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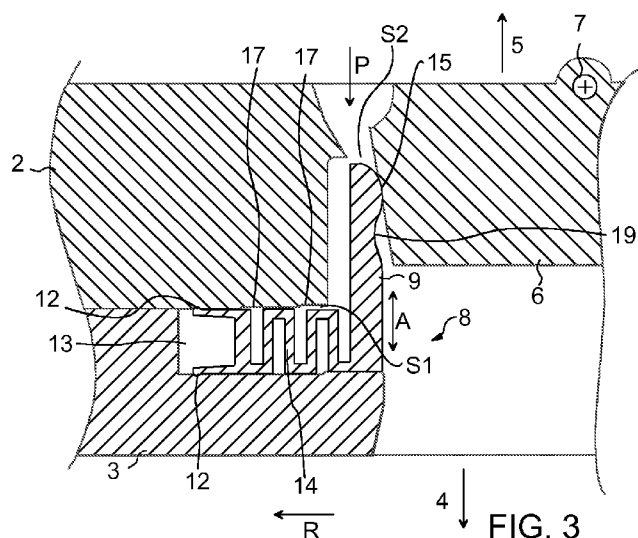
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(54) Title: VALVE AND SEALING RING



(57) Abstract: The present invention relates to a valve (1) comprising a closing means (6) arranged in a flow channel and movable in the flow channel, and a sealing ring (8), which comprises at least a first sealing point (9) and a second sealing point (11), the first one of which is arranged to be set tightly against the closing means (6) and the second one tightly against a body (2, 3). In all situations, the first and second sealing point (9, 11) of the tight valve are arranged radially at a distance from one another, and to allow said first sealing point (9) to move in the axial direction (A) with respect to said second sealing point (11) due to fluid pressure, the sealing ring (8) is provided with a bellows (14) between said first sealing point (9) and said second sealing point (11), and the body (2, 3) is provided with space for allowing said axial movement (A).

VALVE AND SEALING RING

Field of the invention

The present invention relates to a valve and a sealing ring and particularly to a solution providing a structure, by which the tightness of a valve
5 can be ensured.

Description of prior art

There is known a valve in which a flow channel is provided with a closing means, which can be moved by means of a shaft protruding from the closing means. The closing means is pressed against a sealing ring at the
10 valve body when the closing means, in the closed position, closes a flow path between a first and second opening of the valve.

A problem with the above-mentioned known valve is tightness in each situation, notwithstanding on which side of the closing means pressure affects the closing means. Under pressure, the closing means, the shaft of the
15 closing means or even the bearing points of the shaft may yield to such an extent that the closing means moves with respect to the body, whereupon the valve starts to leak.

Summary of the invention

It is an object of the present invention to provide a solution, by
20 which the tightness of a valve may be improved further. This object is achieved by a valve as claimed in independent claim 1, and a sealing ring as claimed in independent claim 9.

A tighter valve is provided by utilising a valve, in which a bellows is provided between a first and second sealing point of the sealing ring. The bel-
25 lows allows the first sealing point to move axially with respect to the second sealing point. Due to the axial movement, the first sealing point may move due to pressure and the valve tightness may be maintained more efficiently regardless of the direction of flow over the valve or a great pressure difference.

Brief description of the figures

30 The invention will be described in the following in greater detail by way of example and with reference to the accompanying figures, in which:

2

Figure 1 shows a first embodiment of a valve according to the invention,

Figure 2 shows a first embodiment of a sealing ring according to the invention,

5 Figure 3 shows the operation of the sealing ring when pressure is applied from the side of a closing means,

Figure 4 shows the operation of the sealing ring when pressure is applied from the side of the sealing ring, and

Figure 5 shows a second embodiment of the sealing ring.

10 Description of at least one embodiment

Figure 1 shows a first embodiment of a valve 1 according to the invention. In this embodiment, it is assumed by way of example that a valve body comprises at least two parts, the larger one of which will be called a casing 2 and the smaller one a flange ring 3. In practice, the flange ring 3 may be
15 attached to the casing 2 by bolts, for instance, whereupon a sealing ring 8 arranged between the flange ring 3 and the casing 2 is fixed in its place in a gap provided between these contact surfaces.

A flow channel between a first opening 4 and second opening 5 of the valve 1 is provided with a closing means 6 having a protruding shaft 7, by
20 which the closing means may be moved in the flow channel to close and open, respectively, a flow connection between the first opening 4 and the second opening 5. In practice, the shaft 7 of Figure 1 may be connected to an actuator, which rotates the shaft 7 during use so that the closing means 6 turns to a desired position in the flow channel. In the case of Figure 1, the flow connection
25 is open. In the closed position of the closing means 6, the sealing ring 8 is arranged to be pressed between the valve body and the closing means 6 to close the flow connection between the first 4 and the second opening 5.

The example of Figure 1 shows that the closing means 6 consists of a flap, i.e. a round disk, the side of which facing the sealing ring 8 in the closed
30 position is flat. However, this is not necessary in all embodiments, but the shape of the closing means may also be different. It may deal with a ball valve, in which case the closing means is ball-shaped. Furthermore, the surface of the closing means that comes into contact with the sealing ring 8 may be elliptical (as in Figures 3 and 4). If the shape of the closing means is elliptical, it

may, when coming into contact with a circular sealing ring, change the shape of the sealing ring elliptical.

The body parts, in this case the casing 2 and the flange ring 3, of the valve as shown in Figure 1 and the closing means 6 are preferably made of
5 a metal suitable for the purpose, such as steel.

Figure 2 shows a first embodiment of the sealing ring according to the invention. The sealing ring 8 of Figure 2 is suitable for use in the valve of Figure 1, for instance. Only a part of the sealing ring 8 is shown in Figure 2 in order to illustrate its shape by means of the cross section of the ends.

10 In the example of Figure 2, the sealing ring comprises a mainly cylindrical first sealing point 9 and a protrusion 10 protruding from the first sealing point 9. In this example, the protrusion 10 protrudes in the radial direction R (arrow R in Figures 3 and 4) outwards from the first sealing point 9. A protrusion refers as a whole to a part which protrudes in some direction outwards
15 from a sealing point, i.e. a part protruding radially outwards in the example of Figure 2, and a portion of which is shaped into a bellows and the end of which that is distally located to a sealing point is provided with a second sealing point 11.

The protrusion 10 comprises a sealing point 11 radially at a distance
20 from the first sealing point 9. The expression "radially at a distance" means that the first sealing point 9 and the second sealing point 11 are at different distances from the central axis of the sealing ring. However, a line that is thought to run via the first sealing point 9 and the second sealing point 11 is not necessarily parallel to the radius of the sealing ring. In other words, it is not neces-
25 sary that the protrusion 10 protrudes specifically in the radial direction R, but it is possible that it protrudes in a direction that forms an angle to the radial direction R of the sealing ring, whereby the first sealing point 9 and the second sealing point 11 are nevertheless located radially at a distance from one another.

In the examples of Figures 2 to 4, the second sealing point 11 comprises two opposite sealing surfaces 12, which are sealed against the valve 1
30 body during use. However, two sealing surfaces are not required in all embodiments, and the structure of the sealing point 11 may also vary in other ways known to a person skilled in the art.

A bellows 14 is formed between the second sealing point 11 and the
35 first sealing point 9 in the sealing ring 8 to allow the first sealing point 9 to

move in the axial direction A (Figures 3 and 4) with respect to the second sealing point 11 of the protrusion 10. In the example of Figure 2, this bellows 14 is provided specifically at the protrusion 10. A bellows refers to a back and forth winding structure as shown in Figure 2, for example, which allows a larger axial movement for the first sealing point 9 without making the material exceed its yield point, for instance, or leading to cracks in the sealing ring material caused by material fatigue, compared to a situation where no bellows is applied. Due to springing of the bellows 14, the first sealing point 9 may move continuously in the axial direction although the second sealing point 11 of the protrusion 10 remains in its place.

The sealing ring 8 is not necessarily circular, but may also be elliptical, for instance. Furthermore, it is possible that the sealing ring 8 is circular but changes its shape (elliptical, for instance) when the closing means is pressed against it to close the flow path. The sealing ring of Figure 8 also allows radial mobility, i.e. centring of the sealing.

In the example of Figure 2, the first sealing point 9 comprises a recess 19 on the inner surface for providing space for rotational motion of the closing means 6. The sealing ring 8 may be made of a material required by the application, such as metal, rubber or plastic. If it deals with a sealing ring of a valve that must withstand very high pressures (even 120 bar or more), the sealing ring is preferably made of metal, such as steel.

Figure 3 shows the operation of the sealing ring 8 when pressure is applied to the side of the closing means, and Figure 4 shows the operation of the sealing ring 8 when pressure is applied from the side of the sealing ring. In Figures 3 and 4, the sealing ring according to Figure 2 is mounted on the valve 1 of Figure 1.

In the embodiment of Figures 3 and 4 the second sealing point of the sealing ring 8, comprising the sealing surfaces 12, is arranged in a gap 13 provided at the interface between the casing 2 and the flange ring 3 forming the valve body. However, such a gap is not necessary in all embodiments, but the sealing ring may be tightly attached to the body by an alternative solution.

In the case of Figure 3, pressure of the fluid in the flow channel of the valve affects from the side of the closing means, i.e. in the direction shown by arrow P. Thus, when the closing means 6 is in the closed position as shown by Figure 3, it is pressed more tightly against the first sealing point 9 of the

sealing ring 8 due to pressure. In this example, the inner surface of the sealing ring comprises a sealing surface 15, against which the closing means 6 is pressed. The opposite sealing surfaces 12 at the sealing point 11 of the protrusion 10 of the sealing ring 8 are, for their part, sealed against the side walls of the groove 13. Leakage of the fluid through the sealing surfaces 12 and 15 is thus prevented.

In the case of Figure 4, pressure affects the closing means 6 from the opposite direction (compared to Figure 3), i.e. from the direction of the sealing ring 8, as shown by arrow P. The fluid pressure thus tends to move the closing means 6 away from the sealing ring 8. In this example, the bellows 14 formed at the protrusion 10 of the sealing ring 8 thus allows the first sealing point 9 of the sealing ring 8 to move in the axial direction A towards the closing means 6, i.e. upwards in Figure 4. Such an axial movement is made possible by back and forth winding portions of the bellows 14, which improve the springing characteristics of the sealing ring 8 considerably.

The axial movement of the first sealing point 9 of the sealing ring 8 is produced by the same fluid pressure P in the flow channel that also affects the closing means 6. In the example of Figure 4, this fluid pressure can affect through an unsealed surface or gap 16 between the protrusion 10 of the sealing ring 8 and the wall of the groove 13, whereupon pressure presses the protrusion 10 and/or bellows 14 of the fluid-impermeable sealing ring 8 upwards in Figure 4, making the bellows 14 yield. Thus, the first sealing point 9 moves in the axial direction A towards the closing means 6, as a result of which a tight contact between the closing means 6 and the first sealing point 9 remains also when the closing means 6 is able to move upwards in Figure 4 due to pressure P. To allow the axial movement, the valve body 2, 3 and the groove 13 are shaped in such a manner that a required space is provided for the movement. Figure 3 shows such a first space S1 at the gap 13 and a second space S2 at the body above the first sealing point 9.

To control the springing movement of the bellows 14 and thereby the length of the axial movement of the first sealing point by taking into account the characteristics of the material (to avoid immediate material damage or fatigue-induced damage), the wall of the groove 13 on the side of the closing means 6 is arranged at a predetermined distance from the bellows 14 in the embodiment of Figure 4. Hence, after a predetermined axial movement the

bellows 14 comes into contact with the wall of the groove 13, and the springing movement is made to stop in a controlled manner and in good time before any material damage is caused.

In the embodiment of Figures 3 and 4, the side wall of the groove 13 on the side of the closing means 6 is also provided with steps 17, which are seen most clearly in Figure 3. Instead of the steps, the surface of the side wall at that point may have a bevelled shape in the cross section shown by the figure. It is essential that the springing movement of the bellows can be ended in a controlled manner after a specific, predetermined displacement.

To control uncontrolled vibration of the sealing ring 8 and particularly the first sealing point thereof when the closing means 6 is entirely or partly in the open position in which it allows a flow through the flow channel, the sealing ring 8 is prestressed in an embodiment. In the example of Figures 3 and 4, this is achieved by providing the side wall of the groove 13 with an elevation 18, which can be seen most clearly in Figure 4. Due to this elevation, a desired prestress is produced at the bellows 14 of the ready-fitted sealing ring 8 also during flow, preventing or substantially reducing vibration of the sealing ring during flow.

To prevent the second sealing point 9 from moving away from the closing means 6 due to pressure, the valve body, for instance the casing 2, may, in contrast to the embodiment of Figures 3 and 4, be provided with a support member, which is in contact with the sealing ring 8 and prevents it from moving away from the closing means.

Figure 5 shows a second embodiment of the sealing ring 8'. The embodiment of Figure 8 corresponds to a great extent to the embodiment explained in connection with Figures 1 to 4, wherefore the embodiment of Figure 5 is explained in the following primarily by disclosing differences between these embodiments.

Also in the embodiment of Figure 5, the sealing ring 8' comprises a first sealing point 9 and a protrusion 10' which protrudes from the first sealing point and for which a groove 13' is provided at the valve body. However, the body consisting of the casing 2' and the flange ring 3' is shaped in a different manner than in the previous embodiment. Thus, the groove 13' is not straight, but the protrusion 10' of the sealing ring 8' that is inserted thereto is in this example shaped so as to extend past the two corners in the groove 13'. In this

example, the sealing point 11 radially at a distance from the first sealing point 9 of the protrusion 10' comprises a graphite seal 22.

Similarly as in the previous embodiment, a bellows 14 is provided between the second sealing point 11 and the first sealing point 9 in the sealing ring 8' to allow the first sealing point 9 to move in the axial direction A with respect to the sealing point 11 of the protrusion 10'. To allow the axial A movement of the first sealing point, the groove 13 is provided with a space S1 for axial springing movement of the bellows, and the body is also shaped so that there is provided a space S2 above the first sealing point 9 (in Figure 5) for allowing the first sealing point 9 to move axially upwards therein.

When fluid pressure is applied to the closing means 6 in the direction of arrow P, fluid may leak from a gap 16 (or an unsealed surface) between the protrusion 10' and the side wall of the groove into a space 20, i.e. a space between the protrusion 10' and the flange ring 3' in Figure 5. This fluid pressure causes the springing movement of the bellows 14, due to which the first sealing point 9 moves in the axial direction A towards the closing means 6.

Also in the embodiment of Figure 5, the bellows 14 may be prestressed, the prestress being produced as a result of the uppermost surface 21 of the flange ring 3' in Figure 5 being in contact with the protrusion 10'. Hence, when the closing means 6 is in a position allowing a flow through the valve, the prestress of the bellows 14 prevents the vibration of the sealing ring 8'.

It is also explained in the above by way of example that the sealing ring and the closing means may be made of a suitable metal material, such as steel. In this case, the sealing surfaces themselves, i.e. the sealing surface of the first sealing point and the sealing surfaces at the second sealing point of the sealing ring, may provide sealing by means of a metal-metal contact. Alternatively, it is possible that a suitable sealing material, such as rubber, plastic or graphite, is provided at the sealing surface points.

It is to be understood that the above description and the related figures are only intended to illustrate the present invention. It will be obvious to a person skilled in the art that the invention may also be varied and modified in other ways without departing from the scope of the invention.

Claims

1. A valve (1) comprising,
provided at a valve body (2, 3; 2', 3'), a first opening (4), a second
5 opening (5), and a flow channel connecting the first and the second opening
for allowing a flow between the first (4) and the second opening (5),
a closing means (6) arranged in the flow channel and being mov-
able in the flow channel by means of a shaft (7) to close and open, respec-
tively, a flow connection between the first opening (4) and the second opening
10 (5), and
a sealing ring (8, 8') comprising at least a first sealing point (9) and
a second sealing point (11), the first one of which is arranged to be set tightly
against the closing means (6) and the second one tightly against the body (2,
3, 2', 3') to seal a gap between the body (2, 3; 2', 3') and the closing means (6),
15 **characterized in**
that said first and second sealing point (9, 11) are arranged ra-
dially at a distance from one another,
that, to allow said first sealing point (9) to move in the axial direc-
tion (A) with respect to said second sealing point (11) due to fluid pressure, the
20 sealing ring (8, 8') is provided with a bellows (14) between said first sealing
point (9) and said second sealing point (11), and
that at least the body (2, 3; 2', 3') is provided with space (S1, S2) for
allowing said axial (A) movement.
2. A valve as claimed in claim 1, **characterized in**
25 that a groove (13) for said second sealing point (11) is arranged in
the body (2, 3; 2', 3') of the valve (1),
that the bellows (14) is inserted at least partly into said groove (13),
that, on the inner surface, the first sealing point (9) comprises a
sealing surface (15), against which the closing means (6) is set to close the
30 flow connection,
that the bellows (14) and said groove (13) are dimensioned with
respect to one another so that they provide a space (S1) in the groove for al-
lowing an axial movement (A) of the bellows in the groove (13), and

that an unsealed surface or gap (16) is arranged between the sealing ring and a wall of said groove (13) on the side of the sealing ring opposite to the closing means (6), via which fluid pressure may affect the sealing ring to press the first sealing point (9) in the axial direction (A) towards the closing means (6).

3. A valve as claimed in claim 2, **characterized** in that the sealing ring and the wall of the groove (13) are arranged to be pressed against one another to provide an axial (A) prestress at the sealing ring.

4. A valve as claimed in claim 2 or 3, **characterized** in that, to limit the length of the axial (A) movement of said first sealing point (9), the wall of the groove (13) is arranged at a predetermined distance from the part (10, 14) of the sealing ring, with which said wall comes into contact after the axial (A) movement of a predetermined length of the first sealing point (9).

5. A valve as claimed in claim 2 or 3, **characterized** in that the wall of the groove (13) on the side of the closing means (6) is provided with steps (17) that limit the axial (A) movement of the bellows (14).

6. A valve as claimed in any one of claims 1 to 5, **characterized** in that said sealing ring (8, 8') is made of metal.

7. A valve as claimed in any one of claims 1 to 6, **characterized** in

that the closing means (6) is arranged to rotate around said shaft (7) so that, in the closed position, the closing means (6) protrudes partly into the sealing ring and is set against the sealing surface (15) on the inner surface of the first sealing point (9), and

that the first sealing point (9) comprises a recess (19) on the inner surface for providing space for rotational motion of the closing means (6).

8. A valve as claimed in any one of claims 2 to 7, **characterized** in that the valve body (2, 3; 2', 3') consists of at least two parts (2, 3; 2', 3') attached to one another, said groove (13) being provided on a contact surface between these parts.

9. A sealing ring (8, 8') comprising:

a first sealing point (9) and

a second sealing point (11), **characterized** in

that said first and second sealing point (9, 11) are arranged radially at a distance from one another, and

10

that the sealing ring (8, 8') is provided with a bellows (14) between said first and second sealing point (9, 11) to allow the first sealing point (9) to move in the axial direction (A) with respect to the second sealing point (11).

10. A sealing ring as claimed in claim 9, **characterized** in
5 that said sealing ring (8, 8') is made of metal.

11. A sealing ring as claimed in claim 9 or 10, **characterized** in that the first sealing point (9) comprises a sealing surface (15) and a recess (19) on the inner surface for providing space for rotational motion of the closing means (6).

10 12. A sealing ring as claimed in any one of claims 9 to 11, **characterized** in that at least the first or the second sealing point (9, 11) is provided with a separate sealing material (22).

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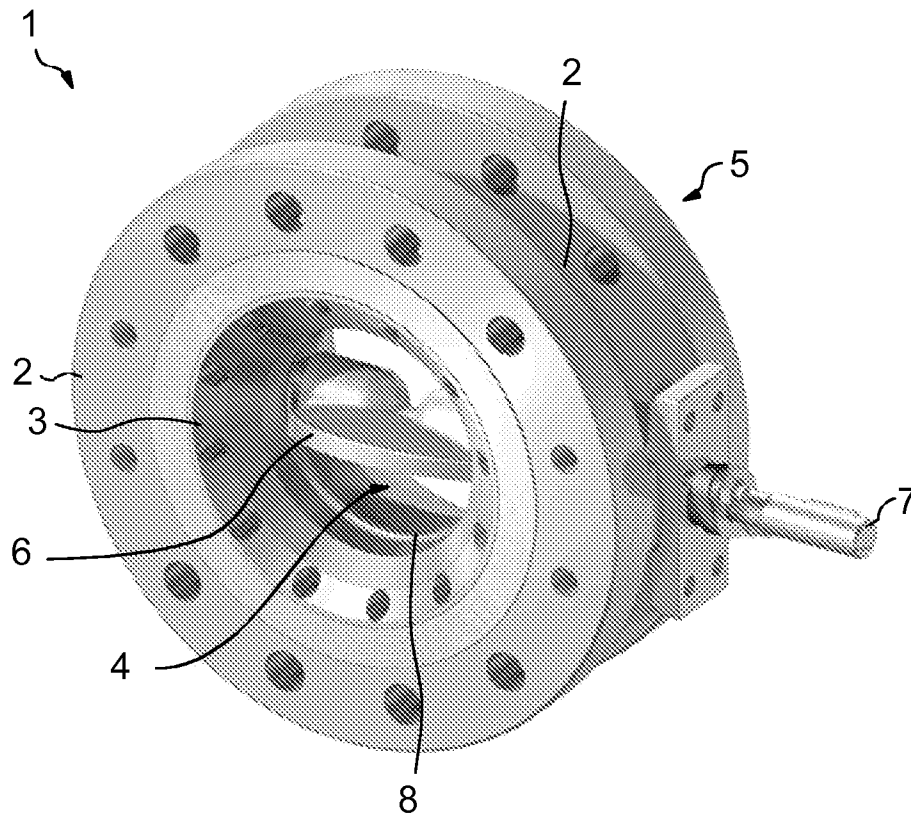


FIG. 1

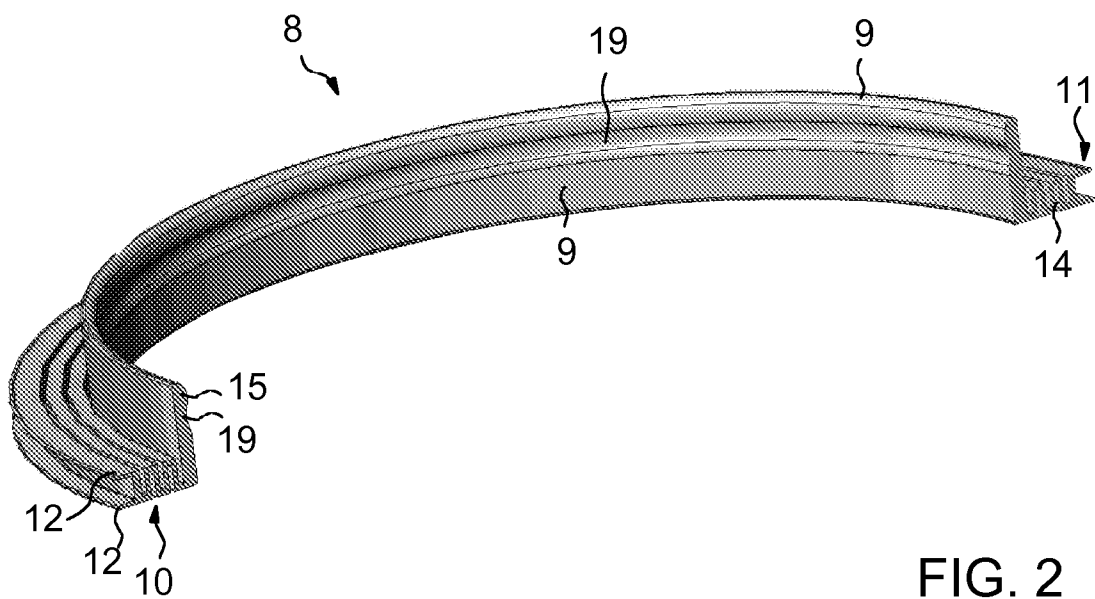
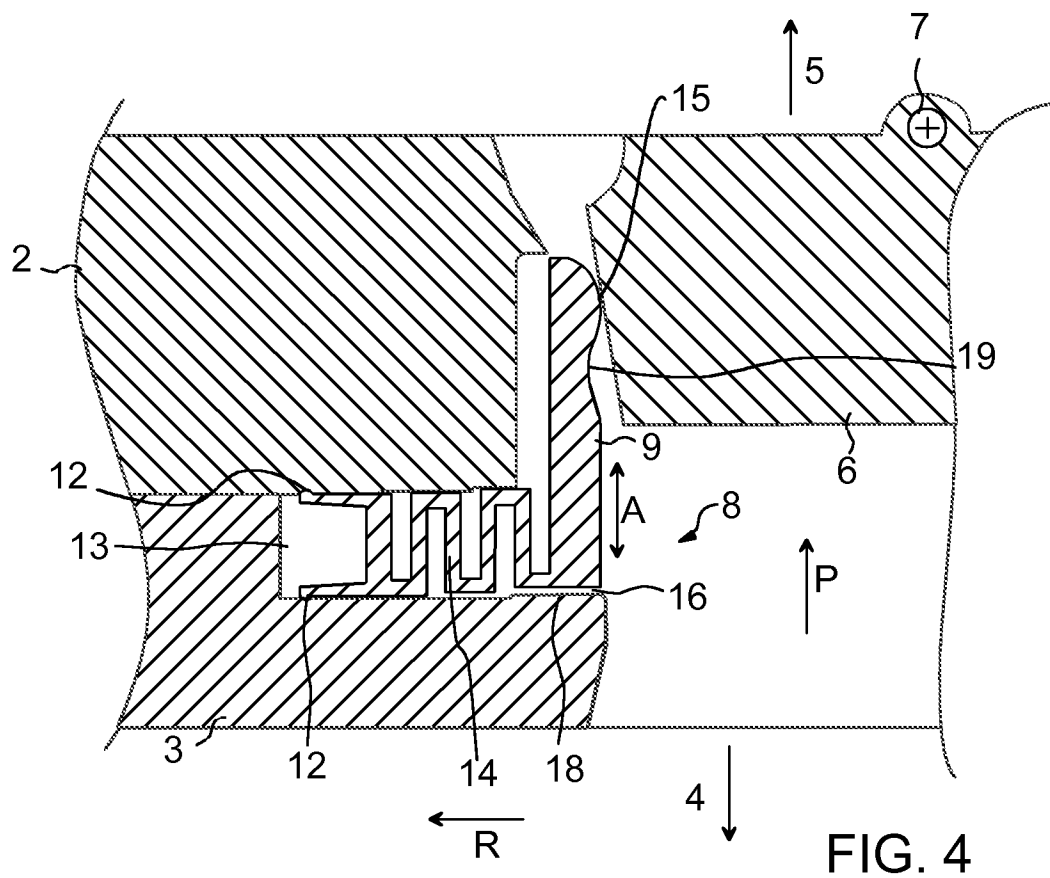
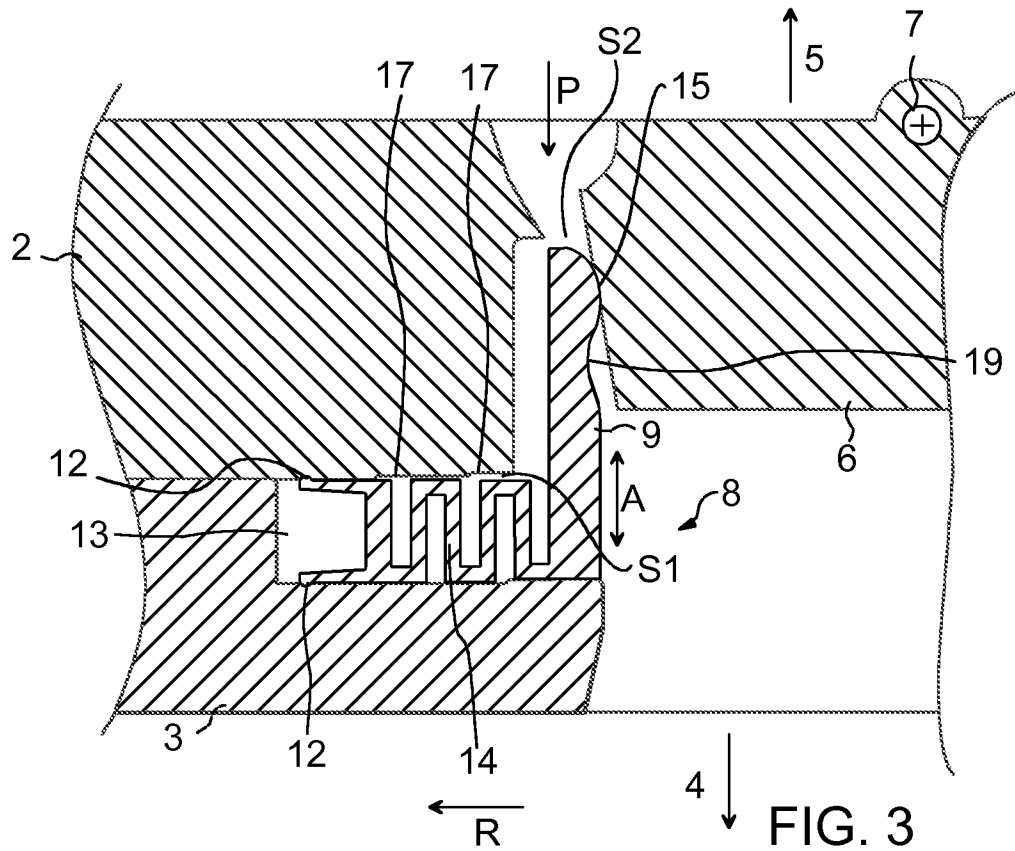
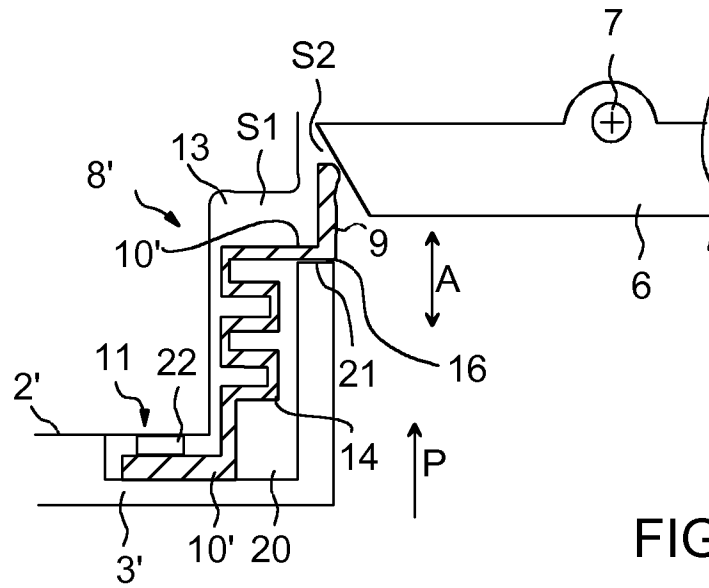


FIG. 2

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2010/051018

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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)

IPC: F16K, F16J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007138429 A1 (HUTCHENS WILBUR D et al.) 21 June 2007 (21.06.2007) abstract; columns [0046] – [0052]; figures 11-13	1-12
X	US 2003164464 A1 (HAUSHAELTER PETER et al.) 04 September 2003 (04.09.2003) abstract; columns [0018] – [0023]; figure 2	1-5, 7-9, 11
X	US 4513946 A (PRIESE WERNER K) 30 April 1985 (30.04.1985) abstract; column 4, lines 25-68; column 5, lines 15-55; column 6 line 45 – column 7, line 11; figures 1-5	1-12
X	US 5685520 A (VELAN ADOLF KAREL) 11 November 1997 (11.11.1997) abstract; column 3, line 25 – column 4, line 34; figures 1-4	1-12
X	FR 2423696 A1 (PONT A MOUSSON) 16 November 1979 (16.11.1979) page 2, line 12 – page 5, line 18; figures 1-3	1-5, 8, 9



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2010/051018

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
US 2007138429 A1	21/06/2007	US 2007215834 A1	20/09/2007
		WO 2007078426 A2	12/07/2007
		JP 2009521652T T	04/06/2009
		EP 1969262 A2	17/09/2008
		CN 101365902 A	11/02/2009
		CA 2634680 A1	12/07/2007
.....			
US 2003164464 A1	04/09/2003	ES 2244840T T3	16/12/2005
		EP 1335158 A2	13/08/2003
		DE 10204787 A1	21/08/2003
.....			
US 4513946 A	30/04/1985	None	
.....			
US 5685520 A	11/11/1997	CA 2177026 A1	22/11/1997
.....			
FR 2423696 A1	16/11/1979	DE 2915889 A1	31/10/1979
.....			

INTERNATIONAL SEARCH REPORT

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CLASSIFICATION OF SUBJECT MATTER

Int.Cl.

F16K 1/228 (2006.01)

F16J 15/16 (2006.01)

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