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(54) **GASKET AND PIPE JOINT USING THE SAME**

(76) Inventor: **Wen-Chi Wu**, Taipei (TW)

Correspondence Address:
ROSENBERG, KLEIN & LEE
3458 ELLICOTT CENTER DRIVE-SUITE 101
ELLICOTT CITY, MD 21043 (US)

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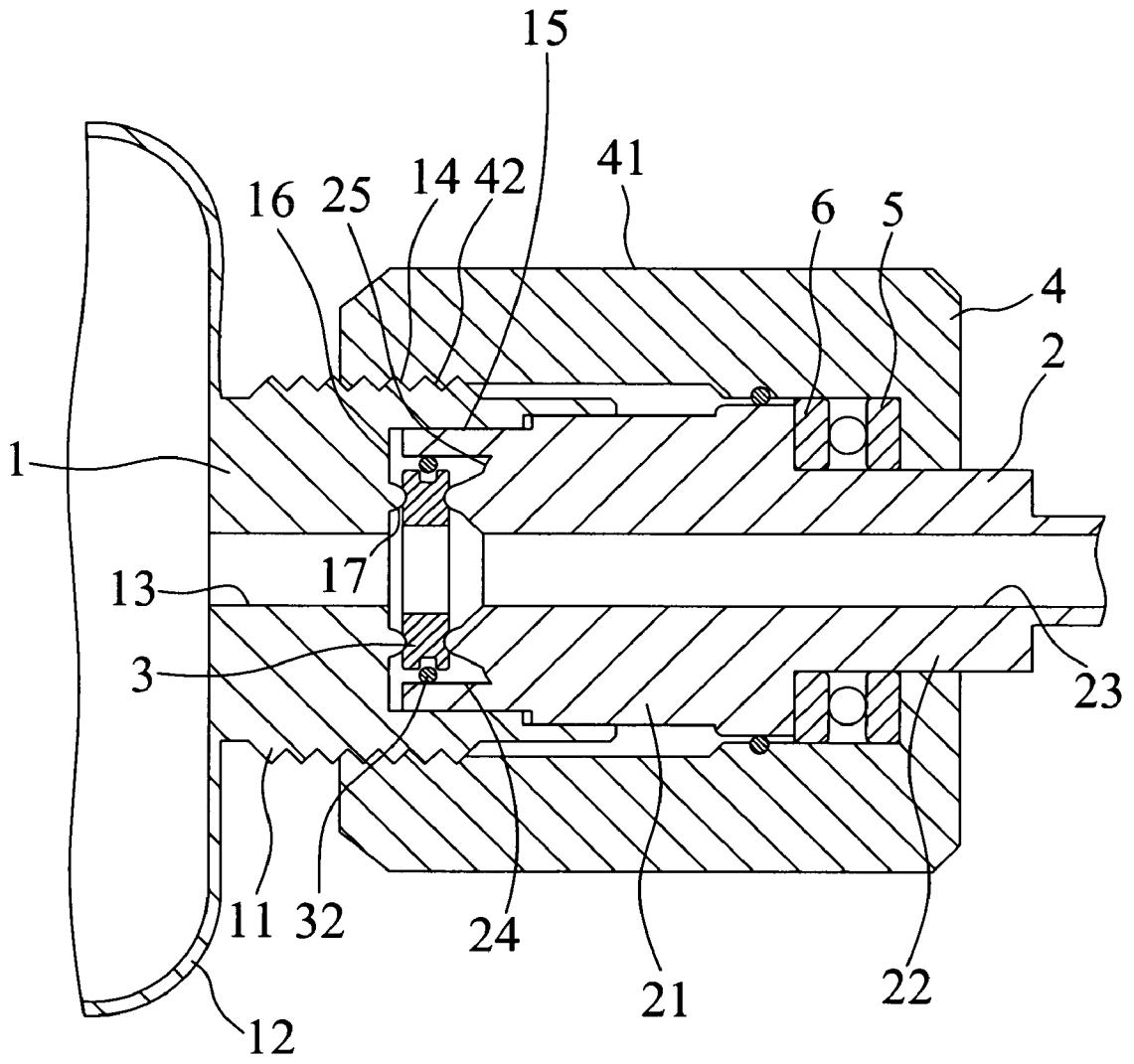
(57) **ABSTRACT**

The present invention discloses a gasket and a pipe joint using the same, which can achieve airtightness with a locking torque smaller than that used conventionally. The gasket of the present invention is interposed in between two coupling faces of a first pipe and a second pipe interconnecting to the first pipe, and each of the two coupling faces has at least one annular protrudent strip. The gasket of the present invention is characterized in that the gasket has at least one annular reception/contact member corresponding to the annular protrudent strip, and that the annular protrudent strip is pressed against the annular reception/contact member to form a twofold airtight mechanism with an inner annular contact area and an outer annular contact area. Thereby, the present invention can effectively promote the airtightness of the two coupling faces of the first pipe and the second pipe.



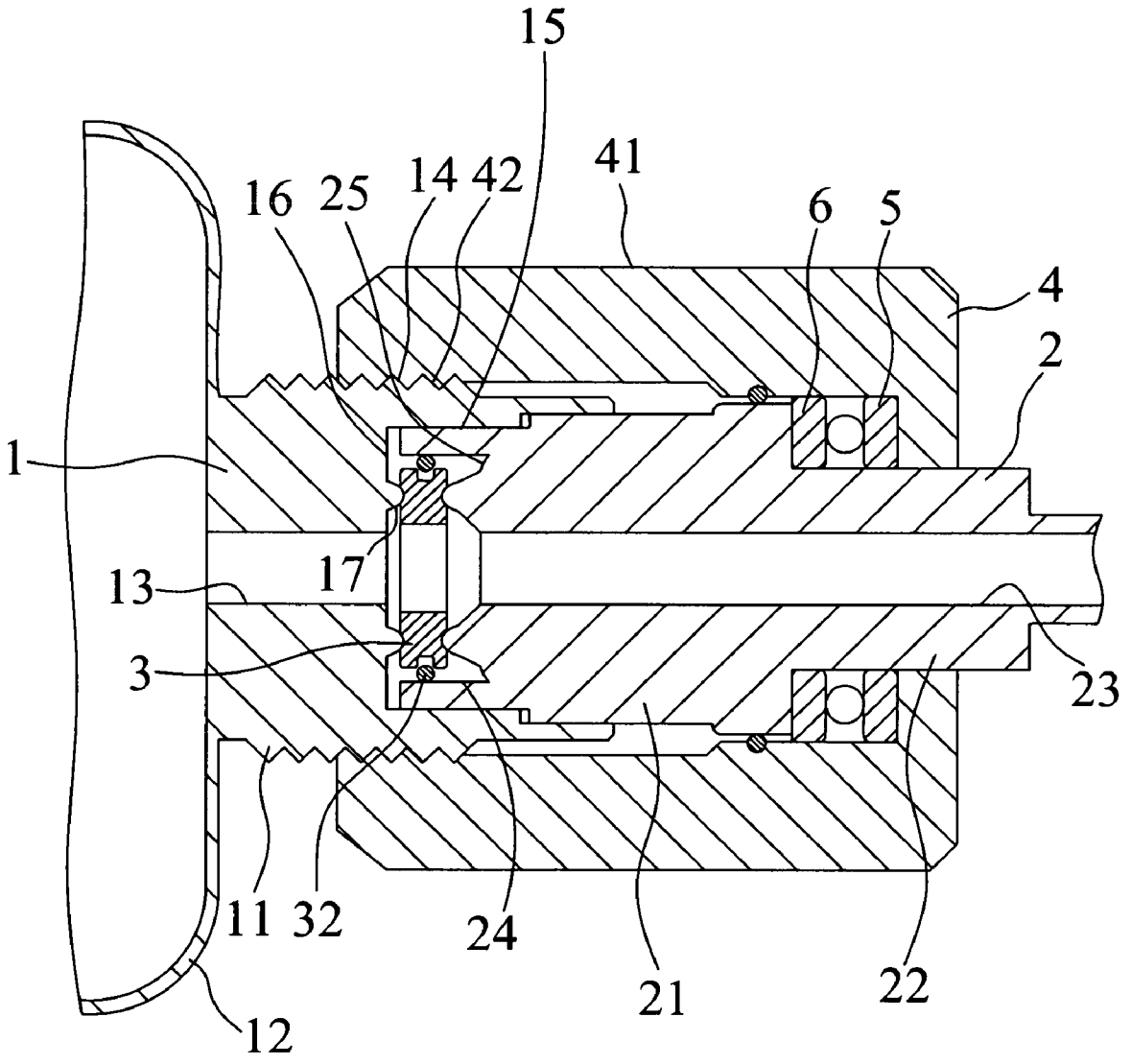


Fig. 1

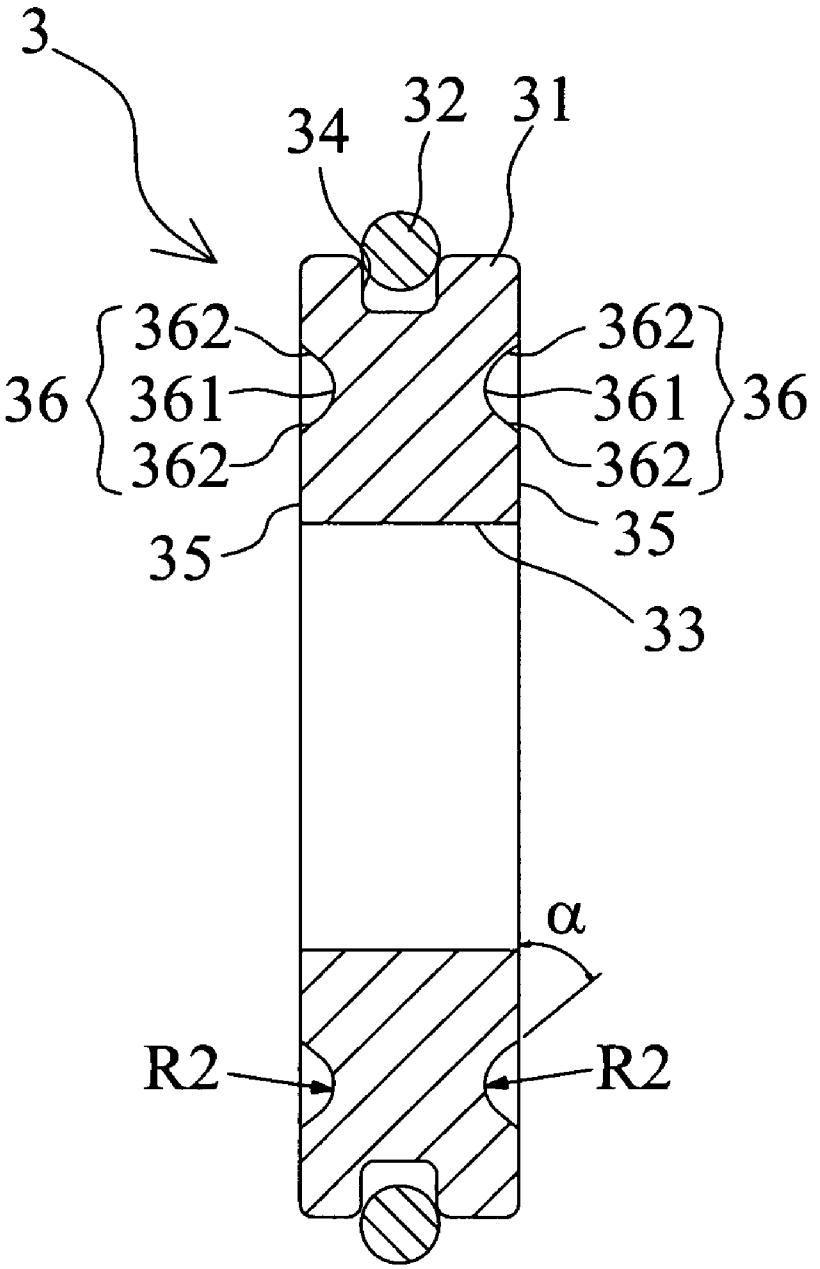


Fig. 2

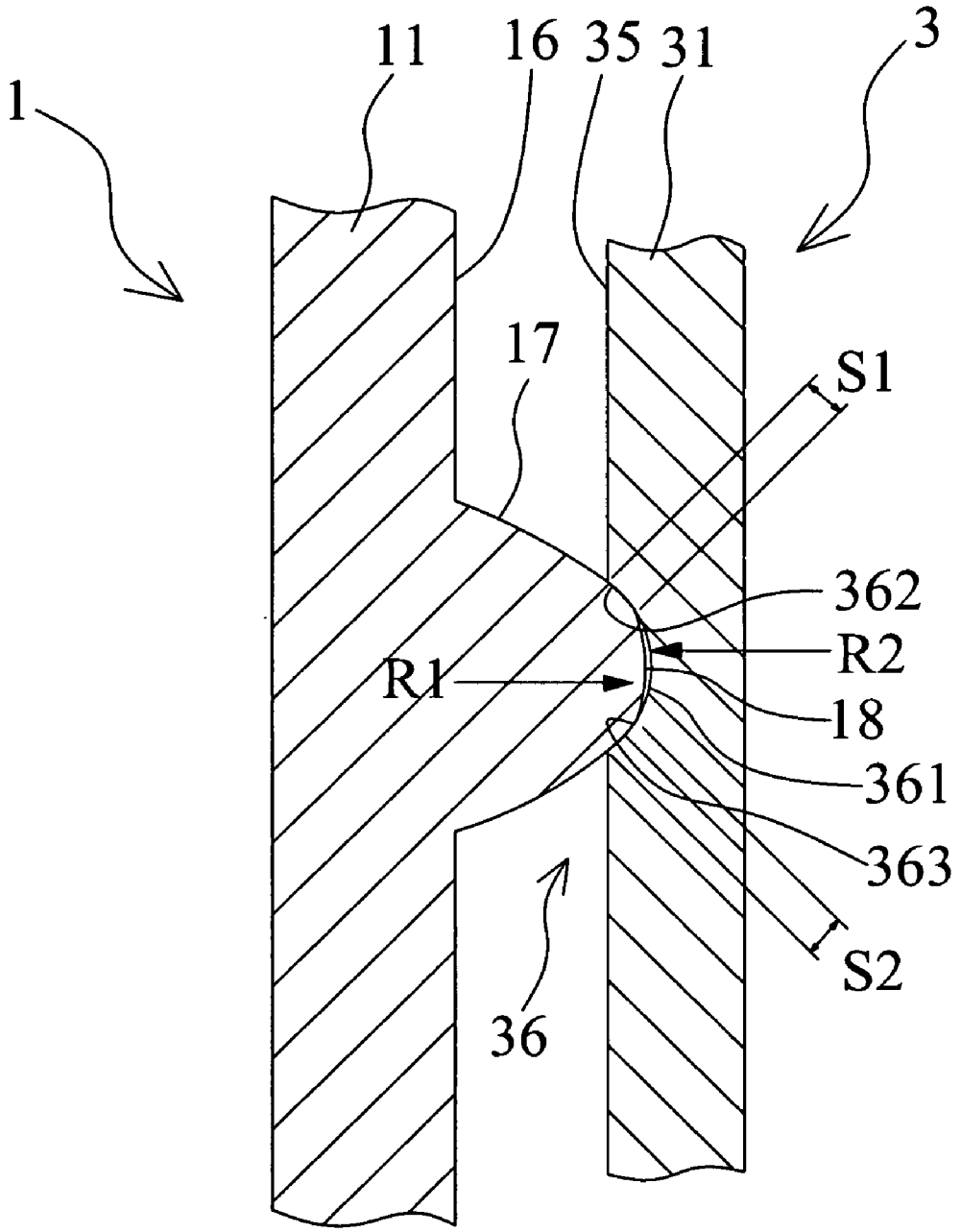


Fig. 3

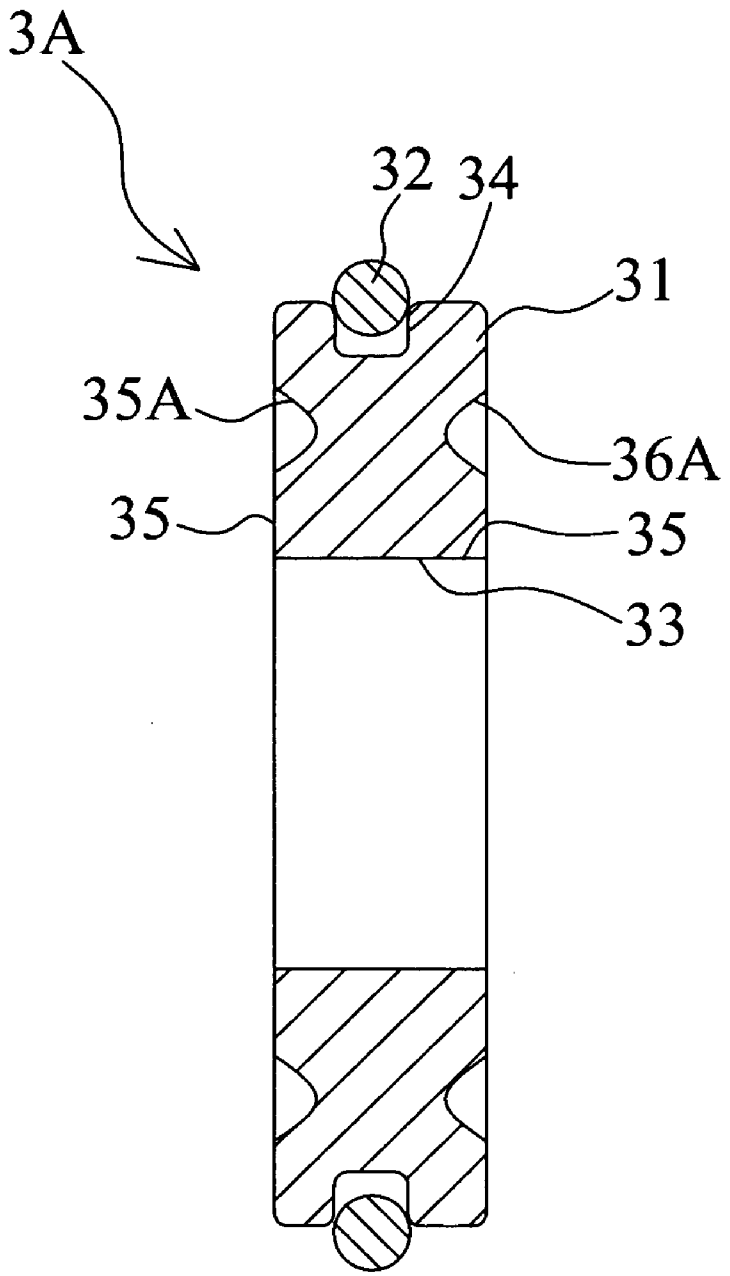
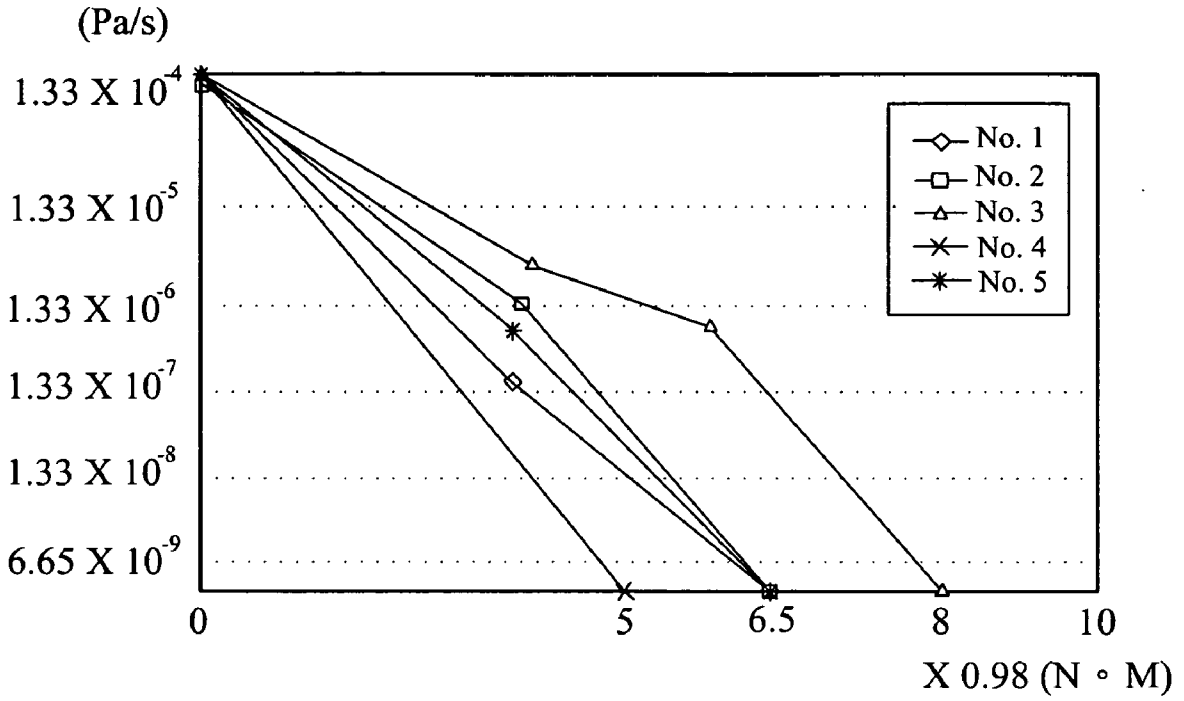


Fig. 4


(Pa/s)
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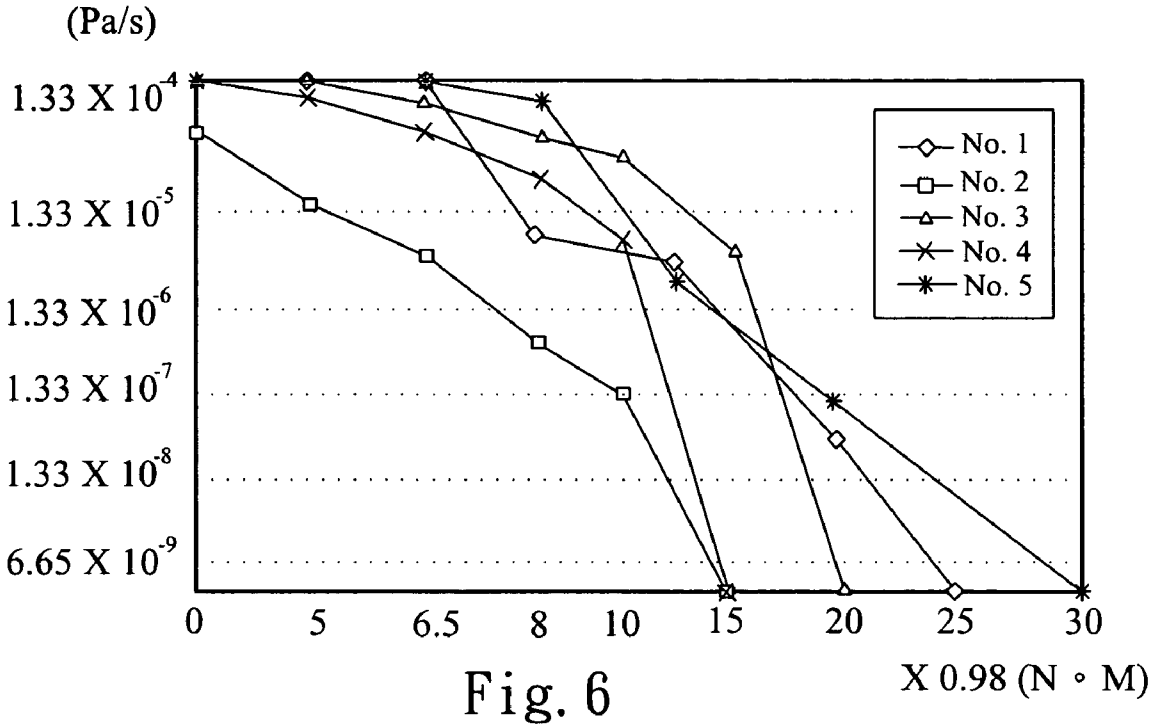
1.33 X 10-5
1.33 X 10-6
1.33 X 10-7
1.33 X 10-8
6.65 X 10-9
No. 1
No. 2
No. 3
No. 4
No. 5
0
5
6.5
8
10
X 0.98 (N ∘ M)

Fig. 5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No. 2
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Fig. 6

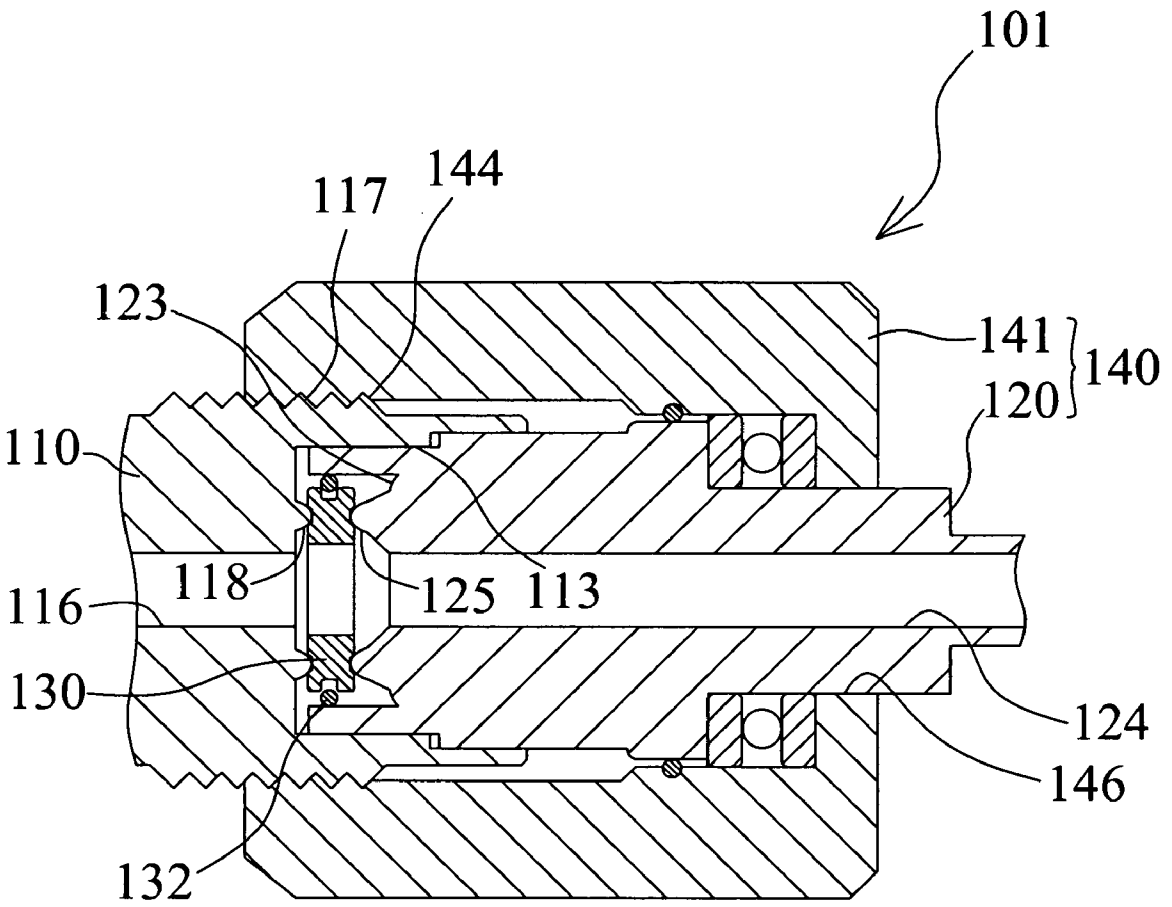

Fig. 7

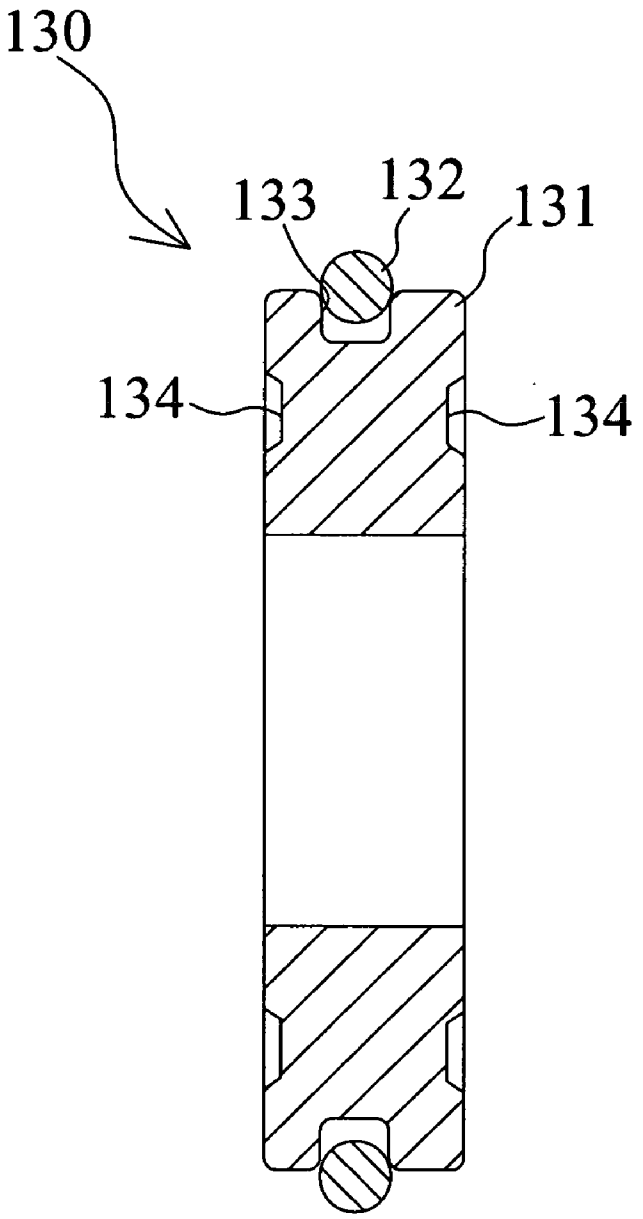

Fig. 8

GASKET AND PIPE JOINT USING THE SAME

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a gasket interposed in between two coupled pipes and a pipe joint using the gasket which can effectively increase the airtightness of piping.

[0003] 2. Description of the Related Art

[0004] In the fabrication processes of semiconductor, LCD, etc., gases, such as ammonia, nitrous oxide, nitrogen trifluoride, and fluorine, are used as the processing gases in film formation. The gas supplying apparatus that supplying these kinds of gas to the film forming processing unit has been well known to the market.

[0005] The processing gases should be of high purity lest impurities to interfere with the desired reaction. Therefore, impurities should be prevented from entering into the transporting piping from the gas container to the gas processing unit. As the processing gases are usually toxic, gas leakage should be prevented also.

[0006] Among a piping system, pipe joints interconnecting different pipes are exactly the places where gas leakage and impurity permeation are most likely to occur.

[0007] Referring to FIG. **7** and FIG. **8**, these drawings schematically show the structure of a common conventional pipe joint (Referring to a Japan patent No. 2003-343762 also). As shown in FIG. **7**, a pipe joint **101** has a male thread component **110** and a female thread component **140** engaging with the male thread component **110**. The male thread component **110** has a male thread **117** on the external surface thereof and a fluid channel **116** along the axial direction. The base end of the fluid channel interconnects to a pipe not shown in the drawings. The male thread component **110** also has a recession **113**. And a protrusion **118** projecting toward the axis direction is formed on the bottom of the recession **113**.

[0008] The female thread component **140** has a body **141** and a press-fitted element **120** press-fitted into the body **141**. The inner wall of the body **141** has a female thread **144** engaging with the male thread **117**. The body **141** also has an axial through-hole **146**. The front end of the press-fitted element **120** has a recession **123**. Also a protrusion **125** is formed on the bottom of the recession **123**. A gasket **130** is inlaid into the recession **123**. The press-fitted element **120** also has a fluid path **124** along with the axial direction. The front end of the fluid channel **124** is at the bottom of the recession **123**, and the base end of the fluid channel **124** interconnects to a pipe joined to the press-fitted element **120** (not shown in the drawing).

[0009] As shown in FIG. **8**, the gasket **130** has an annular gasket body **131** and an elastic element **132** with a C-like shape arranged along the circumference of the gasket body **131**. The gasket body **131** is made of high-purity nickel and has high corrosion resistance and superior airtight performance. Two sides of the annular gasket body **131** respectively have annular grooves **134**. The annular gasket body **131** also has a receiving groove along the circumferential face thereof, and the elastic element **132** is arranged in the receiving groove **133**. The elastic element **133** is made by elastic metal and able to expand radially.

[0010] In the pipe joint **101**, the gasket **130** is interposed between the press-fitted element **120** and the male thread component **110**. When the body **141** of the female thread component **140** is rotated to engage with the male thread component **110**, the protrusion **118** and the protrusion **125** become close to each other and press the receiving grooves **134** of the gasket **3**. Thus pressurization is attained.

[0011] In the prior-art patent, a locking torque no less than a specified value is required to guarantee airtightness. The greater the locking torque, the higher the airtightness. However, considering the convenience and efficiency of joining and disjoining pipes, it is preferable to use a smaller locking torque to achieve a higher airtightness.

[0012] Accordingly, the present invention proposes a gasket and a pipe joint using the same to overcome the abovementioned problem.

SUMMARY OF THE INVENTION

[0013] The primary objective of the present invention is to provide a gasket and a pipe joint using the gasket, which can achieve airtightness by a locking torque smaller than that used conventionally.

[0014] Another objective of the present invention is to provide a novel gasket, which is interposed in between two coupling faces of a first pipe and a second pipe interconnecting to the first pipe. Each of two coupling faces has at least one annular protrudent strip. The gasket of the present invention is characterized in that the gasket has at least one annular reception/contact member corresponding to the annular protrudent strip, and that the annular protrudent strip is pressed against the annular reception/contact member to form a twofold airtight mechanism with an inner annular contact area and an outer annular contact area. Even if each annular contact area of the present invention is the same as the contact area of the conventional onefold airtight mechanism or even if the locking torque used by the present invention is smaller than that used conventionally, a gap is unlikely to appear in between the coupling face and the annular reception/contact member in the present invention because of the twofold airtight mechanism of the inner and outer annular contact areas. Therefore, the present invention can effectively promote the airtightness of a pipe joint.

[0015] In the present invention, the axial pressing forces, which are generated in locking the first and second pipes, are distributed on the two annular contact areas. Thus, stress concentration is reduced, and the reception/contact members of the gasket are less likely to deteriorate or crack after long term usage. Therefore, the present invention can promote the durability of a pipe joint.

[0016] In the present invention, the annular contact areas can promote the airtightness of the two coupling face. Thus, the first and second pipes do not need a special surface finishing treatment. Therefore, the present invention can save the surface finishing process.

[0017] The annular reception/contact member of the present invention may be a V-sectioned groove having a bottom and two inclined planes converging toward the bottom.

[0018] In the present invention, the annular protrudent strip is pressed against the V-sectioned groove to form two annular contact areas on the inclined planes of the V-sectioned groove. The engagement of the annular protrudent strip and the inclined planes can prevent the annular protrudent strip from deviating from the V-sectioned groove. Therefore, the present invention can achieve a stable airtightness.

[0019] In the present invention, the annular reception/contact member may be a simple V-sectioned groove. Therefore, the gasket is easy to be fabricated.

[0020] In the present invention, recessions are respectively formed on coupling-face sides of the first pipe and the second

pipe, and the gasket, whose size do not necessarily fully meet the size of the recession, can still be installed inside the recession. Therefore, the cost and steps of fabrication are decreased in the present invention. For example, the gasket has a receiving groove along the circumference thereof, and a spring is arranged inside the receiving groove. Even if the outer diameter of the gasket is smaller than the inner diameter of the recession, the spring can still keep the gasket secured inside the recession. Besides, the spring can be easily dismounted from the gasket because of its elasticity.

[0021] Further, the spring makes the gasket easily mounted in or dismounted from the recession. Therefore, the gasket of the present invention can be easily replaced.

[0022] The present invention also provides a pipe joint, which comprises a first pipe; a second pipe interconnecting to the first pipe; a gasket interposed in between the two coupling faces of the first pipe and the second pipe; and a nut used to lock together the first pipe and the second pipe both having clamped the gasket. The pipe joint is characterized in that at least one of the two coupling faces of the first pipe and the second pipe has at least one annular protrudent strip, and that the gasket has at least one annular reception/contact member corresponding to the annular protrudent strip, and that the annular protrudent strip is pressed against the annular reception/contact member to form a twofold airtight mechanism with an inner annular contact area and an outer annular contact area.

[0023] Via the above-mentioned structure, the pipe joint of the present invention has superior airtightness.

[0024] In the present invention, the annular protrudent strip has a semi-circle cross-section; the annular reception/contact member is a V-sectioned groove having an arc-sectioned bottom and two inclined planes converging toward the arc-sectioned bottom; the two inclined planes respectively extend from the tangents of two ends of the arc-sectioned bottom; the annular protrudent strip has a curvature radius greater than that of the arc-sectioned bottom.

[0025] Via the above-mentioned structure, the top of the annular protrudent -strip contacts the two inclined planes of the V-sectioned groove. As the curvature radius of the annular protrudent strip is greater than that of the arc-sectioned bottom of the V-sectioned groove, the top of the annular protrudent strip does not contact the arc-sectioned bottom, thus a gap exists between the top of the annular protrudent strip and the arc-sectioned bottom, which guarantees the formation of the twofold airtight mechanism of the inner and outer annular contact areas. Thereby, the pipe joint of the present invention has superior airtightness.

[0026] Below, the embodiments are described in detail to make it more easily understandable of the objectives, technical contents, characteristics and efficacies of the present invention.

BRIEF DESCRIPTION OF THE RELATED ART

[0027] FIG. **1** is an axial cross-sectional view of a gasket and a pipe joint using the gasket according to one embodiment of the present invention;

[0028] FIG. **2** is an axial cross-sectional view of the gasket according to the same embodiment of FIG. **1**;

[0029] FIG. **3** is a partially enlarged cross-sectional view of the gasket and the first pipe according to the same embodiment of FIG. **1**;

[0030] FIG. **4** is an axial cross-sectional view of a gasket according to another embodiment of the present invention;

[0031] FIG. **5** is a diagram showing the test results of the pipe joint using the present invention;

[0032] FIG. **6** is a diagram showing the test results of the pipe joint using the conventional technology;

[0033] FIG. **7** is an axial cross-sectional view of a conventional gasket and a conventional pipe joint; and

[0034] FIG. **8** is an axial cross-sectional view of the same conventional gasket in FIG. **7**.

DETAILED DESCRIPTION OF THE INVENTION

[0035] Refer to FIG. **1** an axial cross-sectional view of a gasket and a pipe joint using the same according to one embodiment of the present invention.

[0036] In this embodiment, the pipe joint comprises a first pipe **1**, a second pipe **2** interconnecting to the first pipe **1**, a gasket **3** interposed in between a first coupling face **16** of the first pipe **1** and a second coupling face **25** of the second pipe **2**, a cap-shaped nut **4** used to lock together the first pipe **1** and the second pipe **2** with the gasket **3** clamped by the first pipe **1** and the second pipe **2**, and a bearing **5** arranged in between the second pipe **2** and the cap-shaped nut **4**.

[0037] The first pipe **1** is made of a stainless steel and comprises a cylindrical pipe body **11** having a diameter of about 20~30 mm, a container **12** joined to the base end of the pipe body **11**, and a first channel **13** axially formed inside the pipe body **11** and allowing a fluid to flow there inside.

[0038] A male thread **14** is formed on the external surface of the pipe body **11**. A first recession **15** is formed on the front end of the pipe body **11**. The bottom of the first recession **15** is used as the first coupling face **16**. The front end of the first channel **13** has an opening at the center of the first coupling face **16**. The base end of the first channel **13** interconnects to the interior of the container **12**. The first coupling face **16** has a first annular protrudent strip **17** encircling the first channel **13** and having a semi-circle cross-section.

[0039] The second pipe is made of a stainless steel and comprises a cylindrical pipe body **21**, a pipe piece **22** axially extending from the base end of the pipe body **21**, and a second channel **23** axially formed inside the pipe body **21** and the pipe piece **22** and allowing a fluid to flow there inside.

[0040] A second recession **24** is formed on the front end of the pipe body **21** and corresponding to the first coupling face **16**. The gasket **3** is to be inlaid in the second recession **24**. The bottom of the second recession **24** is used as the second coupling face **25**. The front end of the second channel **23** has an opening at the center of the second coupling face **25**. The base end of the second channel **23** interconnects to a pipe (not shown in the drawing) joined to the base end of the pipe piece **22**.

[0041] The second coupling face **25** has a second annular protrudent strip **26** encircling the second channel **23** and having a semi-circle cross-section. The second annular protrudent strip **26** is corresponding to the first annular protrudent strip **17** with the gasket **3** interposed there in between.

[0042] Refer to FIG. **2** an axial cross-sectional view of the gasket **3**.

[0043] The gasket **3** comprises a gasket body **31**, a spring **32** arranged along the circumference of the gasket body **31**, and a gasket hole **33** formed at the center of the gasket body **31**.

[0044] The gasket body **31** is made of a highly corrosion-resistant high-purity nickel. The circumference of the gasket body **31** has a receiving groove **34** to accommodate the spring **32**. The gasket body **21** may also be made of a stainless steel. Sometimes, a highly corrosion-resistant metal used by a gas-

ket, such as nickel or stainless steel, is too hard to have a full airtightness. Therefore, the nickel or stainless steel used by the gasket **3** had better be annealed to have hardness lower than that of the first and second pipes **1** and **2**.

[0045] The gasket body **31** has two side faces **35** respectively corresponding to the first coupling face **16** of the first pipe **1** and the second coupling face **25** of the second pipe **2**.

[0046] Each of the side faces **35** has an annular V-sectioned groove **36** encircling the gasket hole **33** and is functioning as an annular reception/contact member. The annular V-sectioned groove **36** has an unsharpened arc-sectioned bottom **361** and two inclined planes **362** converging toward the arc-sectioned bottom **361**. The annular V-sectioned groove **36** has a V-shaped section. In this embodiment, the tangent of each inclined plane **362** has a tilt angle of about 40 degrees with respect to the side face **35** (the angle denoted by α in FIG. **2**). The two annular V-sectioned grooves **36** are respectively formed on the positions corresponding to the first protrudent strip **17** and the second protrudent strip **26**. In the present invention, the tilt angle α is between 20 and 70 degrees.

[0047] The spring **32** is a stainless-steel wire bent into a C shape. The spring **32** is arranged in the receiving groove **34** and can deform and recover from deformation in the circumferential direction.

[0048] The cap-shaped nut **4** is made of a stainless steel. The cap-shaped nut **4** is a hexagonal-prism component having a hexagonal cross-section in the direction vertical to the axis. The cap-shaped nut **4** has rectangular side faces **41** and a female thread **42** on the inner wall at the front end of the cap-shaped nut **4** (near the container **12**).

[0049] The bearing **5** inside the cap-shaped nut **4** receives the second pipe **2**, and the cap-shaped nut **4** can rotate freely with respect to the second pipe **2**. Via screwing the female thread **42** into the male thread **14** of the first pipe **1**, the first pipe **1** and the second pipe **2** is locked together, and the gasket **3** is also clamped by the first annular protrudent strip **17** and the second annular protrudent strip **26**.

[0050] A positioning element **6** is secured in the inner wall of the cap-shaped nut **4** and arranged in between the bearing **5** and the outer surface of the pipe body **21** lest the bearing **5** drops out from the inner wall of the cap-shaped nut **4**.

[0051] Refer to FIG. **3** a partially enlarged cross-sectional view of the gasket **3** and the first pipe **1**.

[0052] The two inclined planes **362** of the annular V-sectioned groove **36** are pressed against two sides of the top **18** of the first protrudent strip **17** to form two annular contact areas S**1** and S**2** on the two inclined planes **362**. The annular contact areas S**1** and S**2** encircle the gasket hole **33** and form a twofold airtight mechanism with an inner annular contact area and an outer annular contact area.

[0053] As the inclined planes **362** are pressed against the top **18** of the first protrudent strip **17**, the two annular contact areas S**1** and S**2** are elastically deformed and flattened, whereby the contact area in between the first protrudent strip **17** and the V-sectioned groove **36** is increased. Besides, the opening of the V-sectioned groove **36** is also elastically expanded to have a tilt angle greater than before pressing, whereby the contact area in between the first protrudent strip **17** and the V-sectioned groove **36** is further increased. Therefore, the airtightness is increased.

[0054] As the curvature radius R**1** of the first protrudent strip **17** is greater than the curvature radius R**2** of the arc-sectioned bottom **361** of the V-sectioned groove **36**, a gap exists in between the top **18** of the first protrudent strip **17** and the arc-sectioned bottom **361** of the V-sectioned groove **36**, which guarantees the formation of the twofold airtight mechanism of the annular contact areas S**1** and S**2**.

[0055] The airtight mechanism in between the gaskets and the second pipe **2** is similar to that in between the gasket **3** and the first pipe **1**.

[0056] Below is described the method of locking together the first pipe **1** and the second pipe **2** with the cap-shaped nut **4**.

[0057] Firstly, the spring **32** is greatly expanded and then inlaid into the receiving groove **34**. Next, the gasket **3** is inlaid in the second recession **24** of the second pipe **2**. At this time, the V-sectioned groove **36** on the side face **35** facing the second pipe **2** is pressed against the second protrudent strip **25**. Next, the second pipe **2** is accommodated inside the cap-shaped nut **4**.

[0058] Next, the second pipe **2** is inserted into the first recession **15** of the first pipe **1** to press the V-sectioned groove **36** of the side face **35** facing the first pipe **1** against the first protrudent strip **17** of the first pipe **1**. Next, the female thread **42** of the cap-shaped nut **4** is screwed into the male thread **14** of the first pipe **1**. A wrench is used to clamp the rectangular side faces **41** of the cap-shaped nut **4**, and a locking torque of a specified value is applied to the wrench to lock the cap-shaped nut **4**. As the bearing **5** exists in between the second pipe **2** and the cap-shaped nut **4**, only the cap-shaped nut **4** rotates, and the second pipe **2** remains standstill. Therefore, the first pipe **1**, the second pipe **2** and the reception/contact members of the gasket **3** will not wear.

[0059] During screwing the cap-shaped nut **4**, an axial pressing force from base end to the front end of the first pipe **1** acts on the first coupling face **16** of the first pipe **1**, and an axial pressing force from the base end to the front end of the second pipe **2** acts on the second coupling face **25** of the second pipe **2**. Thus, the first coupling face **16** and the second coupling face **25** are forcefully pressed to each other with the gasket **3** clamped by them. As shown in FIG. **3**, the top **18** of the first protrudent strip **17** is pressed against the two inclined planes **362** of the V-sectioned groove **36**, and the two annular contact areas S**1** and S**2** are thus formed on the two inclined planes **362**.

[0060] After the cap-shaped nut **4** has been locked by the locking torque of a specified value, the annular contact areas S**1** and S**2** have a width of 0.1~0.4 mm. The width of the annular contact areas S**1** and S**2** had better be adjusted according to the size of the pipe joint or the flow rate of the fluid.

[0061] Thereby it is completed the locking of the first pipe **1** and the second pipe **2**. The first channel **13** and the second channel **23** are thus airtightly interconnected.

[0062] Via the structure described above, this embodiment of the present invention has the following efficacies:

[0063] (1) As two sets of annular contact areas S**1** and S**2** respectively exist in between the two inclined planes **362** and the first protrudent strip **17** and in between the other two inclined planes **362** and the second protrudent strip **26**, gaps are less unlikely to appear in between the first pipe **1** and the second pipe **2** of the present invention than in the conventional pipe joint having only a single contact area. Thus, the present invention can promote the airtightness of a pipe joint. Even when the locking torque is smaller, the present invention can still guarantee the airtightness.

[0064] (2) As the axial pressing forces are distributed on the two annular contact areas S**1** and S**2**, stress concentration is reduced. Unlike the conventional gasket and pipe joint

having only a single contact area, the reception/contact members of the gasket **3** and the first and second pipes **1** and **2** are less likely to deteriorate or crack after long term usage. Therefore, the present invention can promote the durability of a pipe joint.

[0065] (3) Since the annular contact areas S**1** and S**2** formed on the V-sectioned groove **36** can promote the airtightness of the first coupling face **16** and the second coupling face **25**, the first pipe **1** and the second pipe **2** do not need a special surface finishing treatment. Therefore, the present invention can save the surface finishing process.

[0066] (4) The engagement of the first protrudent strip **17**, the second protrudent strip **26** and the inclined planes **362** of the V-sectioned grooves **36** can prevent the first protrudent strip **17** and the second protrudent strip **26** from deviating from the V-sectioned grooves **36**. Therefore, the present invention can achieve a stable airtightness.

[0067] (5) As the V-sectioned grooves **36** have a simple shape, they are easy to fabricate.

[0068] (6) As the gasket **3** does not need a high a precision to meet the size of the second recession **24**, the cost and steps of fabrication are decreased. In other words, even when the outer diameter of the gasket **3** is smaller than the inner diameter of the second recession **24**, the spring **32** can still keep the gasket **3** secured inside the second recession **24**. Because of the elasticity of the spring **32**, the gasket **3** is easy to mount into or dismount from the second recession **24**. Therefore, the gasket **3** can be replaced easily.

[0069] (7) As the curvature radius R**1** of the first protrudent strip **17** is greater than the curvature radius R**2** of the arc-sectioned bottom **361**, a gap exists in between the top **18** of the first protrudent strip **17** and the arc-sectioned bottom **361**, which guarantees the formation of the two annular contact areas S**1** and S**2** and the airtightness of the pipe joint.

[0070] (8) As the gasket **3** is made of a metallic material, it is unlikely to swell by imbibing water or another liquid or by heat. Therefore, the present invention can keep the airtightness of the first coupling face **16** and the second coupling face **25** for a long time.

[0071] (9) As the spring **32** having a C-like shape that can deform and recover from deformation in the circumferential direction, it is easy to be expanded and received by the receiving groove **34**. Because of the elasticity of the spring **32**, the gasket **3** is easy to mount into or dismount from the second recession **24**. Therefore, the present invention can convenience the replacement of the gasket **3**.

[0072] The present invention is not limited by the embodiments described above but also includes any modification and variation able to achieve the objectives of the present invention.

[0073] In the above-mentioned embodiments, the first protrudent strip **17** of the first coupling face **16** and the second protrudent strip **26** of the second coupling face **25** have a semi-circle section. However, the protrudent strips of the present invention are not limited to having a semi-circle section. Any convex element protruding from the first coupling face **16** and the second coupling face **25** may also function as the protrudent strip and are also included by the present invention. For example, the protrudent strip may also be a dual-ridged element.

[0074] In the above-mentioned embodiments, the V-sectioned grooves **36** are used as the annular reception/contact members. However, the annular reception/contact members of present invention are not limited to having a V-shaped section. Any groove, which is able to form twofold annular contact areas with the first protrudent strip **17** of the first coupling face **16** and the second protrudent strip **26** of the second coupling face **25**, may also function as the annular reception/contact member and is also included by the present invention, such as the grooves shown in FIG. **4**.

[0075] Refer to FIG. **4**. U-sectioned grooves **36**A having a semi-oval section are respectively formed on two side faces **35** of a gasket **3**A and function as the annular reception/contact members of the present invention. The tops of two sides of the U-sectioned groove **36**A has a width greater than that of the tops of the first protrudent strip **17** and second protrudent strip **26**, but the bottom of the U-sectioned groove **36**A has a curvature radius smaller than that of the tops of the first protrudent strip **17** and second protrudent strip **26**. Therefore, the tops of the first protrudent strip **17** and second protrudent strip **26** contact the two sides of the U-sectioned grooves **36**A. Thus is formed an inner annular contact area and an outer annular contact area on the U-sectioned groove **36**A. Thereby, superior airtightness is achieved.

[0076] The present invention also includes an embodiment that only one side face **35** of the gasket body **31** has the annular reception/contact member, and the opposite side face **35** has none annular reception/contact member. The present invention also includes an embodiment that both side faces **35** have different types of annular reception/contact members. For example, one side face **35** has the V-sectioned groove **36** shown in FIG. **2**, and the opposite side face **35** has the U-sectioned groove **36**A shown in FIG. **4**.

[0077] Below are shown the tests for comparing the present invention with the conventional technology.

[0078] The leakage tests are undertaken for the gasket and pipe joint described in the above-mentioned embodiments and the conventional gasket and pipe joint:

[0079] 1. Test item

[0080] Finding the locking torque guaranteeing that none leakage occurs

[0081] 2. Test conditions

[0082] Including number of samples, locking torque, test gas, and lower limit of leakage

[0083] (1) number of samples: 5

[0084] (2) test gas: helium

[0085] (3) locking torque: 5, 6.5, 8, 10, 15, 20, 25, 30 N·m

[0086] (4) lower limit of leakage: 6.55×10^{-9} Pa/s (5×10^{-11} torr/s)

[0087] 3. Test method

[0088] (1) Close the pipe on one side of the pipe joint, and switching on a valve to interconnect the pipe on the other side to a vacuum pump

[0089] (2) Evacuate the interior of the pipe joint, switching off the valve and dismounting the vacuum pump

[0090] (3) Place the pipe joint in a container filled with helium for a specified period of time

[0091] (4) Take out the pipe joint, and use a leakage test apparatus to test leakage

[0092] (5) Vary the locking torque, and repeat the steps of from (1) to (4)

[0093] 4. Results and analysis

[0094] FIG. **5** shows the test results of the pipe joint using the present invention, and FIG. **6** shows the test results of the pipe joint using the conventional technology (shown in FIG.

7 and FIG. 8), wherein the vertical axis denotes the leakage rate (Pa/s) and the horizontal axis denotes the locking torque (N·m).

[0095] In the test for the present invention, when the locking torque is 5 N·m, the leakage rate of only one sample is below the lower limit. When the locking torque is 6.5 N·m, the leakage rates of four samples are below the lower limit. When the locking torque is 8 N·m, the leakage rates of all samples are below the lower limit.

[0096] In the test for the conventional technology, not all the samples are below the lower limit until the locking torque reaches as high as 30 N·m. Thus, the present invention can achieve the same airtightness with only a locking torque of no less than 8 N·m.

[0097] In other words, the present invention can use a smaller locking torque than the conventional technology to achieve identical airtightness; and the present invention can use identical locking torque to achieve higher airtightness than the conventional technology.

[0098] Furthermore, the present invention not only can lock together two pipes airtightly but also can couple together two workpieces seamlessly.

[0099] The embodiments described above are only to exemplify the present invention but not to limit the scope of the present invention. Therefore, any modification or variation according to the characteristics or spirit of the present invention is to be also included within the scope of the present invention.

What is claimed is:

1. A gasket, interposed in between two coupling faces of a first pipe and a second pipe interconnecting to said first pipe with each of said two coupling faces having at least one annular protrudent strip, and characterized in said gasket has at least one annular reception/contact member corresponding to said annular protrudent strip, and said annular protrudent strip is pressed against said annular reception/contact member to form a twofold airtight mechanism with an inner annular contact area and an outer annular contact area.

2. The gasket according to claim **1**, wherein said annular reception/contact member is an annular V-sectioned groove having an arc-sectioned bottom and two inclined planes converging toward said arc-sectioned bottom.

3. The gasket according to claim **2**, wherein said two inclined planes extending from tangents of two ends of said arc-sectioned bottom.

4. The gasket according to claim **3**, wherein said annular protrudent strip has a curvature radius greater that that of said arc-sectioned bottom.

5. The gasket according to claim **1**, wherein said gasket has an annular receiving groove along a circumference of said gasket, and said annular receiving groove accommodates an annular spring.

6. The gasket according to claim **1**, wherein said annular protrudent strip has a semi-circle section.

7. The gasket according to claim **1**, wherein said gasket is made of a highly corrosion-resistant material.

8. The gasket according to claim **7**, wherein said gasket is made of nickel or a stainless steel.

9. A pipe joint,

comprising

a first pipe;

a second pipe interconnecting to said first pipe, wherein each of two coupling faces of said first pipe and said second pipe has at least one annular protrudent strip;

a gasket interposed in between said two coupling faces of said first pipe and said second pipe; and

a nut used to lock together said first pipe and said second pipe both having clamped said gasket,

and characterized in

that said gasket has at least one annular reception/contact member corresponding to said annular protrudent strip, and

that said annular protrudent strip is pressed against said annular reception/contact member to form a twofold airtight mechanism with an inner annular contact area and an outer annular contact area.

10. The pipe joint according to claim **9**, wherein said annular protrudent strip has a semi-circle section.

11. The pipe joint according to claim **9**, wherein said annular reception/contact member is an annular V-sectioned groove having an arc-sectioned bottom and two inclined planes converging toward said arc-sectioned bottom.

12. The pipe joint according to claim **11**, wherein said two inclined planes respectively extend from tangents of two ends of said arc-sectioned bottom.

13. The pipe joint according to claim **11**, wherein said annular protrudent strip has a curvature radius greater that that of said arc-sectioned bottom.

14. The pipe joint according to claim **9**, wherein said gasket has an annular receiving groove along a circumference of said gasket, and said annular receiving groove accommodates an annular spring.

15. The pipe joint according to claim **9**, wherein said gasket is made of a highly corrosion-resistant material.

16. The pipe joint according to claim **15**, wherein said gasket is made of nickel or a stainless steel.

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