US 20130014639A1

(19) **United States**

(12) **Patent Application Publication**

Takeshita et al.

(10) **Pub. No.: US 2013/0014639 A1**

(43) **Pub. Date: Jan. 17, 2013**

(54) **DIAPHRAGM**

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(21) Appl. No.: **13/637,877**

(22) PCT Filed: **Mar. 24, 2011**

(86) PCT No.: **PCT/JP2011/057082**

§ 371 (c)(1), (2), (4) Date: **Sep. 27, 2012**

(30) **Foreign Application Priority Data**

Mar. 29, 2010 (JP) 2010-074546

Publication Classification

(51) **Int. Cl.**
F01B 19/02 (2006.01)

(52) **U.S. Cl.** **92/96**

(57) **ABSTRACT**

Disclosed is a diaphragm having a flexible film portion and an outer peripheral flange portion integrally provided on the peripheral edge of the film portion, said outer peripheral flange portion being provided between and held by a first housing and a second housing, wherein the film portion is prevented from rising upward when the diaphragm is attached to the housings. The outer peripheral flange portion has a first pressed surface which is one surface of the diaphragm in the thickness direction and which is in close contact with the first housing, and a three-dimensional shape composed of a projected portion or a recessed portion, on the first pressed surface. When the outer peripheral flange portion is attached to the first housing and the second housing while being compressed and deformed therebetween, the three-dimensional shape defines voids in the thickness direction between the outer peripheral flange portion and the first housing.

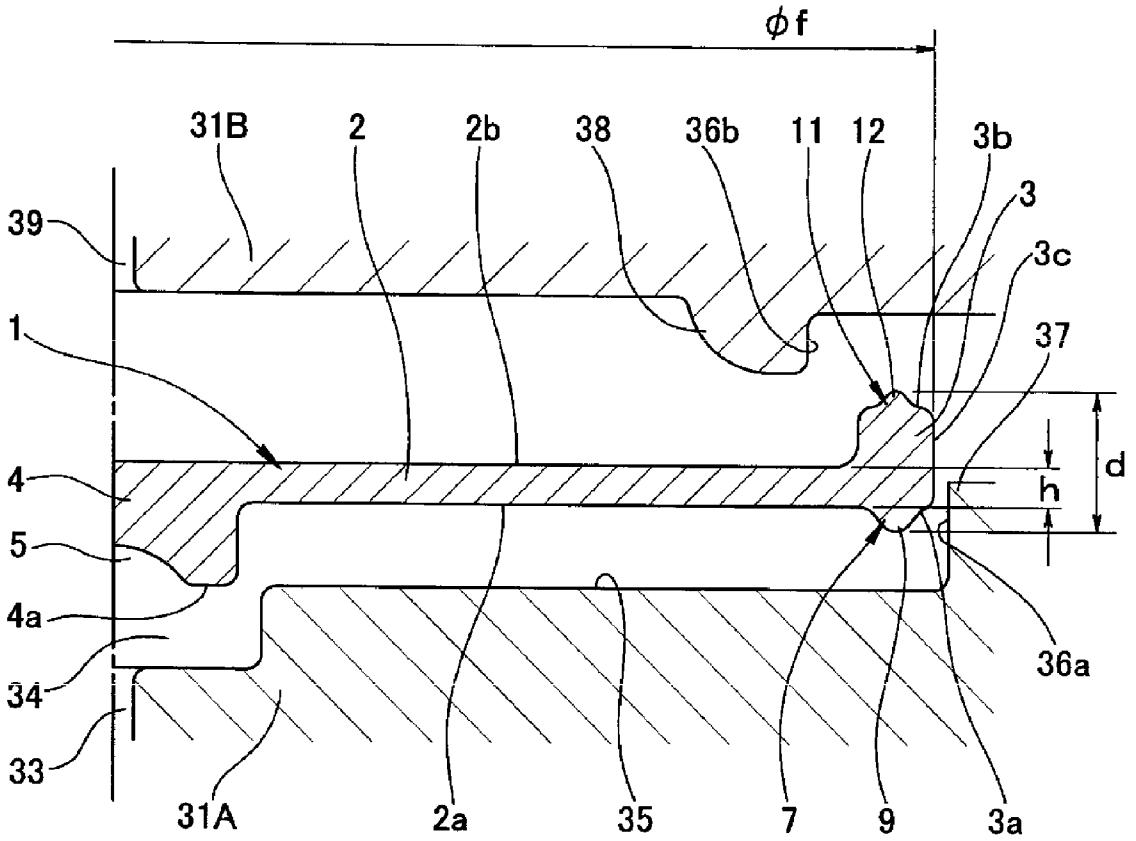


FIG. 1A

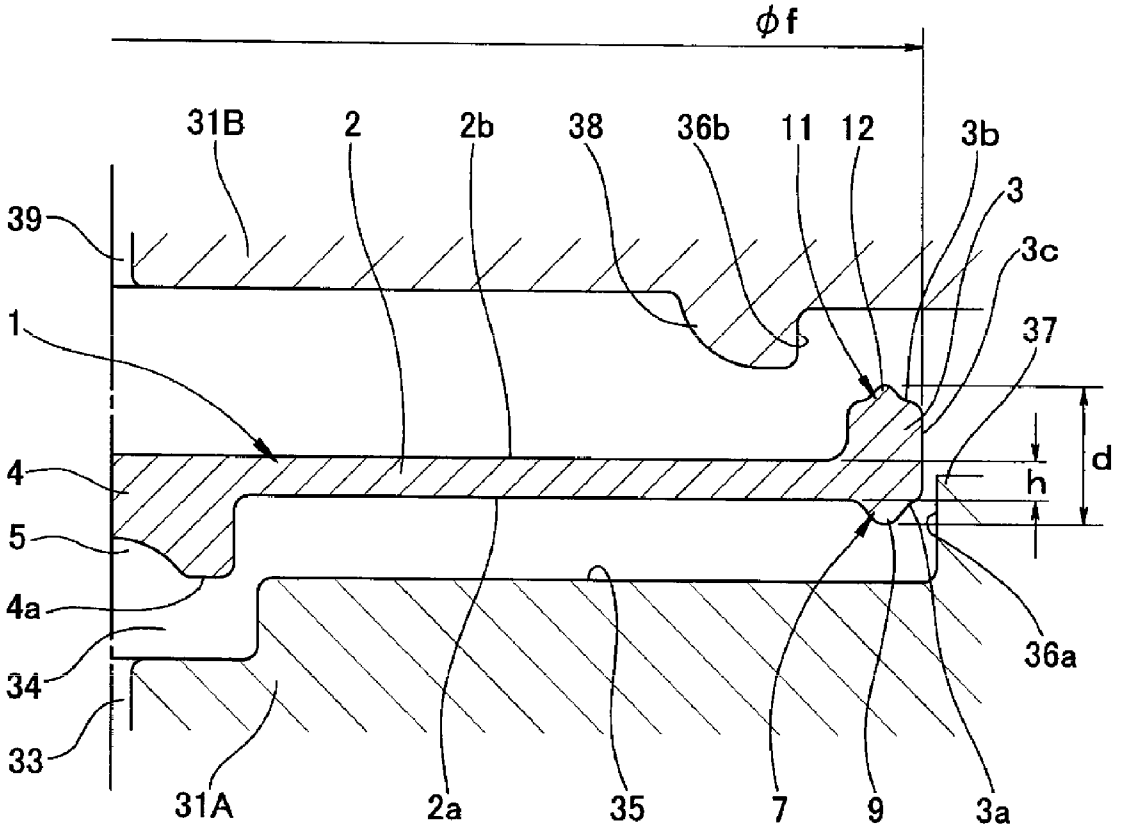

φf
31B
2
2b
38
36b
11
12
3b
3
3c
37
39
1
4
5
4a
34
33
31A
2a
35
7
9
3a
36a
d
h

FIG. 1B

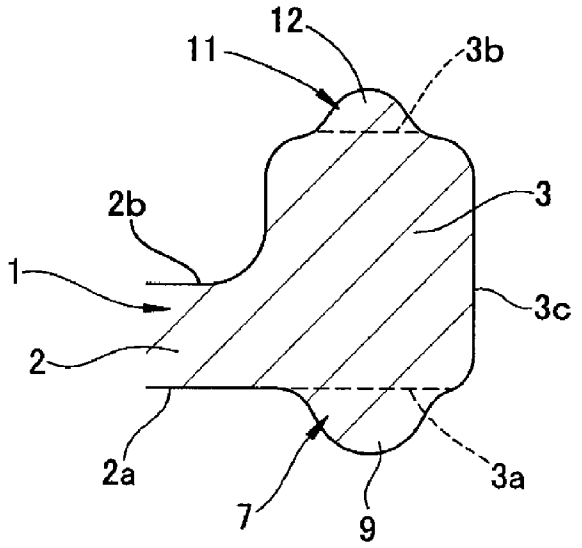
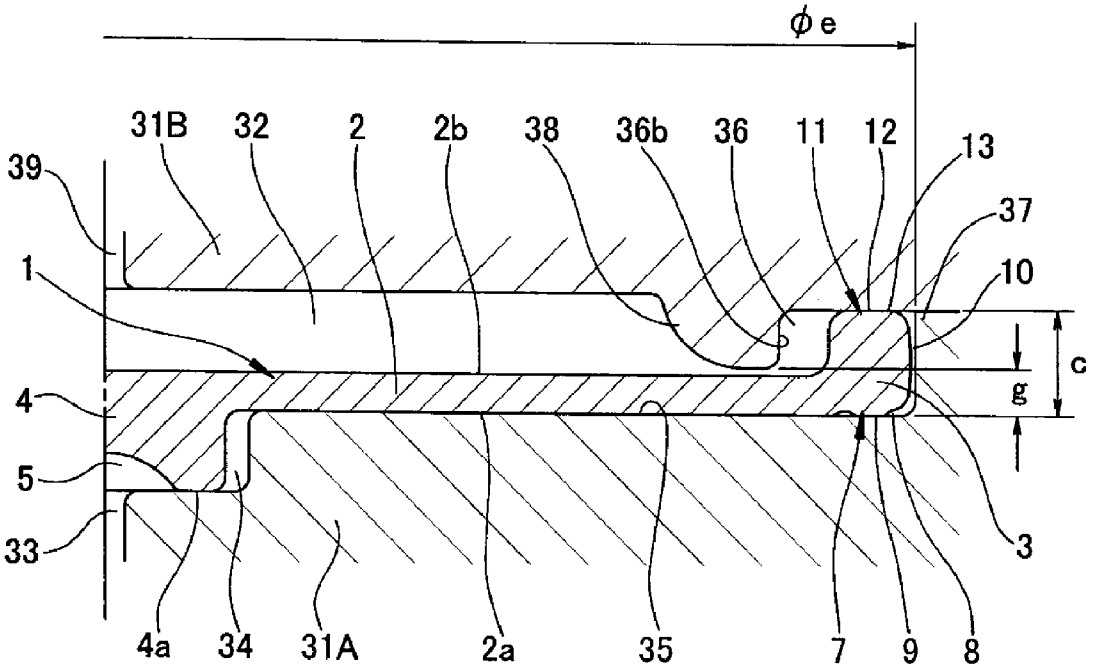

12
11
3b
2b
3
1
3c
2
2a
7
9
3a

FIG. 2A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31B
32
2
2b
38
36b
36
11
12
13
37
10
39
1
4
5
33
c
g
3
4a
34
31A
2a
35
7
9
8

FIG. 2B

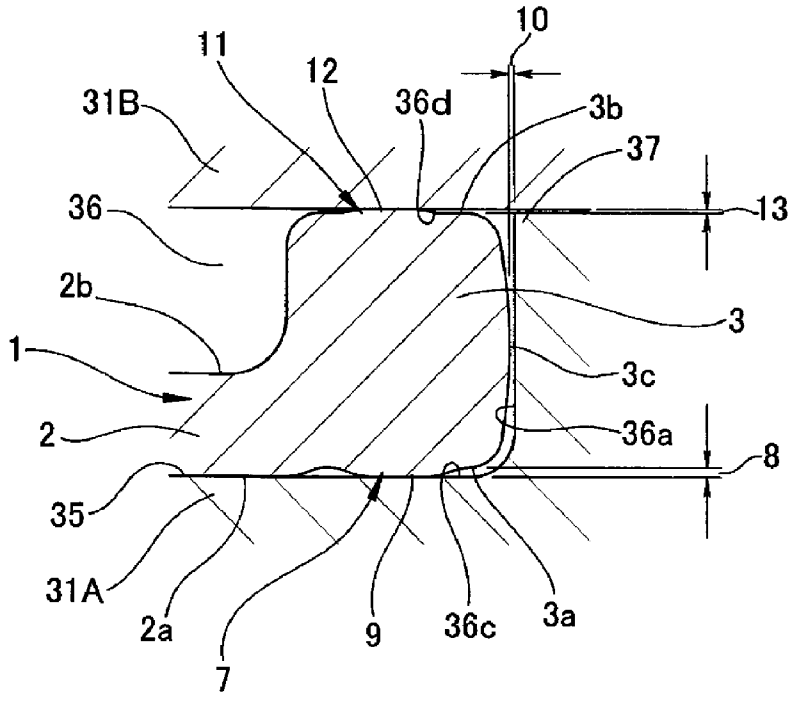

10
11
12
31B
36d
3b
37
36
13
2b
3
1
3c
2
36a
8
35
31A
2a
9
36c
3a
7

FIG. 3A

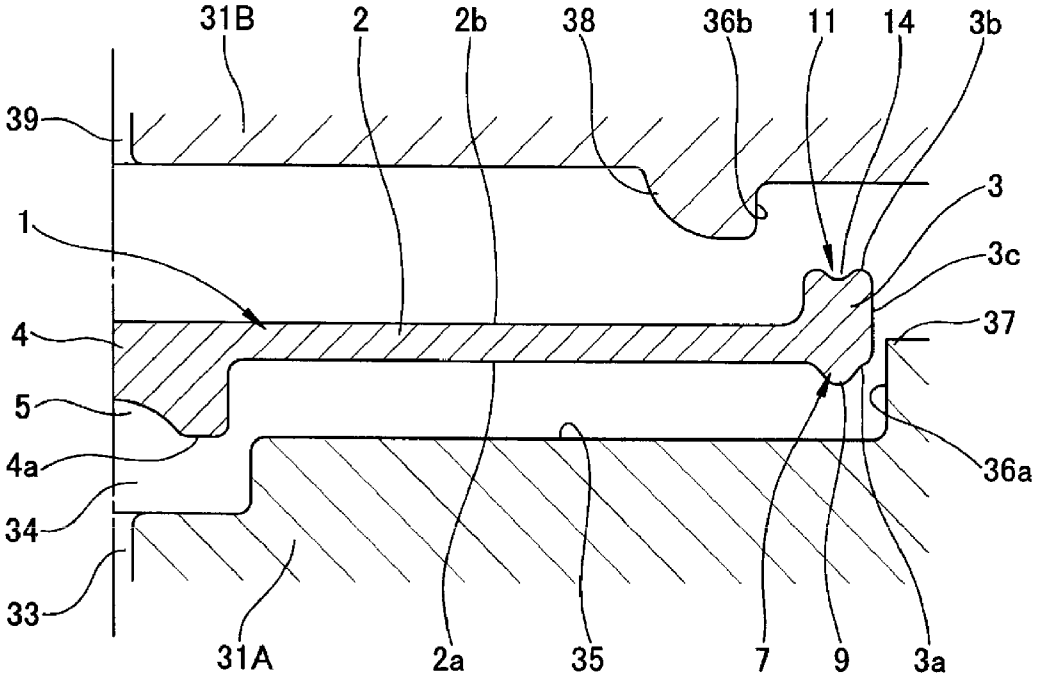

31B
2
2b
38
36b
11
14
3b
39
3
1
3c
4
37
5
4a
36a
34
33
31A
2a
35
7
9
3a

FIG. 3B

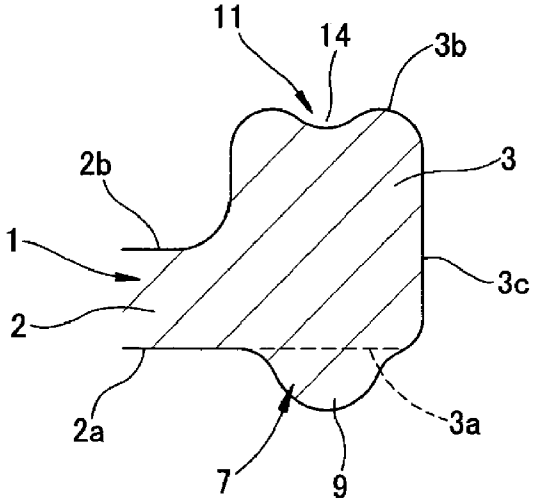

11
14
3b
2b
3
1
3c
2
2a
3a
7
9

FIG. 4A

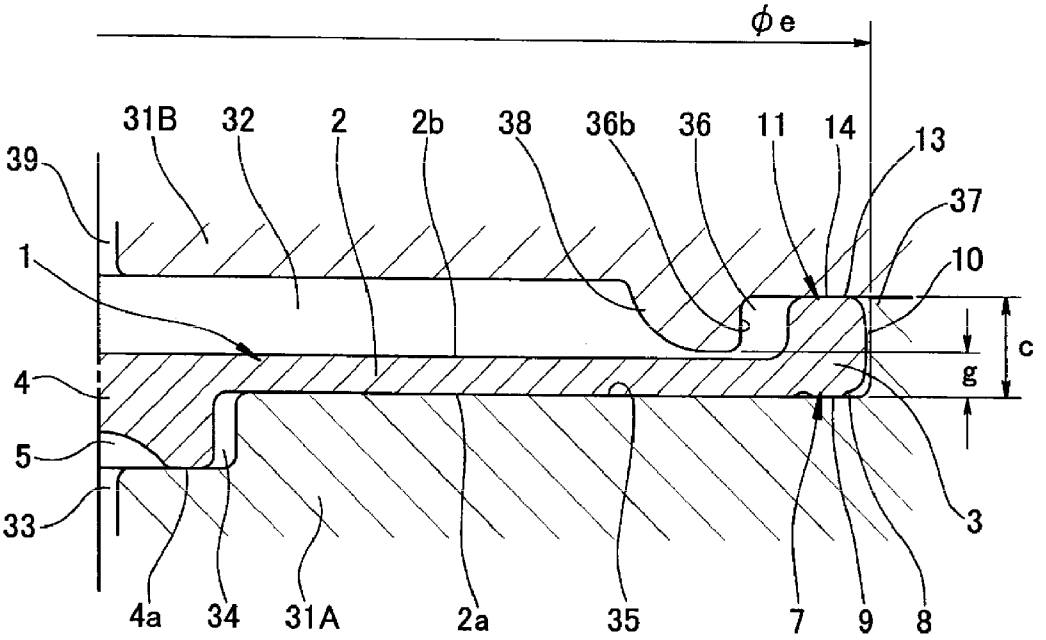

ϕe
31B
32
2
2b
38
36b
36
11
14
13
37
10
39
1
4
5
33
c
g
3
4a
34
31A
2a
35
7
9
8

FIG. 4B

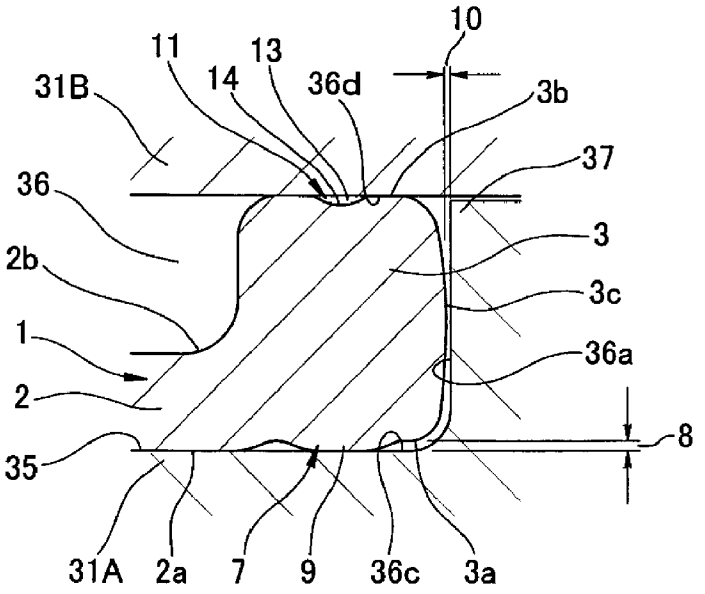

10
11
13
14
36d
31B
3b
37
36
3
2b
3c
1
36a
2
8
35
31A
2a
7
9
36c
3a

FIG. 5

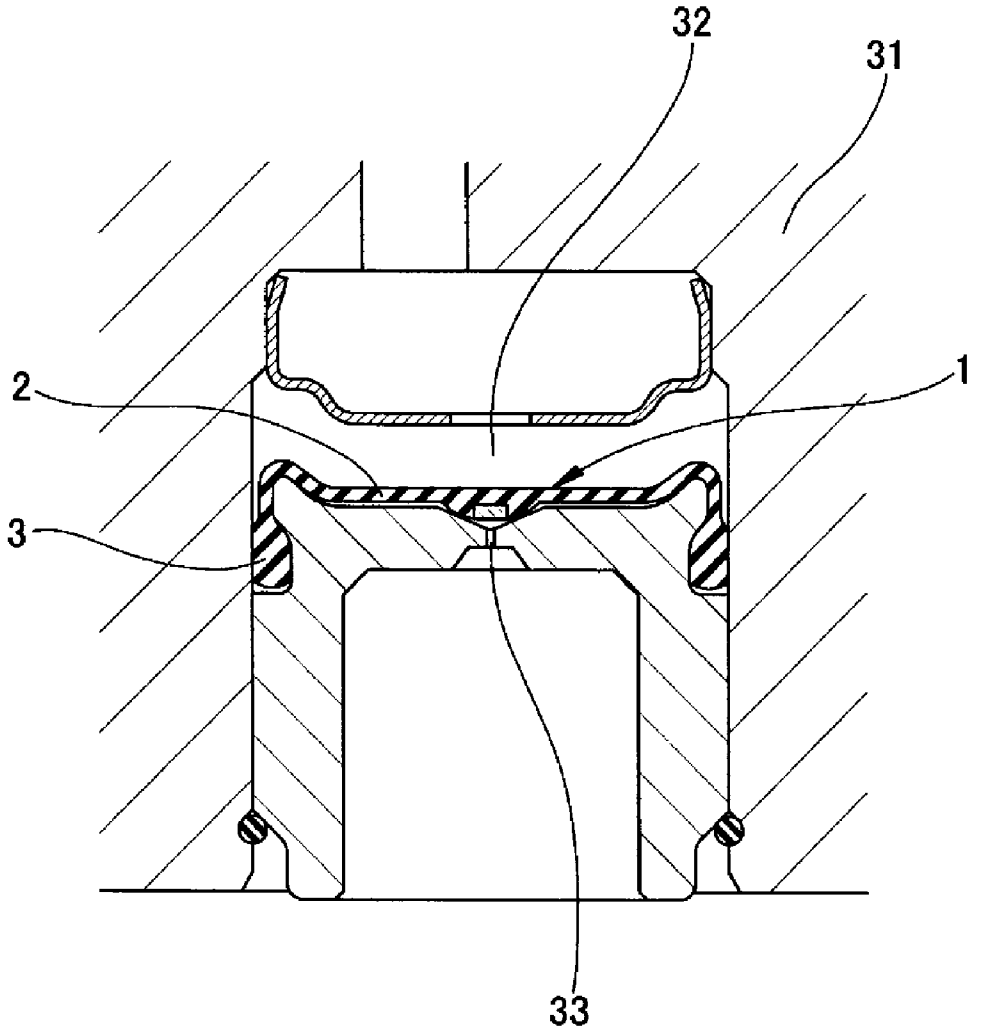


FIG. 6A

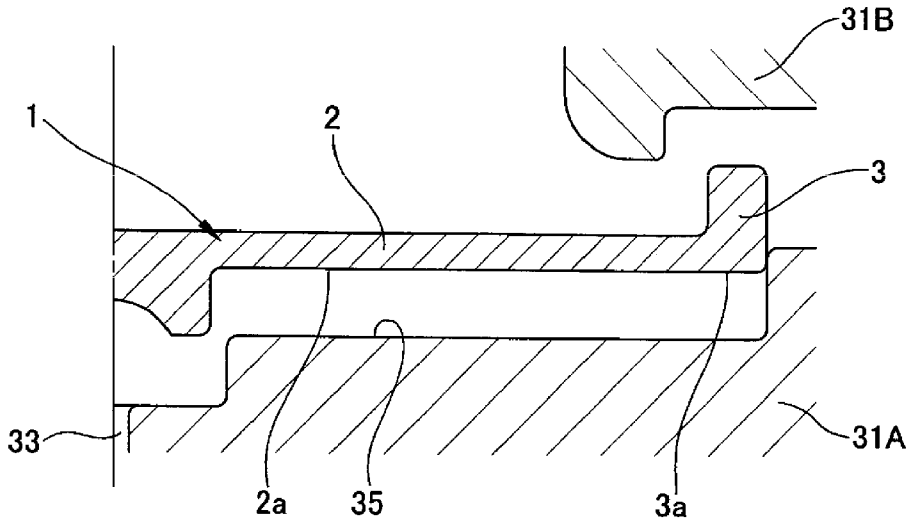


FIG. 6B

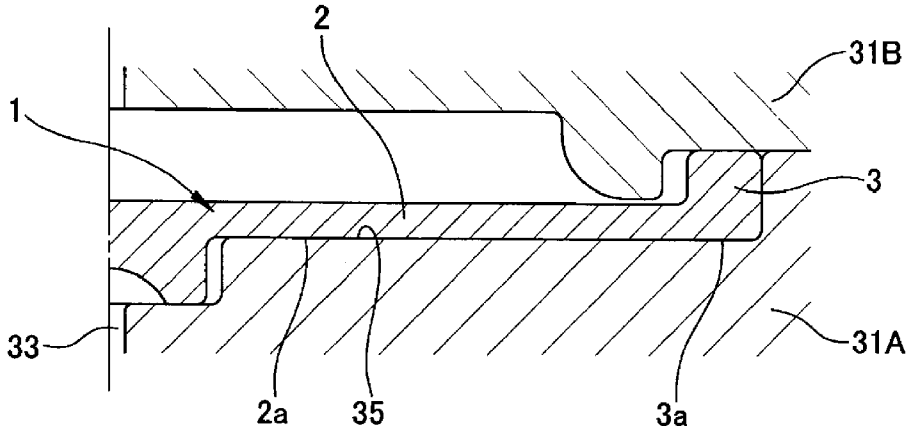
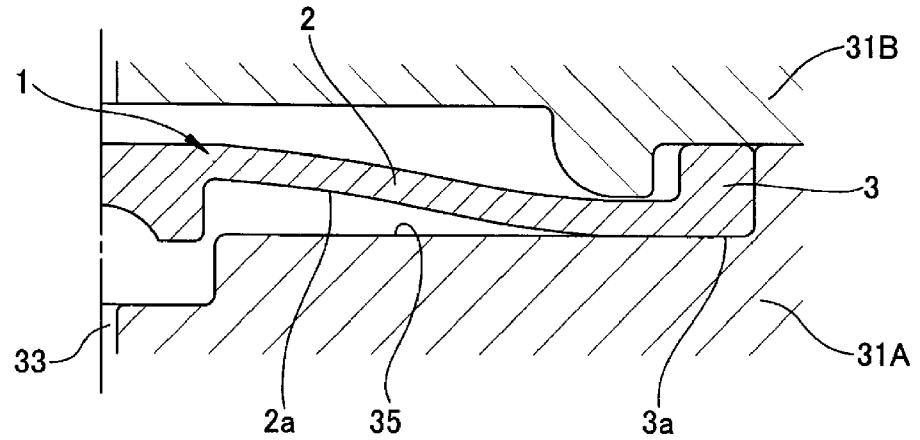


FIG. 6C



DIAPHRAGM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a U.S. National Stage Application of International Application No. PCT/JP2011/057082, filed on Mar. 24, 2011 and published in Japanese as WO 2011/122424-A1 on Oct. 6, 2011. This application claims the benefit of Japanese Application No. 2010-074546, filed on Mar. 29, 2010. The entire disclosures of the above applications are incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a diaphragm, and more particularly, the diaphragm suitably used for an accumulator of a fluid pressure control apparatus for a vehicle, or the like.

[0004] 2. Description of the Conventional Art

[0005] From conventional, as illustrated in FIG. **5**, a diaphragm **1** made of a rubber-like elastic body, and including a flexible film portion **2** and an outer peripheral flange portion **3** integrally provided on the peripheral edge of the film portion **2**, has been known. The diaphragm **1** is used in, for example, the accumulator of the fluid pressure control apparatus for a vehicle, or the like, and is attached to a pressure room **32** in a housing **31**. The film portion **2** is flexibly deformed by operation of pressure, and changes a volume of the pressure room **32** and open/close a vent hole **33**.

[0006] In the above outlines of the diaphragm, recently, as illustrated in FIG. **6**(A), a diaphragm having a type, in which one surface **2***a* in the thickness direction of the film portion **2** and one end surface **3***a* in the thickness direction of the outer peripheral flange portion **3** are arranged on the same plane, has been developed. As illustrated in FIG. **6**(B), the diaphragm **1** is attached by which the outer peripheral flange portion **3** is sandwiched between a pair of an upper housing **31**A and a lower housing **31**B. At this time, the film portion **2** becomes, as an initial moving attitude, a state in which one surface **2***a* of the film portion **2** is in contact with a plane portion **35** of the housing **31**A in the lower side in FIG. **6**(B), where the vent hole **33** is provided.

[0007] However, in the diaphragm **1** illustrated in FIGS. **6**(A) and **6**(B), the diaphragm **1** is largely pressed and deformed when the outer peripheral flange portion **3** is inserted between the pair of the housings **31**A and **31**B. Thus, as illustrated in FIG. **6**(C), by receiving the effect of the deformation, one surface **2***a* of the film portion **2** may be separated and risen upward from the plane portion **35** of the lower side housing **31**. In such a case, it is necessary to prevent the rising upward of the film portion **2** and ensure an accurate initial moving attitude.

SUMMARY OF THE INVENTION

Problems to be Solved by the Invention

[0008] In view of the above problems, the present invention is directed to provide a diaphragm enabling to prevent generation of the rising upward phenomenon of the film portion when the diaphragm is attached to the housing.

Means for Solving the Problems

[0009] For obtaining the above object, the first aspect of the diaphragm in the present invention is that the diaphragm includes a flexible film portion and an outer peripheral flange portion integrally provided on a peripheral edge of the film portion. The outer peripheral flange portion is provided between and held by a pair of a first housing and a second housing. The outer peripheral flange portion includes a first pressed surface and a three-dimensional shape composed of a projected portion and a recessed portion. The first pressed portion is one surface of the diaphragm in the thickness direction and is in close contact with the first housing. When the outer peripheral flange portion is attached to the first housing and the second housing while being compressed and deformed therebetween, the three-dimensional shape defines voids in the thickness direction between the outer peripheral flange portion and the first housing.

[0010] The diaphragm according to the present invention includes the flexible film portion and the outer peripheral flange portion integrally provided on the peripheral edge of the film portion. When the outer peripheral flange portion is provided between and held by a pair of the first housing and the second housing, for example, the diaphragm is used in an accumulator of the fluid pressure control apparatus for a vehicle, or the like, the state in which the film portion is seated in the first housing is set to be an initial moving attitude. When a pressure difference between the space between the first housing and the diaphragm and the space between the diaphragm and the second housing is generated, the diaphragm operates so as to separate the film portion from the first housing. According to the first aspect, only making the first pressed surface to have the three dimensional shape, voids in the thickness direction can be defined between the outer peripheral flange portion and the first housing. The voids in the thickness direction absorbs the deformation by compression from the first housing and the second housing of the outer peripheral flange portion, so that the rising upward of the film portion from the first housing generated by the effect of the deformation can be prevented, when the diaphragm is attached between the first housing and the second housing, i.e., in the initial moving attitude where the pressure difference is not generated.

[0011] Further, the second aspect of the diaphragm in the present invention is that, in the diaphragm according to the first aspect, the three-dimension shape is an annular projection provided on a center portion in the diameter direction of the first pressed surface. When the outer peripheral flange portion is attached to the first housing and the second housing while being compressed and deformed therebetween, the voids in the thickness direction is defined on the more outer side in the diameter direction than the annular projection on the first pressed surface.

[0012] According to the second aspect, the voids in the thickness direction is defined on the more outer side in the diameter direction than the annular projection on the first pressed surface, so that a space of the voids in the thickness direction can be sufficiently secured by the annular projection. Thus, the deformation by the compression from the first housing and the second housing of the outer peripheral flange portion can be easily absorbed.

[0013] Further, the third aspect of the diaphragm in the present invention is that, in the diaphragm according to the first aspect or second aspect, when the outer peripheral flange portion is attached between the first housing and the second

housing, the outer peripheral flange portion is set to have the outer diameter size which can define the voids in the diameter direction between the outer peripheral surface of the outer peripheral flange portion and at least one of the first housing or the second housing, in the diameter direction of the diaphragm.

[0014] According to the third aspect, the absorption of the deformation by the compression from the first housing and the second housing becomes more easily by the voids in the diameter direction.

[0015] Further, the fourth aspect of the diaphragm in the present invention is that, in any one of the diaphragm according to the first aspect or third aspect, the outer peripheral flange portion includes a second pressed surface, which is another surface in the thickness direction of the diaphragm and pressed by the second housing, and a three-dimensional shape composed of a projected portion or a recessed portion on the second pressed surface.

[0016] According to the fourth aspect, by only making the second pressed surface to have the three-dimensional shape, the voids in the thickness direction can be easily defined between the outer peripheral flange portion and the second housing. Thus, the deformation by the compression from the first housing and the second housing can be more easily absorbed by the voids in the thickness direction.

[0017] Furthermore, the fifth aspect of a supporting structure of the diaphragm in the present invention is the diaphragm supporting structure which holds the diaphragm by the first housing and the second housing, and includes any one of diaphragm according to the first aspect or fourth aspect as the diaphragm.

[0018] According to the fifth aspect, in the diaphragm supporting structure, the rising upward of the film portion from the first housing can be prevented by any one of the diaphragm according to the first aspect or fourth aspect.

Effect of the Invention

[0019] The present invention has following effects.

[0020] That is, as described above, in the present invention, the voids in the thickness direction and the voids in the diameter direction are set around the outer peripheral flange portion and refuges of the rubber-like elastic body are secured at the time of deformation of the flange, so that the deformation of the flange portion can be absorbed in the refuges to prevent the influence of the deformation to reach the film portion in the inner peripheral side. Therefore, the phenomenon of the rising upward of the film portion can be prevented and the accurate initial moving attitude can be secured.

BRIEF EXPLANATION OF DRAWINGS

[0021] FIG. **1** is a view illustrating a diaphragm according to an example of the present invention. (A) is a half cross-sectional view in the state before being attached and (B) is an enlarged view of the essential part of (A).

[0022] FIG. **2** is a view illustrating the same diaphragm in FIG. **1**. (A) is a half cross-sectional view in the state being attached and (B) is an enlarged view of the essential part of (A).

[0023] FIG. **3** is a view illustrating a diaphragm according to another example of the present invention. (A) is a half cross-sectional view in the state before being attached and (B) is an enlarged view of the essential part of (A).

[0024] FIG. **4** is a view illustrating the same diaphragm in FIG. **3**. (A) is a half cross-sectional view in the state being attached and (B) is an enlarged view of the essential part of (A).

[0025] FIG. **5** is a cross-sectional view illustrating the attached state of a diaphragm according to a conventional example.

[0026] FIG. **6** is the diaphragm according to the comparative example. (A) is a half cross-sectional view in the state before being attached, (B) is an enlarged view of the essential part of (A), and (C) is a half cross-sectional view in the defect generation state.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0027] Then, the examples of the present invention will be described, referring to figures.

[0028] As illustrated in FIG. **1** and FIG. **2**, a diaphragm **1** according to the present example is formed in a disk-like shape by a predetermined rubber-like elastic body. The diaphragm integrally includes a flexible film portion **2** and an annular outer peripheral flange portion (outer peripheral attaching portion) **3** provided at a peripheral edge of the film portion **2**. Further, the diaphragm **1** according to the present examples is used for an accumulator of a fluid pressure control apparatus for vehicles which performs ABS control, ESC control, or the like. In the diaphragm **1**, the outer peripheral flange portion **3** is sandwiched by a pair of upper and lower housings **31**A and **31**B to be attached to a pressure room **32** (refer to FIG. **2**) in the housings **31**A and **31**B. A vent hole **33** is provided in the lower side housing **31**A in FIG. **1** and, at the upper side housing **31**B, fore example, a communication hole **39**, which communicates with a flow path of an operation fluid of the fluid pressure control apparatus for vehicles, is provided.

[0029] As for a detailed structure of the diaphragm **1**, the film portion **2** is formed to be a flat plate having a uniform thickness over the whole surface (however, the case when a thick portion described below is provided is excepted). The film portion **2** includes one surface **2***a* facing to one housing **31**A (a first housing), in which the vent hole **33** is provided, and another surface **2***b* in the opposite side. The outer peripheral flange portion **3** is set to have a larger thickness than the film portion **2** and formed to have a cross-sectional approximately rectangular shape. One end surface in the thickness direction of the outer peripheral flange portion is set to be a pressed surface (a first pressed surface) **3***a* with respect to the one housing **31**A in which the vent hole **33** is provided, and another end surface is set to be a pressed surface (a second pressed surface) **31***b* pressed by the another housing (a second housing) **31**B. The first pressed surface **3***a* and the one surface **2***a* of the film portion **2** is arranged on the same plane to be a flat surface. The second pressed surface **3***b* protrudes more in the thickness direction than the another surface **2***b* of the film portion **2**.

[0030] In addition, for preventing the film portion **2** to interfere with the vent hole **33** (the film portion **2** is bitted into the vent hole), a thick portion **4** having recessed part **5** is integrally formed at the plane center of the film portion **2**. Corresponding to the thick portion **4**, a recessed portion **34** for inserting the thick portion **4** is provided around the opening of the vent hole **33** in the one housing **31**A. However, the thick portion **4** and the recessed portion **34** are not indispensable configurations, so that these portions can not be provided.

[0031] In the one housing **31**A in which the above vent hole **33** is provided, the plane portion **35**, which is in contact with the approximately whole surface of the one surface **2***a* of the film portion **2**, is provided. Between a pair of the housings **31**A and **31**B, an annular attaching portion **36** (refer to FIG. **2**) for attaching the outer peripheral flange portion **3** of the diaphragm **1** is provided. With this structure, in the one housing **31**A, an annular step portion **37** is provided to form an outer peripheral wall **36***a* of the attaching portion **36** and, in the another housing **31**B, an annular stopper portion **38** having a projection shape is provided to form an inner peripheral wall **36***b* of the attaching portion **36**.

[0032] A size c of the attaching portion **36** in the thickness direction (refer to FIG. **2**) is set to be smaller than a size d of the outer peripheral flange portion **3** in the thickness direction in a free state (c<d) (refer to FIG. **1**). In contrast, a size ϕe of the attaching portion **36** in the width direction (a diameter direction) (refer to FIG. **2**) is set to be larger than a size ϕf of the outer peripheral flange portion **3** in the width direction in the free state (ϕe>ϕf) (refer to FIG. **1**). Further, a distance g between the plane portion **35** of the one housing **31**A and the stopper portion **38** of the another housing **31**B (refer to FIG. **2**) is set to be the same as a thickness size h of the film portion **2** (refer to FIG. **1**) or a little larger than the thickness size of the film portion **2** (g≧h).

[0033] Assuming these items mentioned above, when the diaphragm **1** is attached between a pair of the housings **31**A and **31**B, as illustrated in FIG. **2**, the state in which the film portion **2** is in contact with the plane portion **35** of the one housing **31**A by the one surface **2***a* thereof becomes an initial moving attitude. When pressure is applied to the diaphragm in the initial moving attitude, the film portion **2** is separated from the plane portion **35** of the housing **31**A. The outer peripheral flange portion **3** is compressed and deformed when the diaphragm is attached between the housings **31**A and **31**B, as illustrated from FIG. **1** to FIG. **2**. Even when the outer peripheral flange portion **3** is compressed and deformed, it is an ideal form for the diaphragm to keep the state in which the film portion **2** is in contact with the plane portion **35** of the housing **31**A. However, as described above, depending on the cross-sectional shape of the diaphragm **1**, as illustrated in FIG. **6**(C), the film portion **2** can be already separated and risen from the planet portion **35** of the housing **31**A in the initial moving attitude in which the outer peripheral flange portion **3** is only attached between the housings **31**A and **31**B. In such a case, the countermeasure of this phenomenon is necessary.

[0034] Thus, the present inventors have reached the present invention and propose the following examples according to the present invention.

[0035] That is, as illustrated in FIG. **1**, in the diaphragm **1** according to the examples, a three-dimensional shape **7** is provided on a part of the plane of the first pressed surface **3***a* of the outer peripheral flange portion **3**. As illustrated in FIG. **2**, the three-dimensional shape **7** sets voids in the thickness direction **8** (which are illustrated in FIG. **2**) between the outer peripheral flange portion **3** and the one housing **31**A. The voids in the thickness direction **8** becomes a refuge space at a time of deformation of the outer peripheral flange portion **3** and prevents generation of the phenomenon of rising upward of the film portion **2** by the deformation of the outer peripheral flange portion **3**, when the outer peripheral flange portion **3** is attached between the housings **31**A and **31**B and compressed and deformed.

[0036] More specifically, the three-dimensional shape **7** is provided as a projection **9** provided at the center portion in the diameter direction of the first compressed surface of **3***a*. By being provided such the projection **9**, the voids in the thickness direction **8** is set, in the attached state of the diaphragm, on the outer periphery side of the projection **9** and between the first pressed surface **3***a* of the outer peripheral flange portion **3** and the bottom surface **36***c* of the housing attaching portion **36**. The projection **9** is formed in a circle shape in a cross section cut by a plane containing a center axis of the diaphragm illustrated in FIG. **1**. In a plane view viewing from the under side in FIG. **1**, the projection **9** is annually formed on the whole periphery of the first pressed surface **3***a*. However, the shape in the plane view is not limited to the circle shape but can be an arrangement in which a plurality of projections are arranged on the first pressed surface **3***a* in the circumferential direction, if there are no problems in the sealing ability.

[0037] Further, the outer peripheral flange portion **3** is set to have the outer diameter size enabling to define voids in the diameter direction **10** (which is illustrated in FIG. **2**) between the outer peripheral surface **3***c* of the outer peripheral flange portion **3** and the outer peripheral wall **36***a* of the housing attaching portion **36**, when the outer peripheral flange portion **3** is attached between the housings **31**A and **31**B. On a part of the outer peripheral surface **3***c* of the outer peripheral flange portion **3**, projections (not illustrated) can be provided and in contact with the outer peripheral wall **36***a* of the housing attaching portion **36**.

[0038] Further, although the second pressed surface **3***b* of the outer peripheral flange portion **3** can be a flat surface, in this example, a three-dimensional shape **11** in a part on the plane is also provided on the second pressed surface **3***b*. More specifically, the three-dimensional shape **11** is provided as a projection **12** at a center portion in the diameter direction of the second pressed surface **3***b*. By being provided such a projection **12**, in the attaching state, the voids in the thickness direction **13** is set on the outer peripheral side of the projection **12** and between the second pressed surface **3***b* of the outer peripheral flange portion **3** and a bottom surface **36***d* in the opposite side of the housing attaching portion **36**, as illustrated in FIG. **2**. Similar to the aforementioned projection **9**, the projection **12** is formed to have a circle shape in a cross section cut by a plane containing a center axis of the diaphragm illustrated in FIG. **1**. In a plane view viewing from the upper and under sides in FIG. **1**, the projection **12** is annually formed on the whole periphery of the second pressed surface **3***b*. However, the shape of the plane view of the projection **12** is not limited to the circle shape but can be a structure in which a plurality of projections are arranged in the circumferential direction, if there are no problems in the sealing ability.

[0039] According to the diaphragm **1** including the aforementioned structure, the three-dimensional shape **7** in a part on the plane, i.e., the projection **9**, is provided on the first pressed surface **3***a* of the outer peripheral flange portion **3**. By this projection **9**, the voids in the thickness direction **8** is defined on the outer peripheral side of the projection **9** and between the first pressed surface **3***a* of the outer peripheral flange portion **3** and the bottom surface **36***c* of the housing attaching portion **36**. The voids in the thickness direction **8**_has a size enabling to absorb the elastic deformation of the outer peripheral flange portion **3** by the compression in the vertical direction illustrated in FIGS. **1** and **2**, when the diaphragm **1** is attached between the first housing **31**A and the second housing **31**B. Therefore, even when the outer periph-

eral flange portion **3** is compressed and deformed, the influence hardly reaches to the film portion **2**, so that the generation of rising upward phenomenon of the film portion **2**, which is illustrated in FIG. **6**(C), can be prevented. In addition, the voids in the thickness direction **8** can be provided not only on the outer peripheral side but also the inner peripheral side.

[0040] Further, in the present examples, the voids in the diameter direction **10** are defined between the outer peripheral surface **3***c* of the outer peripheral flange portion **3** and the outer peripheral wall **36***a* of the housing attaching portion **36** together with aforementioned voids in the thickness direction **8**. The voids in the diameter direction **10** absorbs a part of the elastic deformation of the outer peripheral flange portion **3** generated by the vertical compression illustrated in FIGS. **1** and **2**, when the diaphragm **1** is attached between the first housing **31**A and second housing **31**B. By adding the voids in the diameter direction **10** to the voids in the thickness direction **8**, the voids absorbing the elastic deformation of the outer peripheral flange portion **3** can be more enlarged, and the generation of the rising upward of the film portion **2** can be more easily prevented.

[0041] Furthermore, in the present examples, together with the aforementioned voids, the three-dimensional shape **11**, i.e., the projection **12** is also provided on the second pressed surface **3***b* of the outer peripheral flange portion **3**, so that the voids in the thickness direction **13** is defined on the outer peripheral side of the projection **12** and between the second pressed surface **3***b* and the bottom surface **36***b* of the housing attaching portion **36**. The voids in the thickness direction **13** also absorbs a part of the elastic deformation of the outer peripheral flange portion **3** by the compression in the vertical direction illustrated in FIGS. **1** and **2**, when the diaphragm **1** is attached between the first housing **31**A and the second housing **31**B. In addition to the voids in the thickness direction **8** and the voids in the diameter direction **10**, the voids in the thickness direction **13** can enlarge more the voids absorbing the elastic deformation of the outer peripheral flange portion **3**, so that the generation of rising upward of the film portion **2** can be more easily prevented. In addition, the voids in the thickness direction **13** can be defined not only on the outer peripheral side of the projection **12** but also on the inner peripheral side of the projection **12**.

[0042] Further, as for the projected portion, such as, the projections **9** and **12** which are the above voids three-dimensional shapes **7** and **11**, there is a case in which a plurality of projected portions is respectively provided in parallel on the first pressed surface **3***a* or the second pressed surface **3***b* of the outer peripheral flange portion **3**. In this case, the voids in the thickness direction **8** and **13**, which become the refuge of the rubber-like elastic body, are set between the projections **9** and **12** each other.

[0043] Further, the three-dimensional shape **7**, **11** can be a recessed portion instead of the projected portions, such as, the projections **9** and **12**. In this case, voids **8** and **13**, which become the refuge of the rubber-like elastic body, are set between the outer peripheral flange portion **3** and the bottom surfaces **36***c* and **36***d* of the housing attaching portion **36**, while being in the state that the first pressed surface **3***a* or the second pressed surface **3***b* of the outer peripheral flange portion **3** are directly in contact with the bottom surface **36***c* or **36***d* of the housing attaching portion **36** and compressed. There also can be a case in which a plurality of recessed portions are arrange in parallel. In FIG. **3** and FIG. **4** illustrated as another example, the three-dimensional shape **11** in the upper side in figures is formed on the second pressed surface **3***b* by a groove-shaped recessed portion **14**, in the upper and lower three-dimensional shapes **7** and **11**.

[0044] In addition, the aforementioned each voids **8**, **10**, and **13** act as the refuge of the rubber-like elastic body when the outer peripheral flange portion **3** is sandwiched between the housings **31**A and **31**B, and compressed and deformed. Thus, in the state when the compression and deformation by attaching is completed (in the state when the attaching operation is completed), there can be a case that a part or the whole of the voids disappears (filled by the rubber-like elastic body and does not exist as a space).

1-5. (canceled)

6. A diaphragm comprising a flexible film portion and an outer peripheral flange portion integrally provided on a peripheral edge of the film portion,

wherein at least a portion of one surface in the thickness direction of the film portion and at least a portion of one end surface in the thickness direction of the outer peripheral flange portion are arranged on the same plane to be a flat surface,

wherein another end surface in the thickness direction of the outer peripheral flange portion protrudes more in the thickness direction than another surface in the thickness direction of the film portion,

wherein, when the diaphragm is attached between a pair of a first housing and a second housing, the outer peripheral flange portion becomes to be a state compressed between the first housing and the second housing, and the film portion becomes to be a state in which one surface of the film portion in the thickness direction is in contact with the first housing over the approximately whole surface of the one surface of the film portion,

wherein the one end surface in the thickness direction of the outer peripheral flange portion includes a first pressed surface contacting the first housing, and a three dimensional shape comprising a projected portion or a recessed portion is provided on the first pressed surface,

wherein, when the outer peripheral flange portion is compressed in the thickness direction between a pair of the first housing and the second housing, the three-dimensional shape defines voids in the thickness direction between the outer peripheral flange portion and the first housing,

wherein the voids in the thickness direction absorbs compression and deformation of the outer peripheral flange portion, so that the influence of the compression and deformation hardly reaches to the film portion, and rising upward of the film portion from the first housing is prevented.

7. The diaphragm according to claim **6**,

wherein the three-dimensional shape is an annular projection provided on a center portion in the diameter direction of the first pressed surface,

wherein, when the outer peripheral flange portion is attached to the first housing and the second housing while being compressed and deformed therebetween, the three-dimensional shape defines voids in the diameter direction on the more outer side than the annular projection on the first pressed surface.

8. The diaphragm according to claim **6**,

wherein, when the outer peripheral flange portion is attached between the first housing and the second hous-

ing, the outer peripheral flange portion is set to have an outer diameter size enabling to define voids in the diameter direction between the outer peripheral surface of the outer peripheral flange portion and at least one of the first housing and the second housing, in the diameter direction of the diaphragm.

9. The diaphragm according to claim **6**,

wherein the outer peripheral flange portion includes a second pressed surface and a three-dimensional shape,

wherein the second pressed surface is another surface in the thickness direction of the diaphragm and is pressed by the second housing,

wherein the three-dimensional shape includes a projected portion or a recessed portion on the second pressed surface.

10. A diaphragm supporting structure sandwiching a diaphragm by a first housing and a second housing,

wherein the diaphragm supporting structure includes the diaphragm according to claim **6** as the diaphragm.

11. The diaphragm according to claim **7**,

wherein, when the outer peripheral flange portion is attached between the first housing and the second housing, the outer peripheral flange portion is set to have an outer diameter size enabling to define voids in the diameter direction between the outer peripheral surface of the outer peripheral flange portion and at least one of the first housing and the second housing, in the diameter direction of the diaphragm.

12. The diaphragm according to claim **8**,

wherein the outer peripheral flange portion includes a second pressed surface and a three-dimensional shape,

wherein the second pressed surface is another surface in the thickness direction of the diaphragm and is pressed by the second housing,

wherein the three-dimensional shape includes a projected portion or a recessed portion on the second pressed surface.

13. A diaphragm supporting structure sandwiching a diaphragm by a first housing and a second housing,

wherein the diaphragm supporting structure includes the diaphragm according to claim **9** as the diaphragm.

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