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MULTIPLE SEAL RING

This invention relates to an O-ring, and more particularly to a multiple seal ring.

Referring to Fig. 1, a conventional O-ring 11 is
5 in a connecting device 13 adapted for interconnecting two
metal tubes 12. The connecting device 13 includes two
annular connecting members or flanges 131 sleeved
respectively on the metal tubes 12, an inner ring 132
clamped between the connecting members 131, and a locking
10 unit 133 for locking the connecting members 131 on each
other. The O-ring 11 is sleeved on the inner ring 132 to
seal a gap 130 formed between the connecting members 131
and in fluid communication with the metal tubes 12, so as
to prevent the fluid passing through the metal tubes 12
15 from leakage via the gap 130.

When the fluid is corrosive, the O-ring 11 is apt to
degrade or corrode due to long-term contact with the fluid.

The object of this invention is to provide a multiple
seal ring.

20 According to this invention, a multiple seal ring
includes an annular flexible main ring body, and an annular
flexible auxiliary ring body unit extending integrally,
radially, and outwardly from an outer periphery of the main
ring body and being of a cross-section having a maximum
25 thickness, which is more than or equal to the maximum
thickness of the main ring body. The auxiliary ring body
unit has at least one portion being of a cross-section

having a thickness, which is less than the maximum thickness of the main ring body.

When degradation or corrosion of the main ring body occurs due to long-term contact between the main ring body and chemical fluid so that the main ring body no longer
5 has the sealing function, the auxiliary ring body unit can maintain the sealing function of the multiple seal ring.

These and other features and advantages of this invention will become apparent in the following detailed
10 description of the preferred embodiments of this invention, with reference to the accompanying drawings, in which:

Fig. 1 is a schematic sectional view illustrating that a conventional O-ring is used in a connecting device adapted for interconnecting two metal tubes;

15 Fig. 2 is a schematic sectional view of the first preferred embodiment of a multiple seal ring according to this invention, which is used in a connecting device adapted for interconnecting two metal tubes;

Fig. 3 is a schematic sectional view of the first
20 preferred embodiment when it is not clamped;

Fig. 4 is a view similar to Fig. 3 but illustrating a modified auxiliary ring body unit;

Fig. 5 is a schematic sectional view of the first preferred embodiment when it is clamped;

25 Fig. 6 is a schematic sectional view of the second preferred embodiment of a multiple seal ring according to this invention, which is used in a connecting device adapted

for interconnecting two metal tubes;

Fig. 7 is a schematic sectional view of the second preferred embodiment when it is not clamped;

Fig. 8 is a view similar to Fig. 7 but illustrating a modified auxiliary ring body unit; and

Fig. 9 is a schematic sectional view of the second preferred embodiment when it is clamped.

Before the present invention is described in greater detail in connection with the preferred embodiments, it should be noted that similar elements and structures are designated by like reference numerals throughout the entire disclosure.

Referring to Figs. 2 and 3, the first preferred embodiment of a multiple seal ring according to this invention is used in a connecting device 3 adapted for interconnecting two metal tubes 2. The connecting device 3 includes two annular connecting members or flanges 31 defining an annular gap 30 therebetween, an inner ring 32 clamped between the connecting members 31, and a locking unit 33 for locking the connecting members 31 on each other. The annular gap 30 includes a wide gap portion 301 disposed at an inner end thereof and having a first width (W1) in a direction perpendicular to the plane of the multiple seal ring, and a narrow gap portion 302 extending outwardly from an outer end of the wide gap portion 301 and having a second width (W2) in the direction, which is less than the first width (W1).

The multiple seal ring is disposed between the connecting members 31 to establish a liquid-tight seal therebetween so as to prevent a fluid from flowing through the gap 30, and includes an annular flexible main ring body 4 and an annular flexible auxiliary ring body unit 5. The main ring body 4 is sleeved on the inner ring 32 of the connecting device 3, is disposed in the narrow gap portion 302, and is of a circular cross-section having a maximum thickness (t) in the direction. The auxiliary ring body unit 5 extends integrally, radially, and outwardly from an outer periphery of the main ring body 4, and includes two interconnected auxiliary ring bodies 51 arranged in a radial direction of the main ring body 4 and disposed in the narrow gap portion 302. Each of the auxiliary ring bodies 51 is of a frustoconical cross-section having a maximum thickness in the direction, which is more than or equal to the maximum thickness (t) of the main ring body 4. The thickness of the frustoconical cross-section reduces gradually in a direction toward the main ring body 4. In this embodiment, the maximum thickness of each of the auxiliary ring bodies 51 is slightly more than that of the main ring body 4. That is, the thickness of at least one portion of each of the auxiliary ring bodies 51 is less than the maximum thickness (t) of the main ring body 4. Since each of the main ring body 4 and the auxiliary ring bodies 51 seals the gap 30, when the degradation or corrosion of the main ring body 4 occurs, the auxiliary

ring bodies 51 still can prevent the fluid from flowing through the gap 30, thereby maintaining the sealing function of the multiple seal ring. The shapes of the cross-sections of the auxiliary ring bodies 51 may be changed, as long as the maximum thicknesses of the auxiliary ring bodies 51 are more than or equal to the maximum thickness (t) of the main ring body 4. In addition, the number of the auxiliary ring bodies 51 may be increased or reduced.

10 With particular reference to Figs. 2 and 5, the multiple seal ring can be clamped between the connecting members 31 to deform. When a negative pressure is kept in the metal tubes 2, the gap-sealing effect of the deformed multiple seal ring can be increased.

15 Referring to Figs. 6 and 7, the second preferred embodiment of a multiple seal ring according to this invention is also applied to the connecting device 3. In this embodiment, the multiple seal ring includes an annular flexible main ring body 4, a flexible auxiliary ring body unit 5, and an inner ring body 6. The main ring body 4 is clamped between the connecting members 31 of the connecting device 3, and is of a circular cross-section having a maximum thickness (t) in a direction perpendicular to the plane of the multiple seal ring. The auxiliary ring body unit 5 includes two interconnected auxiliary ring bodies 51 arranged in a radial direction of the main ring body 4. Similar to the first preferred embodiment, each of the

auxiliary ring bodies 51 is of a frustoconical cross-section having a maximum thickness in the direction, which is more than or equal to the maximum thickness (t) of the main ring body 4. The thickness of the frustoconical cross-section reduces gradually in a direction toward the main ring body 4. The inner ring body 6 extends inwardly from an inner periphery of the main ring body 4, is received fittingly in the wide gap portion 301 for replacing the inner ring 32 (see Fig. 2) of the connecting device (3), and is of a rectangular cross-section. When the degradation or corrosion of the main ring body 4 occurs, the auxiliary ring body unit 5 still can seal the gap 30 to maintain the sealing function of the multiple seal ring.

The multiple seal ring can be clamped to deform. When a negative pressure is kept in the metal tubes 2, the gap-sealing effect of the deformed multiple seal ring can be increased, as shown in Fig. 9. When a positive pressure is kept in the metal tubes 2, the peripheral portion of the inner ring body 6 is pressed against shoulders 311 of the connecting members 31 disposed between the wide gap portion 301 and the narrow gap portion 302, thereby sealing the gap 30.

In view of the above, either the main ring body 4 or the auxiliary ring body unit 5 can seal the gap 30. When the degradation or corrosion of the main ring body 4 occurs, the auxiliary ring body unit 5 still can seal the gap 30 to prevent leakage of the fluid from the metal tubes 2 via

the gap 30.

CLAIMS:

1. A multiple seal ring disposed between two annular connecting members to establish a liquid-tight seal therebetween, the annular connecting members defining an annular gap therebetween, the gap including a wide gap portion disposed at an inner end thereof and having a first width in a direction perpendicular to the plane of the multiple seal ring, and a narrow gap portion extending outwardly from an outer end of the wide gap portion and having a second width in the direction, which is less than the first width, the multiple seal ring comprising:

an annular flexible main ring body of a cross-section having a maximum thickness in the direction, the main ring body being adapted to be disposed in the narrow gap portion; and

an annular flexible auxiliary ring body unit extending integrally, radially, and outwardly from an outer periphery of the main ring body and being of a cross-section having a maximum thickness in the direction, which is more than or equal to the maximum thickness of the main ring body, the auxiliary ring body unit being adapted to be disposed in the narrow gap portion, the thickness of at least one portion of the auxiliary ring body unit being less than the maximum thickness of the main ring body.

2. The multiple seal ring as claimed in Claim 1, wherein

the auxiliary ring body unit includes an auxiliary ring body extending integrally from the outer periphery of the main ring body and being of a cross-section having a maximum thickness in the direction, which is more than
5 or equal to the maximum thickness of the main ring body, the auxiliary ring body having at least one portion being of a cross-section having a thickness in the direction, which is less than the maximum thickness of the main ring body.

10 3. The multiple seal ring as claimed in Claim 2, wherein the cross-section of the main ring body is circular.

4. The multiple seal ring as claimed in Claim 2, wherein the cross-section of the auxiliary ring body is frustoconical, and has a thickness in the direction,
15 which reduces gradually in a direction toward the main ring body.

5. The multiple seal ring as claimed in Claim 1, wherein the auxiliary ring body unit includes a plurality of consecutive auxiliary ring bodies arranged in a radial
20 direction of the main ring body, each of the auxiliary ring bodies being of a cross-section having a maximum thickness in the direction, which is more than or equal to the maximum thickness of the main ring body.

6. The multiple seal ring as claimed in Claim 5, wherein
25 the cross-section of the main ring body is circular.

7. The multiple seal ring as claimed in Claim 5, wherein the cross-section of each of the auxiliary ring bodies

is frustoconical, and has a thickness in the direction, which reduces gradually in a direction toward the main ring body.

- 5 8. The multiple seal ring as claimed in Claim 1, further comprising an inner ring body extending inwardly from an inner periphery of the main ring body and being adapted to be received fittingly in the wide gap portion.
9. The multiple seal ring as claimed in Claim 8, wherein the cross-section of the inner ring body is rectangular.