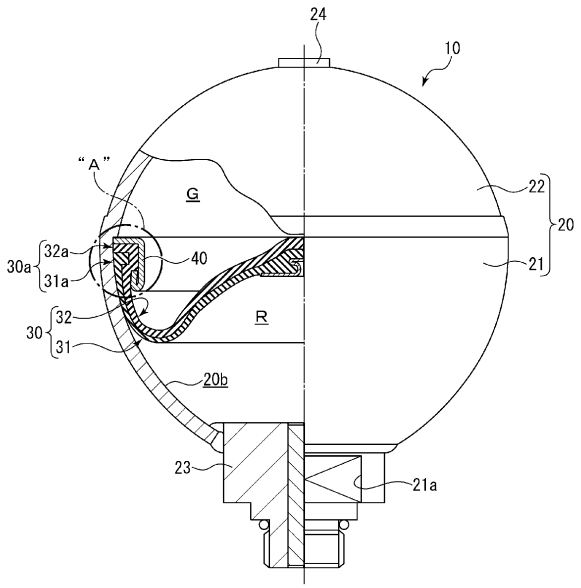
(54) ACCUMULATOR

(57) Provided is an accumulator having excellent sealing performance at a joint between bladders. An accumulator 10 is configured such that a bladder 30 is disposed on the inside of a shell 20 to divide an internal space of the shell 20 into a gas chamber G and a liquid chamber R. The bladder 30 includes an outer-diameter-side bladder 31 having a peripheral edge portion 31a disposed on an inner peripheral portion 20b of the shell 20, and an inner-diameter-side bladder 32 disposed on the inside of the outer-diameter-side bladder 31 and having a peripheral edge portion 32a formed to protrude toward an inner diameter side. The accumulator 10 includes a holder 40 configured to face the inner peripheral portion 20b of the shell 20 to hold, from the inner diameter side, the peripheral edge portion 31a of the outer-diameter-side bladder 31 and the peripheral edge portion 32a of the inner-diameter-side bladder 32. The peripheral edge portion 31a of the outer-diameter-side bladder 31 includes, on an outer diameter side thereof, an outer annular protrusion 31g, and the peripheral edge portion 32a of the inner-diameter-side bladder 32 includes, on the inner diameter side thereof, an inner annular protrusion 32h configured to contact the holder 40.

Fig.1



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Description

{TECHNICAL FIELD}

[0001] The present invention relates to an accumulator configured such that a bladder is disposed on the inside of a shell to divide an internal space of the shell into a gas chamber and a liquid chamber.

{BACKGROUND ART}

[0002] Conventionally, a bladder type of accumulator has been known, which is configured such that a peripheral edge portion of a bladder is in close contact with an inner peripheral face of a shell to divide an internal space of the shell into a gas chamber and a liquid chamber. In order to ensure sealing performance of the bladder configured for dividing it into the gas chamber and the liquid chamber, an accumulator having a bladder structure made of two materials consisting of a first material with favorable gas shielding properties and a second material with favorable liquid resistance has been proposed, the material with favorable gas shielding properties being used as the material of a bladder disposed on a gas side and the material with favorable liquid resistance being used as the material of a bladder disposed on a liquid chamber side (e.g., Patent Citation 1).

{CITATION LIST}

{Patent Literature}

[0003] Patent Citation 1: Japanese Laid-open Utility Model Publication 2-128801 (FIG. 1)

{SUMMARY OF INVENTION}

{Technical Problem}

[0004] However, according to Patent Citation 1, a gas shielding material (forming an inner-diameter-side bladder) and a liquid resistant material (forming an outer-diameter-side bladder) do not come into sufficient close contact with each other at a peripheral edge portion of the bladder made of the two materials. For this reason, gas enters a space between the gas shielding material and the liquid resistant material through a joint between the gas shielding material and the liquid resistant material. This leads to the following problems: after the entering, the gas leaks to the liquid chamber through the liquid resistant material having low gas shielding properties, or remains between the gas shielding material and the liquid resistant material to degrade the function as an accumulator.

[0005] The present invention has been made in view of such problems, and is intended to provide an accumulator having excellent sealing performance at a joint between bladders.

{Solution to Problem}

[0006] In order to solve the above-described problems, an accumulator according to the present invention comprises a shell and a bladder disposed on the inside of a shell to divide an internal space of the shell into a gas chamber and a liquid chamber. The accumulator is characterized in that the bladder comprises an outer-diameter-side bladder having a peripheral edge portion disposed on an inner peripheral portion of the shell, and an inner-diameter-side bladder disposed on an inside of the outer-diameter-side bladder and having a peripheral edge portion formed to protrude toward an inner diameter side. The accumulator further comprises a holder configured to face the inner peripheral portion of the shell to hold, from the inner diameter side, the peripheral edge portion of the outer-diameter-side bladder and the peripheral edge portion of the inner-diameter-side bladder. The peripheral edge portion of the outer-diameter-side bladder includes, on an outer diameter side thereof, an outer annular protrusion, and the peripheral edge portion of the inner-diameter-side bladder includes, on the inner diameter side thereof, an inner annular protrusion configured to contact the holder.

[0007] According to such a feature, the inner annular protrusion of the peripheral edge portion of the inner-diameter-side bladder and the outer annular protrusion of the peripheral edge portion of the outer-diameter-side bladder can be compressed in a radial direction by compression force of the holder in the radial direction, and thus a great tightening margin can be ensured. As a result, sealing performance at a joint between the bladders can be improved.

[0008] The accumulator may be characterized in that the inner-diameter-side bladder is made of a material having low gas permeability, the outer-diameter-side bladder is made of a material having liquid resistance, the gas chamber is disposed on the inner diameter side of the inner-diameter-side bladder, and the liquid chamber is disposed on the outer diameter side of the outer-diameter-side bladder.

[0009] According to such a feature, the inner-diameter-side bladder made of the material having low gas permeability (specifically having lower gas permeability than that on the side of the liquid chamber and resistance to deterioration) is disposed on the side of the gas chamber, and the outer-diameter-side bladder made of the material having liquid resistance (specifically having resistance to deterioration and swelling due to liquid) is used on the side of the liquid chamber. Thus, the two bladders can be provided as one bladder not allowing gas transmission and not deteriorated due to liquid, and the structure can be made such that leakage of liquid on one side to the fluid chamber on the other side is prevented by each bladder.

[0010] The accumulator may be characterized in that the peripheral edge portion of the inner-diameter-side bladder further includes, on the outer diameter side there-

of, an outer annular protrusion.

[0011] According to such a feature, the inner annular protrusion and the outer annular protrusion are provided so that for gas with small fluid particles, its leakage can be prevented. This means that the gas can be prevented from entering the liquid chamber or a space between the two bladders.

[0012] The accumulator may be characterized in that the inner annular protrusion of the inner-diameter-side bladder is provided at a position facing the outer annular protrusion of the outer-diameter-side bladder or the outer annular protrusion of the inner-diameter-side bladder.

[0013] According to such a feature, the inner annular protrusion of the inner-diameter-side bladder is pressed against the outer annular protrusion of the outer-diameter-side bladder or the outer annular protrusion of the inner-diameter-side bladder so that a great tightening margin can be ensured. Thus, sealing performance between the shell and the bladder and between the bladders can be ensured.

[0014] The accumulator may be characterized in that the peripheral edge portion of the outer-diameter-side bladder is, in a nesting manner, surrounded by the peripheral edge portion of the inner-diameter-side bladder.

[0015] According to such a feature, the peripheral edge portion of the outer-diameter-side bladder is, in the nesting manner, surrounded by the peripheral edge portion of the inner-diameter-side bladder, and therefore, sealing performance between the outer-diameter-side bladder and the inner-diameter-side bladder can be ensured.

[0016] The accumulator may be characterized in that the peripheral edge portion of the outer-diameter-side bladder further includes, on the inner diameter side thereof, an inner annular protrusion.

[0017] According to such a feature, the peripheral edge portion of the outer-diameter-side bladder can further ensure a great tightening margin by the outer annular protrusion of the inner-diameter-side bladder, and thus sealing performance between the outer-diameter-side bladder and the inner-diameter-side bladder can be ensured.

{BRIEF DESCRIPTION OF DRAWINGS}

[0018]

FIG. 1 is a partially sectional, side view showing a first embodiment of the accumulator according to the present invention;

FIG. 2A is a view of peripheral edge portions of an outer-diameter-side bladder and an inner-diameter-side bladder of the first embodiment, and FIG. 2B is an enlarged view of a portion "A" of FIG. 1;

FIG. 3 is a partially sectional, side view showing a second embodiment of the accumulator according to the present invention;

FIG. 4A is a view of peripheral edge portions of an outer-diameter-side bladder and an inner-diameter-side bladder of the second embodiment, and FIG. 4B is an enlarged view of a portion "B" of FIG. 3.

{DESCRIPTION OF EMBODIMENTS}

[0019] The embodiments of the accumulator according to the present invention will be described below with reference to examples.

First Embodiment

[0020] The first embodiment of the accumulator will be described with reference to FIGS. 1 and 2. First, a reference numeral 10 of FIG. 1 represents the accumulator to which the present invention has been applied. As illustrated in FIG. 1, the accumulator 10 mainly includes a shell 20, a bladder 30 disposed on an inner peripheral portion 20b of the shell 20 to divide an internal space of the shell 20 into a gas chamber G and a liquid chamber R, and a holder 40 configured to face the shell 20 to hold a peripheral edge portion 30a of the bladder 30 from an inner diameter side, i.e., an inner side of the accumulator.

[0021] As illustrated in FIG. 1, the shell 20 is made of metal and is formed as a spherical body defining hemispherical portions 21, 22 to have a step portion to be engaged with the holder 40 and including a substantially spherical cavity inside. The hemispherical portion 21 is provided in a bottom portion thereof with an opening 21a, and a liquid port member 23 is welded and fixed to the opening 21a. On the other hand, a gas plug 24 is detachably disposed at a bottom portion of the hemispherical portion 22 in opposition to the opening 21a.

[0022] The bladder 30 is a film body having flexibility, and has, in a pressure-free state, a double-layered structure of an outer-diameter-side bladder 31 disposed facing the inner peripheral portion 20b of the shell 20 and an inner-diameter-side bladder 32 disposed on the inner diameter side of the outer-diameter-side bladder 31. The outer-diameter-side bladder 31 is made of a liquid resistant material, such as rubber or a resin film, having resistance to deterioration due to liquid such as oil and keeping high sealing performance even when the material contacts the liquid. Moreover, the inner-diameter-side bladder 32 is made of a gas shielding material, such as rubber or a resin film, having resistance to deterioration even when the material contacts gas such as nitrogen, not allowing gas transmission, and having high shielding properties. The peripheral edge portion 30a of the bladder 30 includes a peripheral edge portion 31a of the outer-diameter-side bladder 31, and a peripheral edge portion 32a of the inner-diameter-side bladder 32. The peripheral edge portion 31a and the peripheral edge portion 32a each contact the inner peripheral portion 20b of the shell 20, and the internal space of the shell 20 is hermetically divided into the gas chamber G filled with gas and the liquid chamber R filled with liquid such as oil.

[0023] As illustrated in FIGS. 1 and 2A, the outer-diameter-side bladder 31 includes the annular peripheral edge portion 31a having a substantially rectangular cross

section and thickly formed to protrude toward the inner diameter side, and a film body portion 31f extending in a bowl shape along the entire circumference from a lower end portion 31e of the annular peripheral edge portion 31a. The peripheral edge portion 31a is provided on an outer peripheral portion 31b thereof with an annular protrusion 31g protruding outward in a radial direction from the outer peripheral portion 31b along the entire circumference thereof, and the annular protrusion 31g contacts the inner peripheral portion 20b of the shell 20 to seal the liquid.

[0024] The inner-diameter-side bladder 32 includes the annular peripheral edge portion 32a formed in a substantially angular U-shape in cross section, and a film body portion 32f extending in a bowl shape from a lower end portion 32e of the annular peripheral edge portion 32a along the entire circumference. Moreover, the peripheral edge portion 32a includes an upper end portion 32c covering an upper end portion 31c of the peripheral edge portion 31a of the outer-diameter-side bladder 31 along the entire circumference, an inner peripheral portion 32d covering an inner peripheral portion 31d of the peripheral edge portion 31a along the entire circumference, and the lower end portion 32e covering the lower end portion 31e of the peripheral edge portion 31a along the entire circumference. The peripheral edge portion 32a of the inner-diameter-side bladder 32 having the substantially angular U-shaped cross section is disposed to cover, from an inner peripheral side, the peripheral edge portion 31a of the outer-diameter-side bladder 31 having the substantially rectangular cross section in a nesting manner. Further, the upper end portion 32c of the peripheral edge portion 32a of the inner-diameter-side bladder 32 is provided on an outer peripheral portion thereof with an annular protrusion 32g formed outward in the radial direction along the entire circumference of the upper end portion 32c, and the annular protrusion 32g is brought into contact with the inner peripheral portion 20b of the shell 20 to seal the gas. In addition, the peripheral edge portion 32a of the inner-diameter-side bladder 32 is provided on the inner peripheral portion 32d thereof with an annular protrusion 32h protruding inward in the radial direction from the inner peripheral portion 32d along the entire circumference thereof. The annular protrusion 32h is pressed and held by the inner peripheral portion 20b of the shell 20 and the below-described holder 40 so that the peripheral edge portion 31a of the outer-diameter-side bladder 31 and the peripheral edge portion 32a of the inner-diameter-side bladder 32 can be compressed in the radial direction to ensure a great tightening margin and enhance sealing performance.

[0025] As illustrated in FIGS. 1 and 2B, the holder 40 is disposed at the peripheral edge portion 30a of the bladder 30 for pressing and holding the peripheral edge portion 30a toward the inner peripheral portion 20b of the shell 20 is, from the inner diameter side of the peripheral edge portion 30a. The holder 40 is formed in a substantially L-shape in cross section. The holder 40 includes an annular flange portion 40a extending in the radial direction, and an annular extending portion 40b extending from an inner diameter portion of the flange portion 40a in an axial direction. The extending portion 40b of the holder 40 is formed to have a greater diameter than that of the inner peripheral portion 32d of the peripheral edge portion 30a of the bladder 30 (see FIG. 2A). When the holder 40 is fitted onto an inner peripheral portion of the peripheral edge portion 30a of the bladder 30, and is further fitted onto the inner peripheral portion 20b of the shell 20, the peripheral edge portion 30a of the bladder 30 is compressed between the holder 40 and the inner peripheral portion 20b of the shell 20. In this state, the annular protrusion 31g of the peripheral edge portion 31a of the outer-diameter-side bladder 31 and the annular protrusion 32g of the peripheral edge portion 32a of the inner-diameter-side bladder 32 are further compressed in the radial direction. This can ensure to provide a great tightening margin, and can enhance sealing performance.

[0026] The annular protrusion 31g of the outer-diameter-side bladder 31 is tightly in contact with the inner peripheral portion 20b of the shell 20 to seal the liquid, and the annular protrusion 32h of the inner-diameter-side bladder 32 is also tightly in contact with the inner peripheral portion 20b of the shell 20 to seal the gas. Thus, sealing performance for the liquid and the gas can be maintained without allowing the liquid and the gas to enter a space between the annular protrusion 31g and the annular protrusion 32g.

[0027] The inner peripheral portion of the peripheral edge portion 30a of the bladder 30, i.e., the inner peripheral portion 30d of the inner-diameter-side bladder 32, further includes the annular protrusion 32h. Thus, when the annular protrusion 32h is compressed between the holder 40 and the inner peripheral portion 20b of the shell 20, greater compression force is generated at the peripheral edge portion 30a of the bladder 30, and as a result the annular protrusion 31g of the outer-diameter-side bladder 31 and the annular protrusion 32g of the inner-diameter-side bladder 32 are more tightly in contact with the inner peripheral portion 20b of the shell 20 so that sealing performance can be further enhanced. In this state, the annular protrusion 31g of the peripheral edge portion 31a of the outer-diameter-side bladder 31 and the annular protrusion 32h of the peripheral edge portion 32a of the inner-diameter-side bladder 32 are formed at opposing positions, and therefore, a greater tightening margin can be ensured.

Second Embodiment

[0028] Next, an accumulator 50 of a second embodiment will be described with reference to FIGS. 3, 4A, and 4B. Note that the same overlapping configuration as that of the above-described embodiment will not be described. As illustrated in FIG. 3, the accumulator 50 mainly includes a shell 60, a bladder 70 disposed on an inner

peripheral portion 60b of the shell 60 to divide an internal space of the shell into a gas chamber G and a liquid chamber R, a gas port member 61 (a holder of the present invention) having one end provided with an opening for gas injection and configured to face the inner peripheral portion 60b of the shell 60 to press and hold, from an inner diameter side, a peripheral edge portion 70a of the bladder 70, and a plug 62 configured to retainably support the gas port member 61 in an axial direction.

[0029] As illustrated in FIG. 3, the shell 60 is formed of a cylindrical member made of metal, opening at an upper end thereof, and having a closed bottom to form a cavity inside. The shell 60 is provided in a bottom portion thereof with a hole 60a, and, e.g., a liquid port is hermetically connected to the hole 60a. An upper end portion of the shell 60 is provided on an inner peripheral face thereof with an internal thread potion 63, and the plug 62 with an external thread portion is screwed into the internal thread potion 63. In this manner, the gas port member 61 is supported.

[0030] As illustrated in FIGS. 3, 4A, and 4B, the bladder 70 is a cylindrical film body having flexibility and having a closed bottom in a pressure-free state. The bladder 70 has, in a pressure-free state, a double-layered structure of an outer-diameter-side bladder 71 disposed facing the inner peripheral portion 60b of the shell 60 and an inner-diameter-side bladder 72 disposed on the inner diameter side of the outer-diameter-side bladder 71. The outer-diameter-side bladder 71 is made of a liquid resistant material, such as rubber or a resin film, having resistance to deterioration due to liquid such as oil and high sealing performance even when the material contacts the liquid. Moreover, the inner-diameter-side bladder 72 is made of a gas shielding material, such as rubber or a resin film, having resistance to deterioration due to gas, not allowing gas transmission, and having high shielding properties. The peripheral edge portion 70a of the bladder 70 includes a peripheral edge portion 71a of the outer-diameter-side bladder 71, and a peripheral edge portion 72a of the inner-diameter-side bladder 72. The peripheral edge portion 71a of the outer-diameter-side bladder 71 is brought into contact with the inner peripheral portion 60b of the shell 60, and the peripheral edge portion 72a of the inner-diameter-side bladder 72 is brought into contact with an inner peripheral portion of the outer-diameter-side bladder 71. The cavity is hermetically divided into the gas chamber G filled with gas and the liquid chamber R filled with liquid such as oil.

[0031] The outer-diameter-side bladder 71 includes thickly-formed annular peripheral edge portions 71b, 71c having a substantially rectangular cross section, an annular portion 71d connecting the peripheral edge portions 71b, 71c, and a cylindrical portion 71f having a closed bottom and extending from a lower end portion of the peripheral edge portion 71c along the entire circumference. The peripheral edge portions 71b, 71c are provided on outer peripheral portions thereof with annular protrusions 71g, 71e, respectively, each of which protrudes outward in a radial direction along the entire circumference thereof, and the peripheral edge portions 71b, 71c are provided on inner peripheral portions thereof with annular protrusions 71h, 71j respectively, each of which protrudes inward in the radial direction along the entire circumference thereof. The peripheral edge portions 71b, 71c are compressed between the gas port member 61 and the inner peripheral portion 60b of the shell 60, and the peripheral edge portions 71b, 71c of the outer-diameter-side bladder 71 are sealed in close contact with the gas port member 61 and the inner peripheral portion 60b of the shell 60. In particular, the annular protrusions 71g, 71e formed respectively at the outer peripheral portions of the peripheral edge portions 71b, 71c and the annular protrusions 71h, 71j formed respectively at the inner peripheral portions of the peripheral edge portions 71b, 71c are compressed in the radial direction between the gas port member 61 and the inner peripheral portion 60b of the shell 60, thereby ensuring a great tightening margin. Thus, the peripheral edge portions 71b, 71c of the outer-diameter-side bladder 71 are more tightly in contact with the gas port member 61 and the shell 60 so that sealing performance can be enhanced.

[0032] As illustrated in FIGS. 3, 4A, and 4B, the inner-diameter-side bladder 72 includes a thickly-formed annular peripheral edge portion 72b having a substantially rectangular cross section, and a cylindrical portion 72f having a closed bottom and extending from a lower end portion of the peripheral edge portion 72b along the entire circumference. Moreover, the annular peripheral edge portion 72b is provided on an outer peripheral portion thereof with two annular protrusions 72g, 72e each protruding outward in the radial direction along the entire circumference thereof, and the peripheral edge portion 72b is provided on an inner peripheral portion thereof with a single annular protrusion 72h protruding inward in the radial direction along the entire circumference thereof.

[0033] The inner peripheral portion of the peripheral edge portion 72b of the inner-diameter-side bladder 72 is pressed and held by the metal gas port member 61, and is sealed by a surface pressure generated between the inner peripheral portion of the peripheral edge portion 72b and the metal gas port member 61. On the other hand, the outer peripheral portion of the peripheral edge portion 72b is sealed by a surface pressure generated between the rubber peripheral edge portion 72b and the rubber cylindrical portion 71f of the outer-diameter-side bladder 71. However, the surface pressure generated by the contact between rubber and rubber is lower than the surface pressure generated by the contact between metal and rubber, and for this reason, sealing performance between the rubber peripheral edge portion 72b and the rubber cylindrical portion 71f is lowered. Thus, the two annular protrusions 72g, 72e are provided on the outer peripheral portion of the peripheral edge portion 72b, and the single annular protrusion 72h is further provided on the inner peripheral portion of the peripheral edge portion

72bc. The annular protrusions 72g, 72e, 72h and the cylindrical portion 71f are compressed between the shell 60 and the metal gas port member 61 so that a great surface pressure can be generated between the rubber peripheral edge portion 72b and the rubber cylindrical portion 71f. Consequently, sealing can be reliably made between the peripheral edge portion 72b of the inner-diameter-side bladder 72 and the cylindrical portion 71f of the outer-diameter-side bladder 71.

[0034] As illustrated in FIG. 4B, annular raised portions 61a, 61b, 61c are formed at an outer peripheral portion of the gas port member 61. The annular raised portions 61a, 61b, 61c are, in a close contact state, fitted respectively in recessed portions 73a, 73b of the outer-diameter-side bladder 71 and an end portion 73c of the inner-diameter-side bladder 72, thereby forming a labyrinth. This can further improve sealing performance of gas and a gaseous substance.

[0035] The embodiments of the present invention have been described above with reference to the drawings. However, a specific configuration is not limited to these embodiments. Even changes and additions made without departing from the gist of the present invention are included in the present invention.

[0036] For example, in the first embodiment, the peripheral edge portion 30a of the bladder 30 is provided with the annular protrusion 31g on an outer diameter side, i.e., an outer side of the accumulator and the annular protrusion 32h on the inner diameter side. However, an annular protrusion may be further provided on the outer diameter side of the inner-diameter-side bladder 32 at a position corresponding to the annular protrusion 32h such that a great tightening margin is provided by further compressing the peripheral edge portion 30a of the bladder 30 in the radial direction. In this manner, sealing performance can be improved. In this state, the further annular protrusion may be provided on one of the outer-diameter-side bladder 31 or the inner-diameter-side bladder 32, or may be provided on both of the outer-diameter-side bladder 31 and the inner-diameter-side bladder 32.

[0037] In the first and second embodiments, the space between the peripheral edge portion of the outer-diameter-side bladder and the peripheral edge portion of the inner-diameter-side bladder is sealed by the surface pressure generated therebetween. However, the peripheral edge portion of the outer-diameter-side bladder and the peripheral edge portion of the inner-diameter-side bladder may be bonded together with, e.g., an adhesive, and in this manner, the surface pressure may be used in combination with bonding.

{REFERENCE SIGNS LIST}

[0038]

10 Accumulator
20 Shell
20b Inner peripheral portion
30 Bladder
31 Outer-diameter-side bladder
31a Peripheral edge portion of outer-diameter-side bladder
31g Outer annular protrusion
32 Inner-diameter-side bladder
32a Peripheral edge portion
32g Outer annular protrusion
32h Inner annular protrusion
40 Holder
50 Accumulator
60 Shell
60b Inner peripheral portion
61 Gas port member (holder)
70 Bladder
71 Outer-diameter-side bladder
71a Peripheral edge portion
71g Outer annular protrusion
71e Outer annular protrusion
71h Inner annular protrusion
71j Inner annular protrusion
72 Inner-diameter-side bladder
72a Peripheral edge portion
72e Outer annular protrusion
72g Outer annular protrusion
72h Inner annular protrusion
G Gas chamber
R Liquid chamber

Claims

1. An accumulator comprising a shell and a bladder disposed on an inside of the shell to divide an internal space of the shell into a gas chamber and a liquid chamber, **characterized in that** the bladder comprises:

an outer-diameter-side bladder having a peripheral edge portion disposed on an inner peripheral portion of the shell; and
an inner-diameter-side bladder disposed on an inside of the outer-diameter-side bladder and having a peripheral edge portion formed to protrude toward an inner diameter side,
wherein the accumulator further comprises a holder configured to face the inner peripheral portion of the shell to hold, from the inner diameter side, the peripheral edge portion of the outer-diameter-side bladder and the peripheral edge portion of the inner-diameter-side bladder,
wherein the peripheral edge portion of the outer-diameter-side bladder includes, on an outer diameter side thereof, an outer annular protrusion, and
wherein the peripheral edge portion of the inner-diameter-side bladder includes, on the inner di-

ameter side thereof, an inner annular protrusion configured to contact the holder.

2. The accumulator of claim 1, **characterized in that**:

the inner-diameter-side bladder is made of a material having low gas permeability,
the outer-diameter-side bladder is made of a material having liquid resistance,
the gas chamber is disposed on the inner diameter side of the inner-diameter-side bladder, and
the liquid chamber is disposed on the outer diameter side of the outer-diameter-side bladder.

3. The accumulator of claim 1 or 2, **characterized in that**:
the peripheral edge portion of the inner-diameter-side bladder further includes, on the outer diameter side thereof, an outer annular protrusion.

4. The accumulator of any one of claims 1 to 3, **characterized in that**:
the inner annular protrusion of the inner-diameter-side bladder is provided at a position facing the outer annular protrusion of the outer-diameter-side bladder or the outer annular protrusion of the inner-diameter-side bladder.

5. The accumulator of any one of claims 1 to 4, **characterized in that**:
the peripheral edge portion of the outer-diameter-side bladder is, in a nesting manner, surrounded by the peripheral edge portion of the inner-diameter-side bladder.

6. The accumulator of any one of claims 1 to 5, **characterized in that**:
the peripheral edge portion of the outer-diameter-side bladder further includes, on the inner diameter side thereof, an inner annular protrusion.

Fig.1

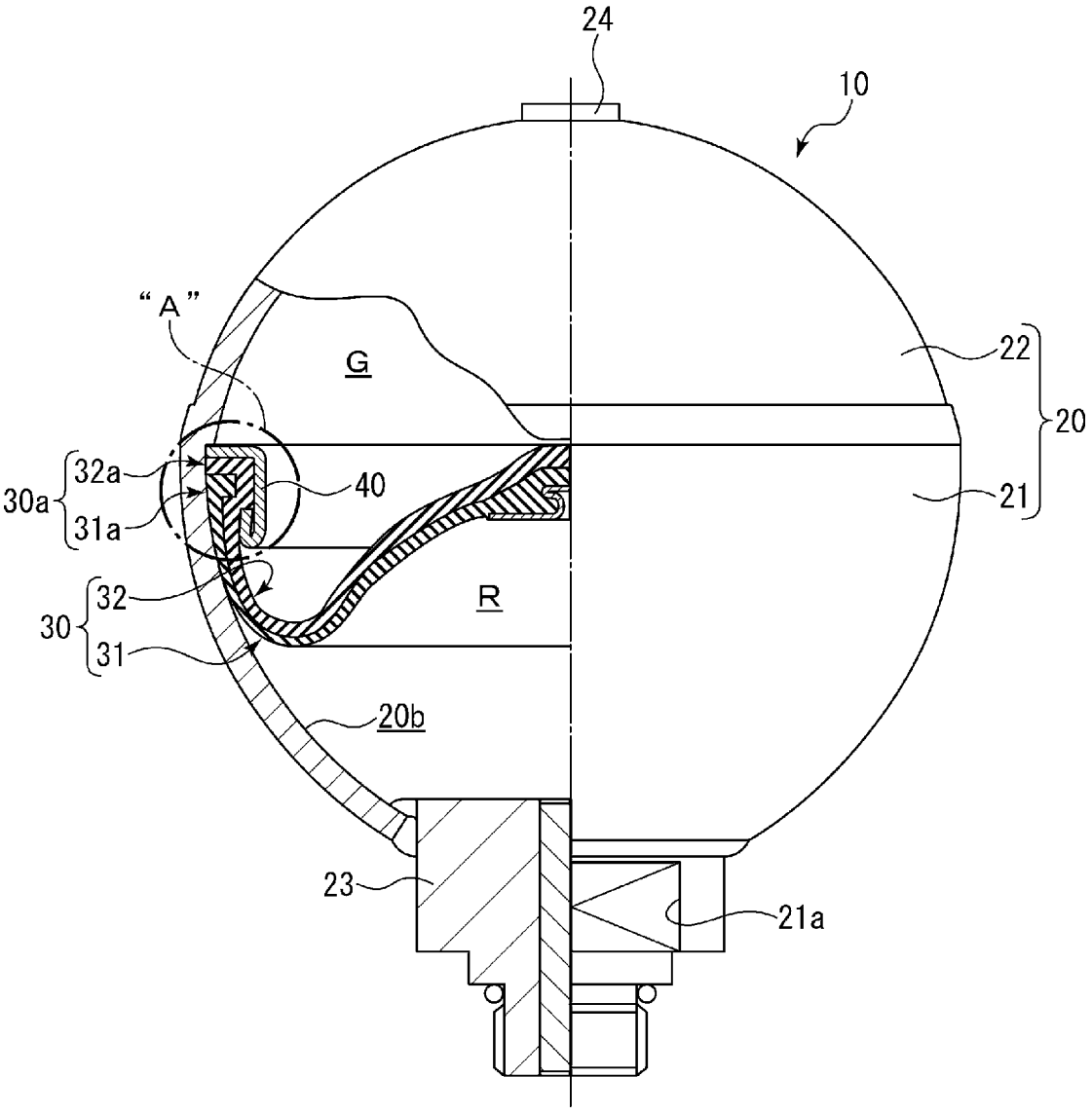
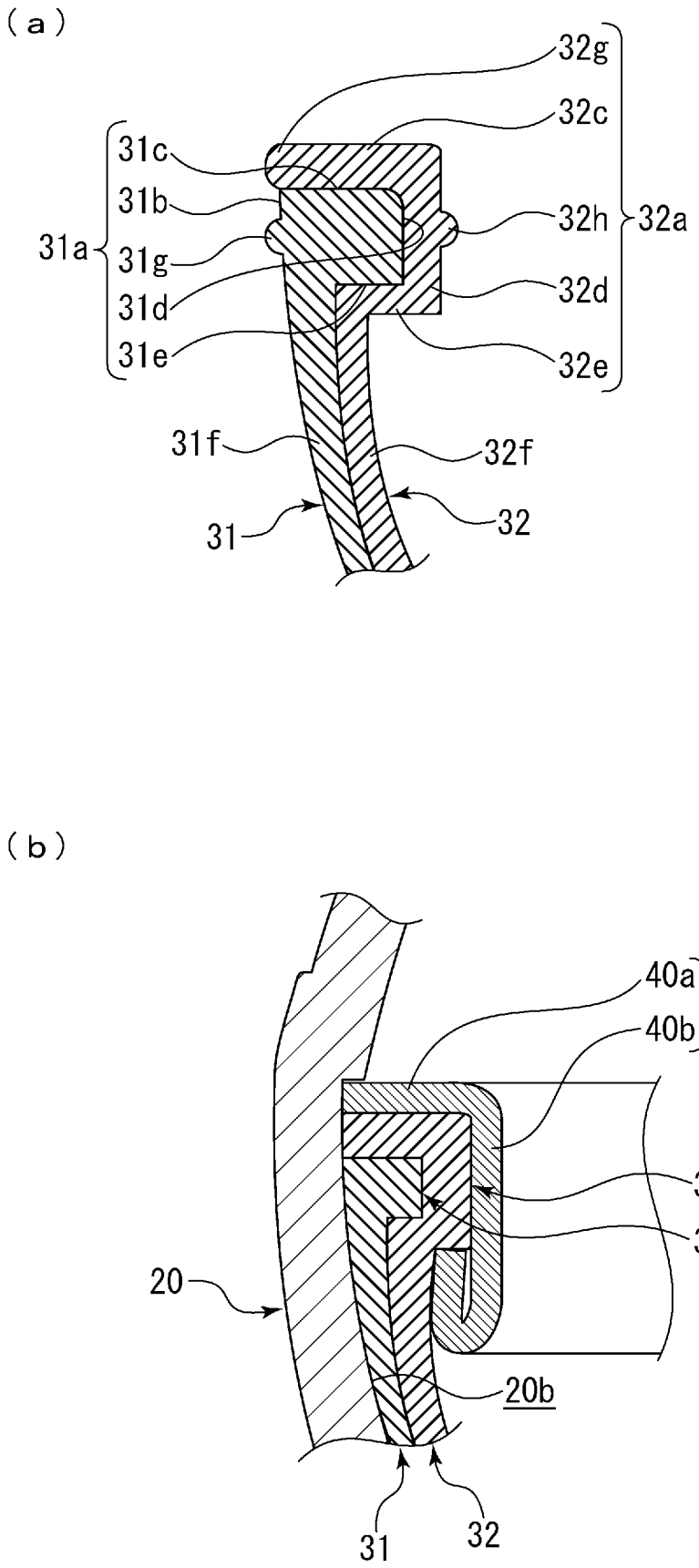


Fig.2


（a）
32g
32c
31c
31b
31a
31g
31d
31e
32h
32a
32d
32e
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（b）
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Fig.3

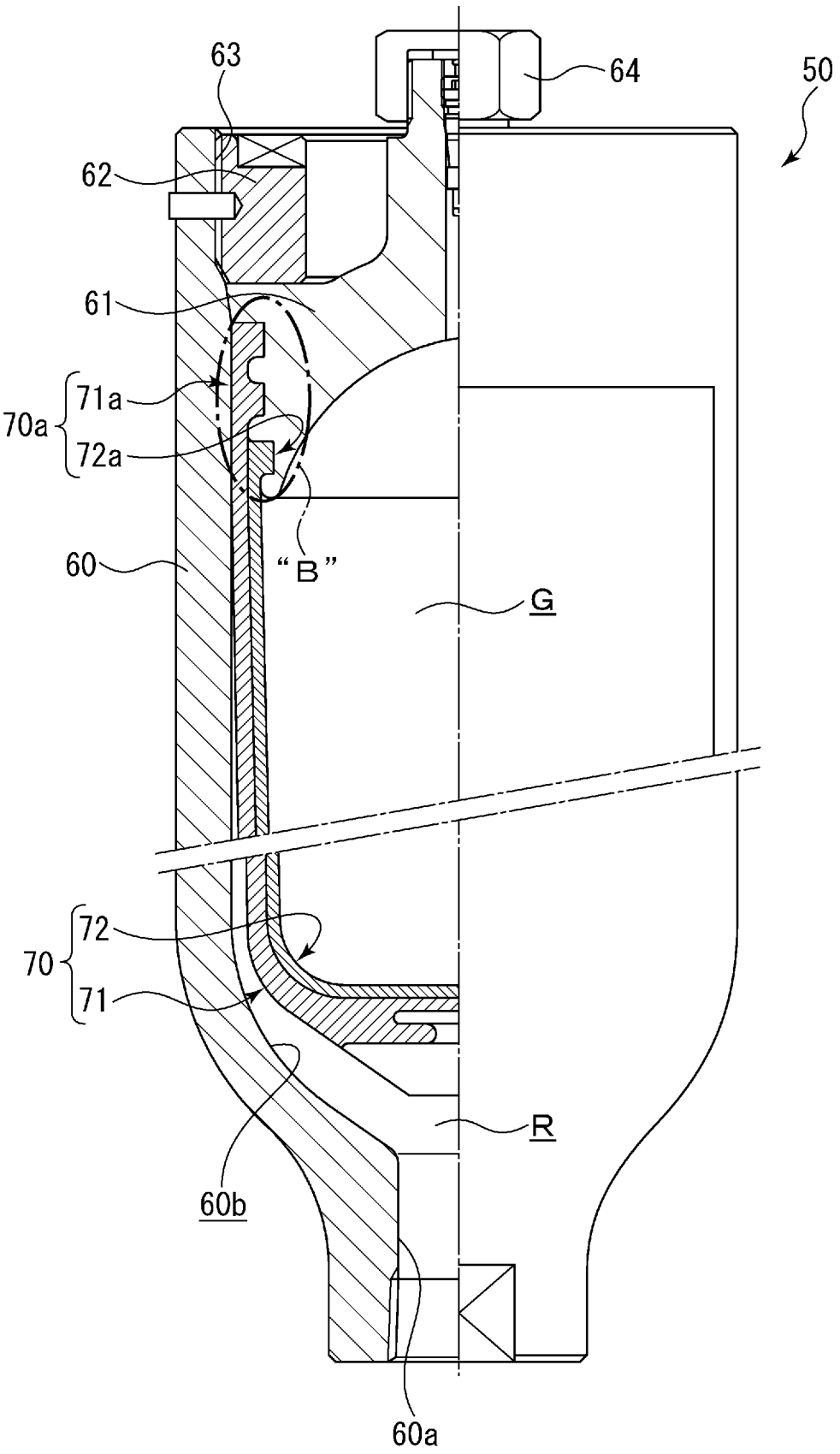
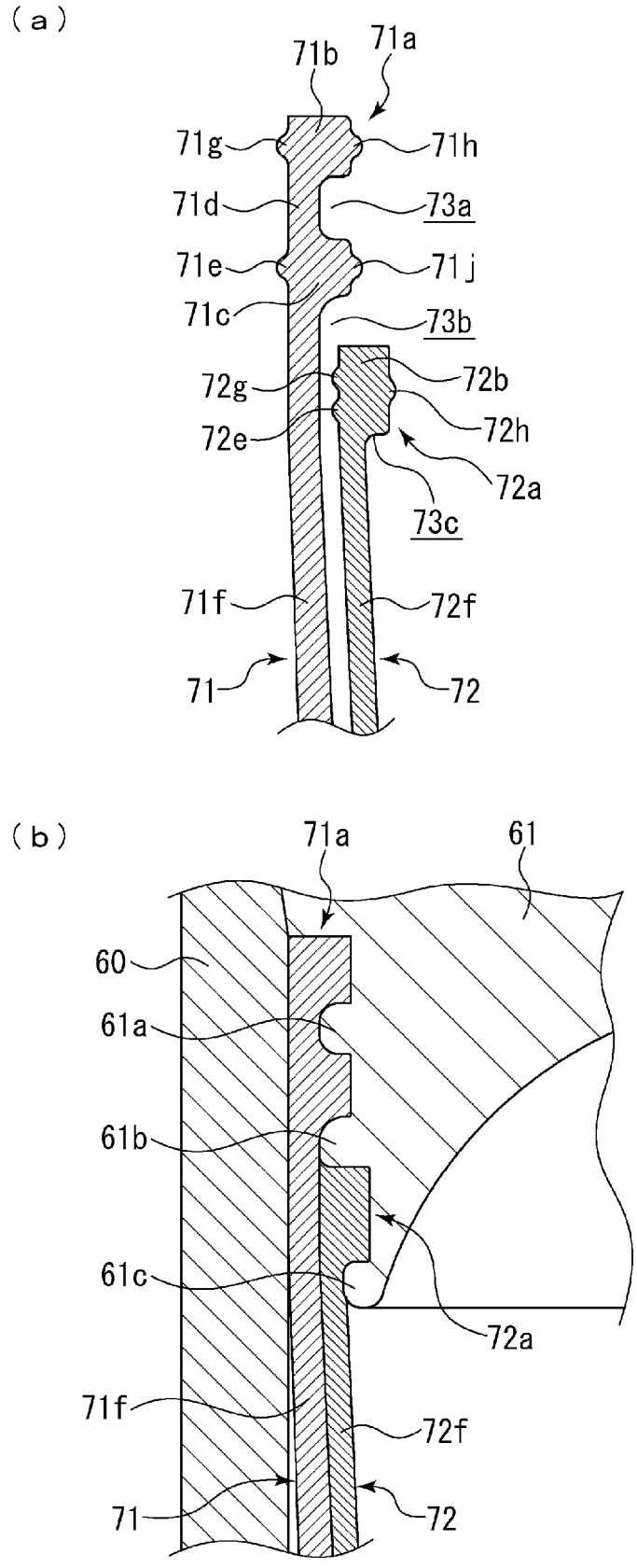


Fig.4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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2017/003819

A. CLASSIFICATION OF SUBJECT MATTER
F15B1/12(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)
F15B1/12

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 1996-2017
Kokai Jitsuyo Shinan Koho 1971-2017 Toroku Jitsuyo Shinan Koho 1994-2017

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 Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 127338/1990(Laid-open No. 84803/1992) (NOK Corp.), 23 July 1992 (23.07.1992), specification, page 11, line 4 to page 16, line 2; fig. 3 to 5 (Family: none)	1,4 2-3,5-6

☒ 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
07 March 2017 (07.03.17)	14 March 2017 (14.03.17)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2017/003819

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 032937/1972(Laid-open No. 108210/1973) (Aisin Seiki Co., Ltd.), 14 December 1973 (14.12.1973), specification, page 2, lines 4 to 16 (Family: none)	2-3,5-6
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 48443/1991(Laid-open No. 117901/1992) (NOK Corp.), 22 October 1992 (22.10.1992), paragraph [0021]; fig. 6 (Family: none)	3,5-6

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2128801 A **[0003]**