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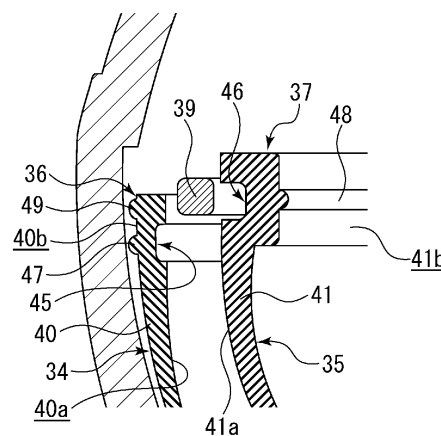
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(54) **ACCUMULATOR**

(57) Provided is an accumulator having excellent sealing performance between a shell and a bladder. An accumulator 1 is configured such that a peripheral edge portion of a bladder 3 formed of an elastic member is in close contact with the inside of a shell 2 to divide an internal space of the shell 2 into a gas chamber G and a liquid chamber R. The bladder 3 includes an outer-diameter-side bladder 4 having a peripheral edge portion 6 disposed on an inner peripheral face 2a of the shell 2, and an inner-diameter-side bladder 5 having a peripheral edge portion 7 disposed on an inner diameter side of the outer-diameter-side bladder 4. The accumulator includes a ring-shaped holder 8 configured to face the inner peripheral face 2a of the shell 2 to hold, from the inner diameter side, the peripheral edge portion 6 of the outer-diameter-side bladder 4 and the peripheral edge portion 7 of the inner-diameter-side bladder 5, and a rigid body 9 disposed between the peripheral edge portion 6 of the outer-diameter-side bladder 4 and the peripheral edge portion 7 of the inner-diameter-side bladder 5 and having a higher stiffness than those of the peripheral edge portion 6 of the outer-diameter-side bladder 4 and the peripheral edge portion 7 of the inner-diameter-side bladder 5.

Fig.5



Description

{TECHNICAL FIELD}

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

{BACKGROUND ART}

[0002] Conventionally, in a bladder type of accumulator configured such that a peripheral edge portion of a bladder 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. A single species of rubber material is used as a rubber material for the bladder. Since the bladder configured for dividing the internal space of the shell into the gas chamber and the liquid chamber is made of the single species of rubber material, different properties, i.e. liquid resistance and gas permeability both depend on the properties of the single species of rubber material. For this reason, when one of the properties is focused, the other property may not be sufficiently fulfilled.

[0003] Moreover, a dual-material rubber bladder structure simultaneously satisfying both properties required for a gas chamber and a liquid chamber by a liquid resistant rubber material placed on a liquid chamber side and a rubber material having favorable gas shielding properties and placed on a gas chamber side has been proposed, focusing on the properties required for the gas chamber and the liquid chamber (e.g., Patent Citation 1).

{CITATION LIST}

{Patent Literature}

[0004] Patent Citation 1: Microfilm (page 6, FIG. 1) of Japanese Utility Model Application 1-90028 (Japanese Laid-open Utility Model Publication 3-29701)

{SUMMARY OF INVENTION}

{Technical Problem}

[0005] In Patent Citation 1, a non-rubber layer is interposed between two bladders, and a peripheral edge portion of each bladder is disposed along an inner periphery of a shell. A ring-shaped holder having a cross section of an inverted L-shape is attached to such peripheral edge portions, thereby sealing spaces between the shell and the bladders. Moreover, the outer-diameter-side bladder is provided with a ring-shaped raised portion, and high sealing performance is obtained using compression deformation of the raised portion by the attachment of the holder.

[0006] However, in Patent Citation 1, high sealing per-

formance is obtained using the compressive deformation of the raised portion of the bladder by the attachment of the holder or a fixing member, and such sealing performance results from the compressive deformation of the raised portion. Thus, there are limitations to improvements of sealing performance of the shell.

[0007] The present invention has been made in view of the above-described problem, and is intended to provide an accumulator having excellent sealing performance between a shell and a bladder.

{Solution to Problem}

[0008] In order to solve the above-described problem, an accumulator according to the present invention comprises a shell and a bladder formed of an elastic member is disposed on the inside of the 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 face of the shell, and an inner-diameter-side bladder having a peripheral edge portion disposed on an inner diameter side of the outer-diameter-side bladder. The accumulator further comprises a holder configured to face the inner peripheral face 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, and a rigid body disposed between the peripheral edge portion of the outer-diameter-side bladder and the peripheral edge portion of the inner-diameter-side bladder and having a higher stiffness than those of the peripheral edge portion of the outer-diameter-side bladder and the peripheral edge portion of the inner-diameter-side bladder.

[0009] According to such a feature, the peripheral edge portion of the inner-diameter-side bladder and the peripheral edge portion of the outer-diameter-side bladder can ensure a tightening margin between each bladder and the rigid body at a position at which the rigid body is disposed as compared to fastening at a position at which the rigid body is not disposed, i.e., a position at which only the elastic bodies are disposed. Thus, the bladders can be more firmly fastened together, leading to excellent sealing performance. Moreover, the rigid body as a separate member is inserted between the two bladders, and therefore, a path for allowing a fluid to enter a space between the two bladders can be complicated. This can prevent fluid from flowing into the space between the inner-diameter-side bladder and the outer-diameter-side bladder.

[0010] The accumulator may be characterized in that the rigid body is in a ring shape continuously extending in a circumferential direction.

[0011] According to such a feature, the peripheral edge portion of the inner-diameter-side bladder and the peripheral edge portion of the outer-diameter-side bladder are equally compressed all over the circumference, and

therefore, high sealing performance can be ensured.

[0012] The accumulator may be characterized in that the rigid body is disposed and embedded at a position of fitting between the peripheral edge portion of the inner-diameter-side bladder and the peripheral edge portion of the outer-diameter-side bladder.

[0013] According to such a feature, the rigid body is held by fitting between the peripheral edge portion of the inner-diameter-side bladder and the peripheral edge portion of the outer-diameter-side bladder, and therefore, these components are integrated together. Thus, the peripheral edge portion of the inner-diameter-side bladder, the peripheral edge portion of the outer-diameter-side bladder, and the rigid body can be easily assembled with the shell.

[0014] The accumulator may be characterized in that the rigid body has a substantially rectangular cross section.

[0015] According to such a feature, since the rigid body has a certain width in an axial direction, a deformation margin of the peripheral edge portion of the inner-diameter-side bladder and the peripheral edge portion of the outer-diameter-side bladder can be ensured, and also a portion with a high surface pressure can be formed wide.

[0016] The accumulator may be characterized in that an annular raised portion protruding inward in the radial direction is provided at a portion of the inner-diameter-side bladder at which the rigid body is disposed, and an annular raised portion protruding outward in the radial direction is provided at a portion of the outer-diameter-side bladder at which the rigid body is disposed.

[0017] According to such a feature, the annular raised portions are provided at the position at which the rigid body is disposed. Thus, compression force in a radial direction of the annular raised portion increases, and sealing performance at such a portion is locally increased.

{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. 2 is an enlarged partial exploded view of a bladder of the first embodiment;

FIG. 3 is an enlarged partial exploded view of the bladder and a holder of the first embodiment;

FIG. 4 is an enlarged partial view of the state in which the bladder and the holder are attached to a shell in the first embodiment;

FIG. 5 is a perspective view showing a second embodiment of the accumulator according to the present invention;

FIG. 6 is an enlarged partial exploded view of a bladder of the second embodiment; and

FIG. 7 is an enlarged partial view of the state in which

the bladder and a holder are attached to a shell in the second embodiment.

{DESCRIPTION OF EMBODIMENTS}

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

10 First Embodiment

[0020] The first embodiment of the accumulator will be described with reference to FIGS. 1 to 5. A right-to-left direction as viewed in the plane of paper of FIG. 1 will be hereinafter referred to as a width direction of the accumulator, and an upper-to-lower direction as viewed in the plane of paper will be hereinafter referred to as an upper-to-lower direction of the accumulator.

[0021] A reference numeral 1 of FIG. 1 represents the accumulator to which the present invention has been applied, and a peripheral edge portion of a bladder 3 is in close contact with an inner peripheral face 2a of a substantially hollow spherical shell 2 to divide an internal space of the shell 2 into a gas chamber G and a liquid chamber R.

[0022] According to properties required for the gas chamber G and the liquid chamber R, the bladder 3 includes a first bladder 4 made of a liquid resistant rubber material and placed on the side of the liquid chamber R, and a second bladder 5 made of a rubber material having favorable gas shielding properties and placed on the side of the gas chamber G. Moreover, the shell 2 is provided in a bottom portion of with an opening 2b, and a liquid port member 25 is welded and fixed to the opening 2b. On the other hand, a gas plug 26 is detachably disposed at an upper portion of the shell 2 in opposition to the opening 2b.

[0023] As illustrated in FIGS. 1 and 2, the first bladder 4 is disposed such that a peripheral edge portion 6 thereof is positioned on an outer diameter side of a peripheral edge portion 7 of the second bladder 5 positioned on an inner diameter side. Moreover, as illustrated in FIGS. 1 and 3, a ring-shaped holder 8 is further disposed on the inner diameter side. As illustrated in FIG. 1, the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 are pressed by the ring-shaped holder 8 against the inner peripheral face 2a of the shell 2, so that the peripheral edge portions 6, 7 are attached on the inner peripheral face 2a.

[0024] Moreover, a ring 9 (a rigid member) continuously extending in a circumferential direction is disposed between the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5. The ring 9 is formed of a rigid body (e.g., a body made of metal) having a higher stiffness than those of the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5, and has a substantially rectangular cross section.

[0025] The peripheral edge portion 7 of the second bladder 5 is provided with a fitting recessed portion 15 having a substantially square U-shape in cross section. The fitting recessed portion 15 includes a bottom portion 12 extending substantially at right angles inward in the radial direction from an upper edge of a planar portion 11 facing a planar portion 10 continuously extending downward from the peripheral edge portion 6 of the first bladder 4, a side portion 13 extending upward substantially at right angles from an inner-diameter-side end portion of the bottom portion 12, and an upper portion 14 extending outward in the radial direction from an upper end of the side portion 13.

[0026] The peripheral edge portion 6 of the first bladder 4 includes a raised projection 16 extending substantially at right angles inward in the radial direction from an upper edge of the planar portion 10 along the inner peripheral face 2a of the shell 2, and the structure is made such that the raised projection 16 is fitted into the fitting recessed portion 15 of the second bladder 5.

[0027] As illustrated in FIG. 3, the above-described ring 9 is embedded to fill a clearance between the fitting recessed portion 15 of the second bladder 5 and the raised projection 16 of the first bladder 4. With a combination of these three members, the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 are brought into a fitted state, and relative movement of the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 in the upper-to-lower direction is restricted. With the fitted state between the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5, four sides of the ring 9 are brought into contact with an inner peripheral face 10a of the planar portion 10 of the first bladder 4, a lower face 16a of the raised projection 16 of the first bladder 4, an upper face 12a of the bottom portion 12 of the fitting recessed portion 15 of the second bladder 5, and an outer peripheral face 13a of the side portion 13 of the second bladder 5, respectively.

[0028] Since the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 are brought into the fitted state as described above, the ring 9 is embedded in a fitting portion such that the four sides of the ring 9 respectively are brought into contact with an inner peripheral face 10a of the planar portion 10 of the first bladder 4, the lower face 16a of the raised projection 16 of the first bladder 4, the upper face 12a of the bottom portion 12 of the fitting recessed portion 15 of the second bladder 5, and the outer peripheral face 13a of the side portion 13 of the second bladder 5. Thus, the peripheral edge portion 6 of the first bladder 4, the peripheral edge portion 7 of the second bladder 5, and the ring 9 can be easily assembled with a step 23 of the shell 2.

[0029] The peripheral edge portion 6 of the first bladder 4 is provided, on the outer peripheral face 10b of the planar portion 10 located slightly lower than an upper

edge of the peripheral edge portion 6, with a first annular protrusion 17 protruding outward in the radial direction.

[0030] Moreover, the second bladder 5 is provided with a second annular protrusion 18 substantially at the center of, in the upper-to-lower direction, an inner peripheral face 13b of the side portion 13 of the fitting recessed portion 15. A radially outer edge of the upper portion 14 of the fitting recessed portion 15 forms a third annular protrusion 19 protruding outward in the radial direction from the outer peripheral face 10b of the first bladder 4 along the inner peripheral face 2a of the shell 2 (see FIG. 3).

[0031] As illustrated in FIGS. 3 and 4, in the state in which the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 are fitted together, the ring-shaped holder 8 is attached to the inner diameter side of the second bladder. The holder 8 has the following structure: the holder 8 is formed of a rigid body made of, for example, metal, and has a side portion 20 in surface contact with the inner peripheral face 13b of the side portion 13 of the second bladder 5; a lower end of the side portion 20 is bent upward to the outer diameter side to form a lower piece 21; and an end portion 21a of the lower piece 21 is in contact with a lower face 12b of the bottom portion 12 of the second bladder 5. Thus, downward movement of the peripheral edge portion 7 of the second bladder 5 fitted onto the peripheral edge portion 6 of the first bladder 4 is restricted. Moreover, the holder 8 has an upper piece 22 extending substantially at right angles outward in the radial direction from an upper end of the side portion 20, and a lower face 22a of the upper piece 22 is in surface contact with an upper face 14a of the upper portion 14 of the second bladder 5. With this configuration, upward movement of the peripheral edge portion 7 of the second bladder 5 fitted onto the peripheral edge portion 6 of the first bladder 4 is restricted.

[0032] As illustrated in FIGS. 3 and 4, the step 23 is formed substantially at the center of, in the upper-to-lower direction, the inner peripheral face 2a of the shell 2, at which the bladder 3 is disposed. The inner peripheral face 2a has a diameter slightly smaller at an upper portion with respect to the step 23 than at a lower portion thereof. An outer-diameter-side end portion 22b of the upper piece 22 of the holder 8 has a greater outer diameter than that of the upper portion of the inner peripheral face of the shell with respect to the step 23. Thus, an upper face 22c of the upper piece 22 contacts a lower face 23a of the step 23, thereby restricting upward movement of the holder 8.

[0033] The outer diameter of the outer-diameter-side end portion of the upper piece 22 of the holder 8 is substantially the same as the inner diameter of the lower portion of the shell 2 with respect to the step 23. According to such a configuration, the shell 2 is in a substantially hollow spherical shape, and therefore, the diameter of the lower portion of the inner peripheral face 2a with respect to the step 23 gradually decreases in a downward

direction. Thus, downward movement of the holder 8 is substantially restricted, the holder 8 being configured such that the outer-diameter-side end portion of the upper piece 22 of the holder 8 has substantially the same diameter as the inner diameter of the lower portion with respect to the step 23.

[0034] The outer peripheral face 10b of the planar portion 10 of the peripheral edge portion 6 of the first bladder 4 is, in a pressure-free state, formed to have a slightly smaller diameter than that of the inner peripheral face 2a of the shell 2, and an outer peripheral face 20a of the side portion 20 of the holder 8 is formed to have a slightly smaller diameter than that of the inner peripheral face 13b of the side portion 13 of the second bladder in the pressure-free state. Thus, in the state in which the holder 8 is attached, the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 are compressed by the inner peripheral face 2a of the shell 2 and the outer peripheral face 20a of the side portion 20 of the holder 8. Consequently, the shell 2, the first bladder 4, the second bladder 5, and the holder 8 are integrally held by repulsion of the first bladder 4 and the second bladder 5 as elastic bodies.

[0035] As illustrated in FIG. 4, the ring 9 is disposed between the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 and between the inner peripheral face 2a of the shell 2 and the outer peripheral face 20a of the side portion 20 of the holder 8. Thus, the total thickness of the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 at the position at which the ring 9 is disposed (i.e., the total of the thickness T2 of the planar portion 10 of the peripheral edge portion 6 of the first bladder 4 and the thickness T3 of the side portion 13 of the peripheral edge portion 7 of the second bladder 5) is smaller than the distance between the inner peripheral face 2a of the shell 2 and the outer peripheral face 20a of the side portion 20 of the holder 8 (i.e., the total horizontal thickness T1 of the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 in the fitted state between the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 at a position at which the ring 9 is not disposed).

[0036] The accumulator 1 has such a structure that the accumulator 1 receives pressure from the side of the liquid chamber R and the side of the gas chamber G to operate the bladder 3 up and down. Thus, high holding force is required to hold the bladder 3 against such operation. For this reason, the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 are thickly formed for the structure in which the lower piece 21 of the holder 8 is locked at the lower face 12b of the bottom portion 12 of the second bladder 5.

[0037] With this structure, a tightening margin can be, according to the above-described configuration, ensured

for the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 at the position at which the ring 9 is disposed. Thus, a surface pressure increases, which is generated between the outer peripheral face 10b (a high-sealing region) of the planar portion 10 of the first bladder 4 and the inner peripheral face 2a of the shell 2. In addition, a surface pressure increases, which is generated between the inner peripheral face 13b of the side portion 13 of the second bladder 5 and the outer peripheral face 20a of the holder 8. Thus, even sealing performance of the thick peripheral edge portion 6 of the first bladder 4 and the thick peripheral edge portion 7 of the second bladder 5 can be enhanced, and no liquid flows from the side of the liquid chamber R to the side of the gas chamber G.

[0038] Moreover, the axial thickness of the ring 9 is formed smaller than that of the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 at a position pressed by the outer peripheral face 20a of the side portion 20 of the holder 8. Thus, the thickness of the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 at the position at which the ring 9 is disposed is smaller than the total radial thickness of the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 at the position at which the ring 9 is not disposed. At such a portion, a compression ratio becomes greater. Thus, the surface pressure locally increases, which is generated between the outer peripheral face 10b (the high-sealing region) of the planar portion 10 of the first bladder 4 and the inner peripheral face 2a of the shell 2 at the above-described portion. This leads to extremely-high sealing performance.

[0039] As illustrated in FIG. 3, the first annular protrusion 17 is formed on the outer peripheral face 10b of the planar portion 10 of the first bladder 4 such that a portion of the first annular protrusion 17 overlaps with the position at which the ring 9 is disposed in the horizontal direction. A surface pressure generated between the first annular protrusion 17 and the inner peripheral face 2a of the shell 2 further locally increases, and therefore, liquid leakage from a space between the first annular protrusion 17 and the inner peripheral face 2a of the shell 2 toward the second bladder 5 is prevented.

[0040] Moreover, the surface pressure increases, which is generated between the inner peripheral face 13b (a high-sealing region) of the side portion 13 of the peripheral edge portion 7 of the second bladder 5 and the outer peripheral face 20a of the side portion 20 of the holder 8 at the position at which the ring 9 is disposed. This leads to high sealing performance, and prevents gas from flowing from the side of the gas chamber G to the side of the liquid chamber R.

[0041] Further, the second annular protrusion 18 is formed on the inner peripheral face 13b of the side portion 13 of the second bladder 5 such that a portion of the second annular protrusion 18 overlaps with the position

at which the ring 9 is disposed in the horizontal direction. A surface pressure generated between the second annular protrusion 18 and the outer peripheral face 20a of the side portion 20 of the holder 8 further locally increases, and therefore, gas leakage from a space between the second annular protrusion 18 and the outer peripheral face 20a of the side portion 20 of the holder 8 toward the first bladder 4 is prevented.

[0042] Moreover, the third annular protrusion 19 is formed on the radially outer edge of the upper portion 14 of the fitting recessed portion 15 of the second bladder 5. This particularly prevents gas with small fluid particles from leaking from a space between the third annular protrusion 19 and the inner peripheral face 2a of the shell 2 toward the first bladder 4.

[0043] Further, the ring 9 is in an endless shape continuously extending in the circumferential direction, and therefore, the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 are equally compressed all over the circumference. Thus, high sealing performance can be ensured. Note that the ring 9 may be formed in a substantially C-shape with ends, and in this manner, the structure may be made such that the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 can be easily attached to the step 23.

[0044] In addition, the cross section of the ring 9 is in the substantially rectangular shape, and therefore, the high-sealing region corresponding to about the axial width of the ring 9 is formed on the fitting portion between the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5. Thus, a sufficient deformation margin can be provided for the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 at the position at which the ring 9 is disposed. Further, the high-sealing region can be formed wide in the axial direction of the ring 9, and therefore, high sealing performance can be ensured.

[0045] Moreover, the total horizontal thickness T1 of the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 in the fitted state is greater than a distance T4 from an outer peripheral face of the lower piece 21 formed on the lower end of the side portion 20 of the holder 8 to the inner peripheral face of the shell. This suppresses the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 in the fitted state from detaching from a space between the outer peripheral face 20a of the side portion 20 of the holder 8 and the inner peripheral face 2a of the shell 2.

[0046] Further, the ring 9 is embedded in the fitting portion between the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5. Thus, in addition to a high coefficient of friction of the portions respectively in contact with the inner peripheral face 2a of the shell 2 and the outer peripheral face 20a of the side portion 20 of the holder 8, the lower

piece 21 of the side portion 20 of the holder 8 is positioned such that a portion of the lower piece 21 below the ring 9 overlaps with the ring 9 in a view from upper or lower side. This suppresses the peripheral edge portion 6 of the first bladder 4 and the peripheral edge portion 7 of the second bladder 5 in the fitted state from detaching from the space between the outer peripheral face 20a of the side portion 20 of the holder 8 and the inner peripheral face 2a of the shell 2.

[0047] In addition, the four sides of the ring 9 are brought into contact with the inner peripheral face 10a of the planar portion 10 of the first bladder 4, the lower face 16a of the raised projection 16 of the first bladder 4, the upper face 12a of the bottom portion 12 of the fitting recessed portion 15 of the second bladder 5, and the outer peripheral face 13a of the side portion 13 of the second bladder 5, respectively. Thus, a surface pressure increases, which is generated between the ring 9 and each face in contact with the ring 9. This prevents gas and liquid from entering a space between the first bladder 4 and the second bladder 5.

Second Embodiment

[0048] Next, an accumulator of a second embodiment will be described with reference to FIGS. 5 to 7. Note that the same overlapping configuration as that of the above-described embodiment will not be described.

[0049] As illustrated in FIGS. 5 and 6, a first bladder 34 and a second bladder 35 are configured such that opposing faces 40a, 41a of planar portions 40, 41 thereof are in surface contact with each other along peripheral edge portions 36, 37. These opposing faces 40a, 41a are provided, respectively, with recessed portions 45, 46 recessed toward outer and inner diameter sides. A ring 39 is fitted into a cavity portion formed by a combination of the recessed portions 45, 46 and having a substantially rectangular cross section, and is embedded in the peripheral edge portion 36 of the first bladder 34 and the peripheral edge portion 37 of the second bladder 35.

[0050] With this structure, the ring 39 is fitted into any of the recessed portion 45 of the peripheral edge portion 36 of the first bladder 34 and the recessed portion 46 of the peripheral edge portion 37 of the second bladder 35 in joining between the peripheral edge portion 36 of the first bladder 34 and the peripheral edge portion 37 of the second bladder 35, and in this manner, can be temporarily held. As a result, the joining process is facilitated.

[0051] As illustrated in FIG. 7, the total of the thickness T12 of the planar portion 40 of the peripheral edge portion 36 of the first bladder 34 at a position at which the ring 39 is disposed and the thickness T13 of the planar portion 41 of the second bladder 35 at the position at which the ring 39 is disposed is smaller than the distance T11 between the inner peripheral face 2a of the shell 2 and the outer peripheral face 20a of the side portion 20 of the holder 8.

[0052] Moreover, a first annular protrusion 47 is formed

on an outer peripheral face 40b of the planar portion 40 of the first bladder 34 to partially overlap with the position at which the ring 39 is disposed, in a view from right or left side. Similarly, a second annular protrusion 48 is formed on an inner peripheral face 41b of the planar portion 41 of the second bladder 35 to partially overlap with the position at which the ring 39 is disposed, in a view from right or left side. Further, a third annular raised portion 49 is formed above the first annular protrusion 47 of the outer peripheral face 40b of the planar portion 40 of the first bladder 34.

[0053] Note that the ring 39 is not limited to such a configuration that the ring 39 is fitted into the recessed portion 45 of the peripheral edge portion 36 of the first bladder 34 and the recessed portion 46 of the peripheral edge portion 37 of the second bladder 35, respectively. For example, it may be configured such that the recessed portion is provided only at any of the peripheral edge portion 36 of the first bladder 34 and the peripheral edge portion 37 of the second bladder 35 and the ring 39 is fitted into such a recessed portion.

[0054] 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.

[0055] For example, the ring of each embodiment described above is configured such that the single annular ring is embedded between the peripheral edge portion of the first bladder and the peripheral edge portion of the second bladder. However, the present invention is not limited to such a configuration. For example, it may be configured such that a plurality of rings are embedded with these rings being dispersedly arranged in the circumferential direction of the peripheral edge portions of the first and second bladders. Moreover, the cross-sectional shape of the ring is not limited to the substantially rectangular shape, and may be, for example, a substantially circular shape, a polygonal shape with five or more sides, or a similar shape.

[0056] Moreover, the configuration of the ring has been described, in which the ring is, before the ring is embedded, received in the clearance formed on the fitting portion between the peripheral edge portion of the first bladder and the peripheral edge portion of the second bladder and having the substantially same inner shape as the outer shape of the ring. However, the ring may be formed with an outer shape larger than that of a clearance. Moreover, the present invention is not limited to these configurations. For example, it may be configured such that the clearance is not substantially present and that the peripheral edge portions of the first and second bladders for embedding the ring are, at the fitting portion therebetween, in surface contact with each other without any clearances. In this configuration, the ring may be embedded in the deformation margin of such a fitting portion.

[0057] Further, the first annular raised portion, the sec-

ond annular raised portion, and the third annular raised portion in the embodiments described above are not limited to the endless shape, and may be each divided into multiple portions. Further, either one of the second annular raised portion or the third annular raised portion is not necessarily provided when sufficient sealing performance can be ensured.

[0058] In addition, the shape of the shell 2 is not limited to the substantially spherical shape, and may be, e.g., a cylindrical shape.

{REFERENCE SIGNS LIST}

[0059]

1	Accumulator
2	Shell
2a	Inner peripheral face
3	Bladder
4	First bladder
5	Second bladder
6	Peripheral edge portion of first bladder
7	Peripheral edge portion of second bladder
8	Holder
9	Ring
10	First bladder planar portion
10a	First bladder planar portion inner peripheral face
10b	First bladder planar portion outer peripheral face
11	Second bladder planar portion
12	Fitting recessed portion bottom portion
12a	Bottom portion upper face
12b	Bottom portion lower face
13	Fitting recessed portion side portion
13a	Bottom portion outer peripheral face
13b	Bottom portion inner peripheral face
14	Upper portion
15	Fitting recessed portion
16	Fitting recessed portion raised projection
17	First annular protrusion
18	Second annular protrusion
19	Third annular protrusion
20	Holder side portion
20a	Side portion outer peripheral face
21	Holder lower piece
22	Holder upper piece
23	Step
23a	Step lower face
34	First bladder
35	Second bladder
36	First bladder peripheral edge portion
37	Second bladder peripheral edge portion
39	Ring
45, 46	Recessed portion
47	First annular protrusion
48	Second annular protrusion
G	Gas chamber

R Liquid chamber

the radial direction is provided at a portion of the outer-diameter-side bladder at which the rigid body is disposed.

Claims

1. An accumulator comprising a shell and a bladder formed of an elastic member and disposed on the inside of a 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 face of the shell; and
 - an inner-diameter-side bladder having a peripheral edge portion disposed on an inner diameter side of the outer-diameter-side bladder, wherein the accumulator further comprises:
 - a holder configured to face the inner peripheral face 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; and
 - a rigid body disposed between the peripheral edge portion of the outer-diameter-side bladder and the peripheral edge portion of the inner-diameter-side bladder and having a higher stiffness than those of the peripheral edge portion of the outer-diameter-side bladder and the peripheral edge portion of the inner-diameter-side bladder.
2. The accumulator of claim 1, **characterized in that:** the rigid body is in a ring shape continuously extending in a circumferential direction.
3. The accumulator of claim 1 or 2, **characterized in that:** the rigid body is disposed and embedded at a position of fitting between the peripheral edge portion of the inner-diameter-side bladder and the peripheral edge portion of the outer-diameter-side bladder.
4. The accumulator of any of claims 1 to 3, **characterized in that:** the rigid body has a substantially rectangular cross section.
5. The accumulator of any one of claims 1 to 4, **characterized in that:**
 - an annular raised portion protruding inward in the radial direction is provided at a portion of the inner-diameter-side bladder at which the rigid body is disposed, and
 - an annular raised portion protruding outward in

Fig.1

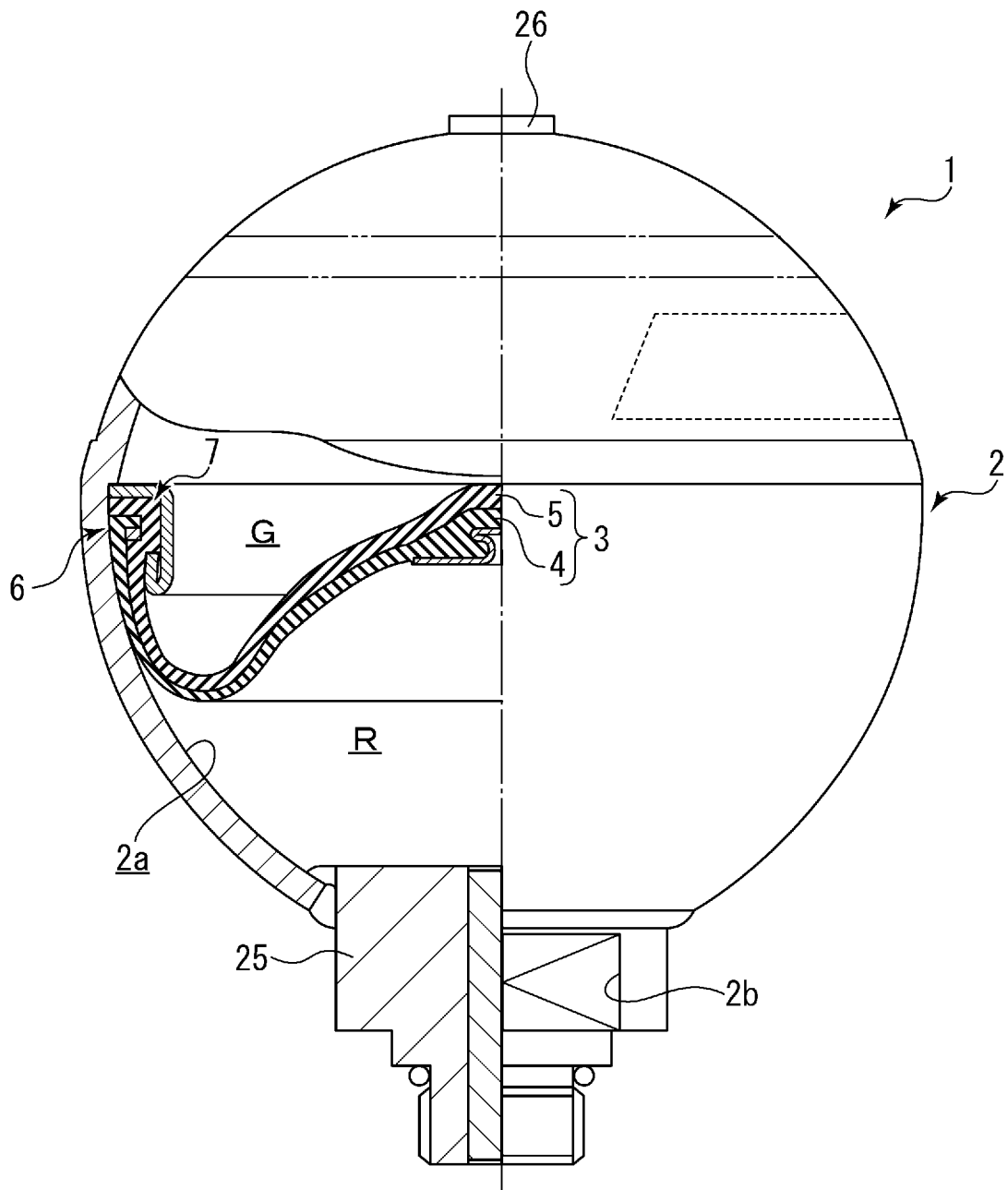


Fig.2

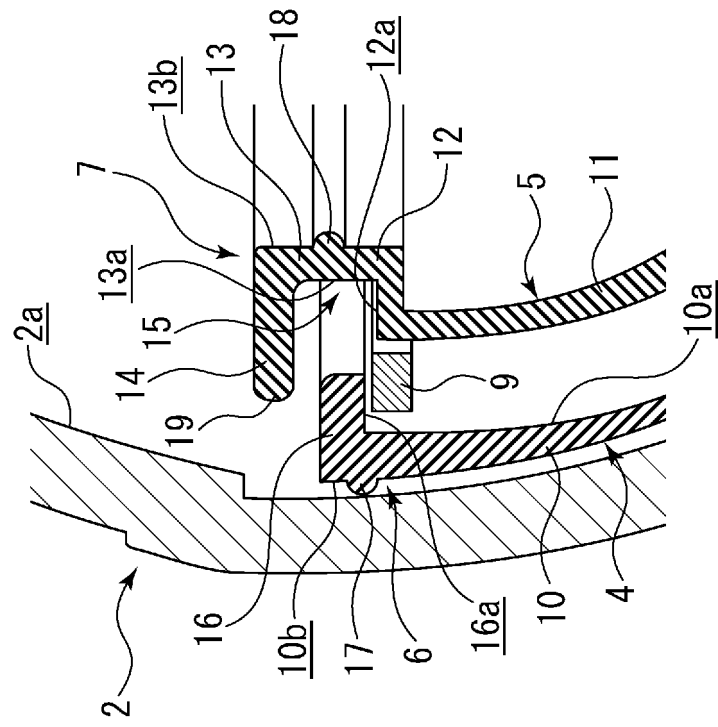
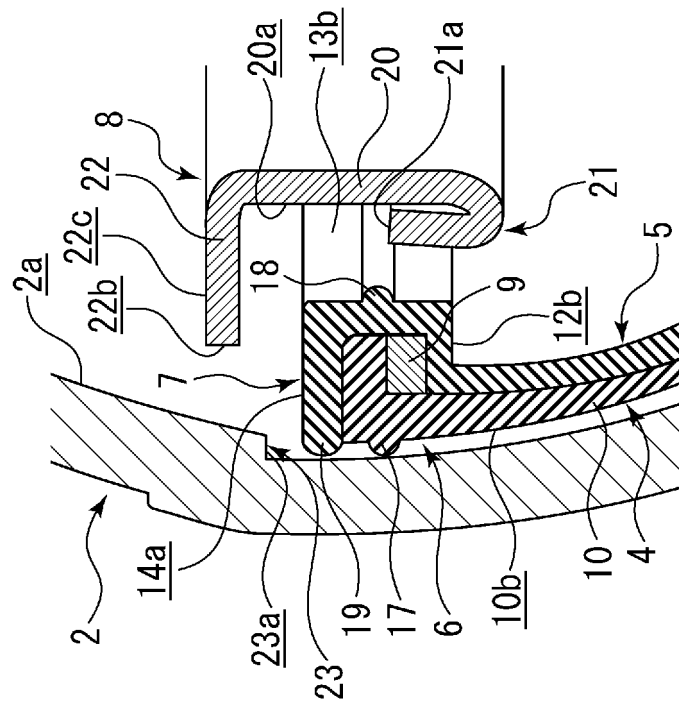


Fig.3



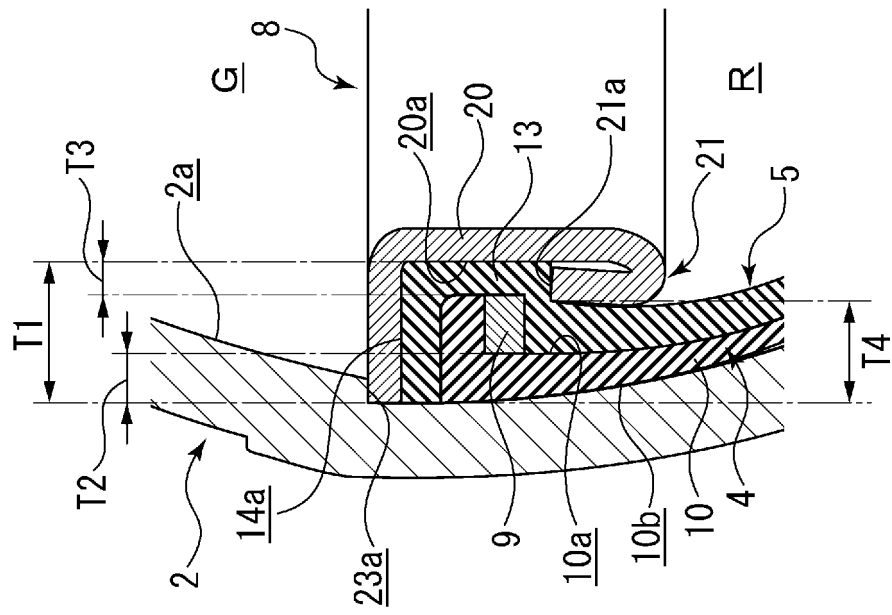


Fig.4

Fig.5

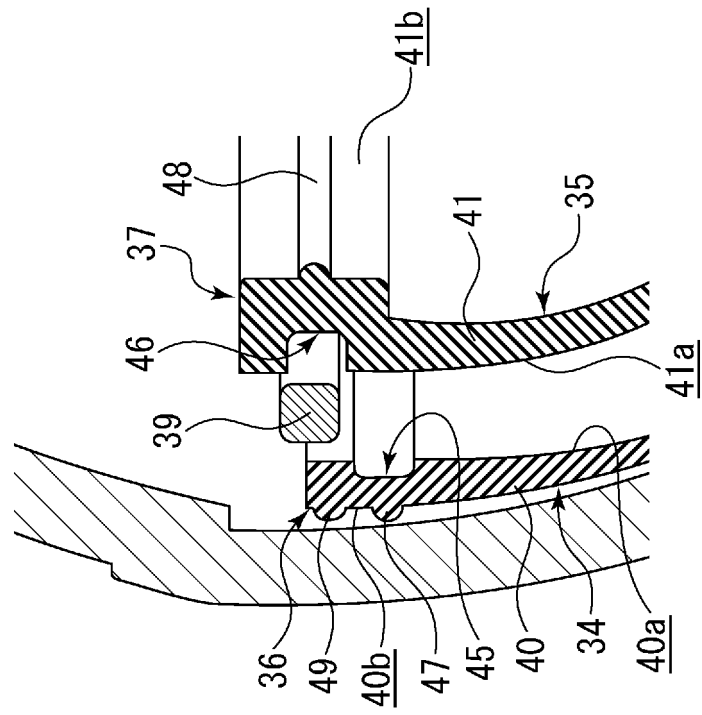
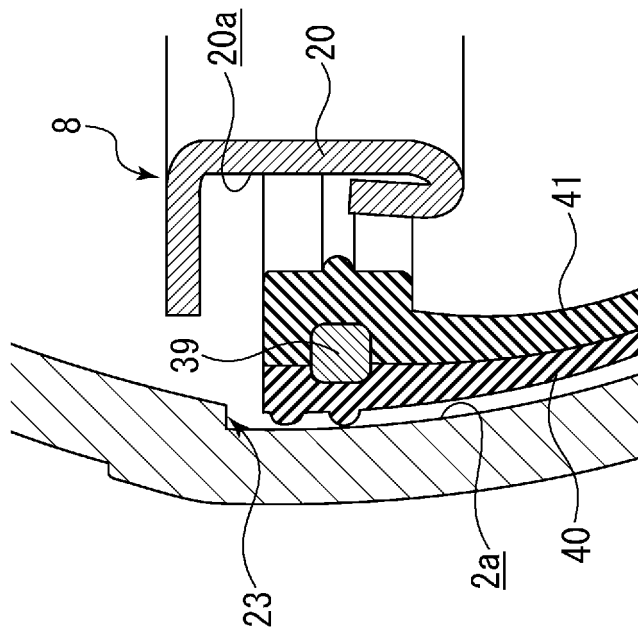


Fig.6



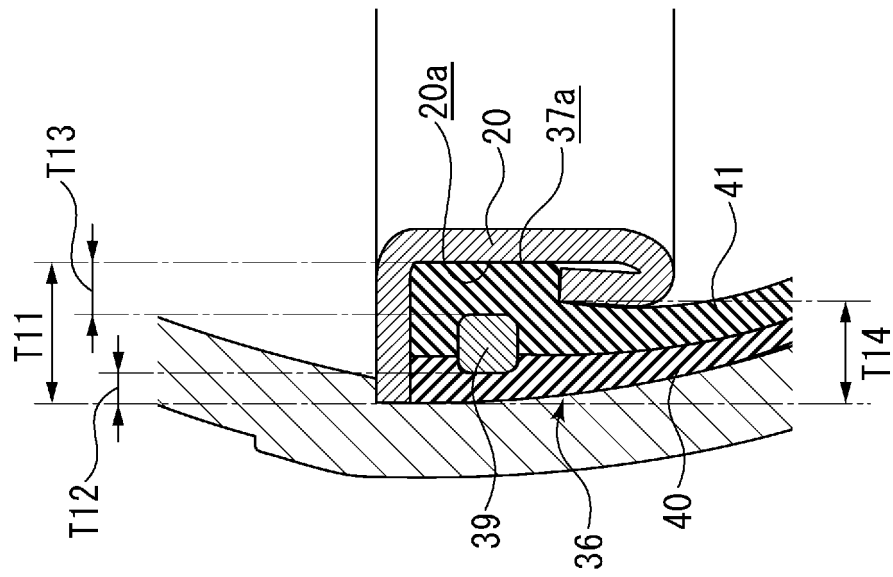


Fig.7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/003824

A. CLASSIFICATION OF SUBJECT MATTER

F15B1/14(2006.01)i, F15B1/10(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)

F15B1/14, F15B1/10

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 A	US 4777982 A (ROBERT BOSCH GMBH), 18 October 1988 (18.10.1988), column 2, line 41 to column 3, line 23; fig. 1 & DE 3628608 A1 & FR 2603075 A1	1-2, 4 3, 5
A	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), fig. 4 (Family: none)	5

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

* Special categories of cited documents:

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search
03 March 2017 (03.03.17)Date of mailing of the international search report
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.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 1090028 A [0004]
- JP 3029701 A [0004]