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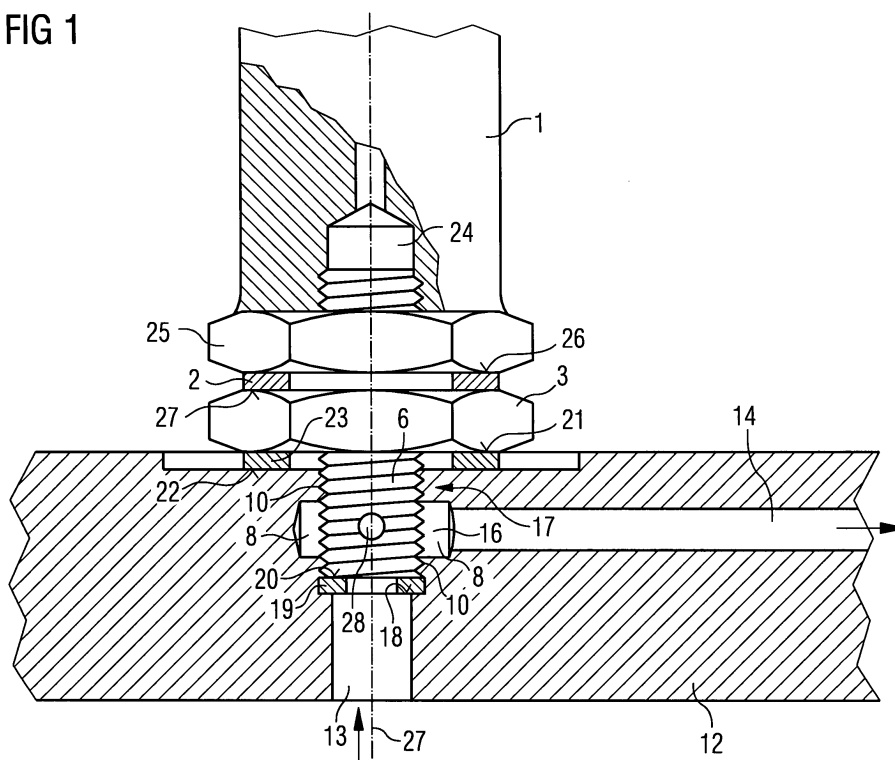
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(54) **Elastomer-free sealing arrangement for a pressure chamber that is connected with a low and high pressure line**

(57) The invention describes a sealing arrangement for a pressure regulator chamber (8) that is connected in an upper part with a low pressure line (14) and in a lower part with a high pressure line (13). For sealing up the high and the low pressure line, a metal sealing element (6,7,23,3) is arranged within the chamber (8) and retained by retaining means (19). For sealing the high pressure line (13) that discharges into a bottom of the chamber (8) a first metallic washer (19) is arranged be-

tween a sealing face that surrounds the orifice of the high pressure line and the bottom of the sealing element. The sealing above the low pressure part of the chamber is attained by a washer that (23) is press-fit between the surface of the body (12) in which the chamber (8) is arranged and a further sealing face that is arranged at an upper end of the sealing element. The sealing faces are arranged perpendicularly to a longitudinal axis of the chamber and the sealing element.

FIG 1



Description

[0001] The invention describes a sealing arrangement for a pressure chamber according the preamble of claim 1.

[0002] Pressure chambers that are connected with a first and a second pressure line are used in different technical fields, for example in fuel injection systems for motor vehicles. In modern fuel injection systems, for example in so-called common rail injection systems, fuel with high pressure is used for the injection. In this system, chambers are provided that are connected with a low pressure line and with a high pressure line.

[0003] In such a chamber for example a pressure regulator is arranged that is connected with the high pressure line and with the low pressure line. Depending on the pressure in the high pressure line the pressure regulator delivers fuel from the high pressure line to the low pressure line. As a known embodiment, the pressure regulator protrudes from an upper opening in the chamber, penetrating the high pressure line with a tip. In an upper part the low pressure line discharges into the chamber. The pressure regulator comprises two openings that are connected with a lower part of the chamber and therefore with the high pressure line and with an upper part of the chamber and therefore with the low pressure line. Between the lower and the upper part of the chamber an annular sealing ring is arranged that seals up the lower part of the chamber. The sealing ring is arranged between the chamber walls and the side surface of the tip of the pressure regulator. Above the upper part of the chamber a second sealing ring is arranged between the walls of the chamber and the surface of the pressure regulator. The pressure regulator is retained by retaining means in the chamber. Using sealing rings has the disadvantage that the sealing ring could be damaged by inserting the pressure regulator into the chamber. Furthermore the sealing ring could slip out of the flute, in which the sealing ring is retained at the pressure regulator.

[0004] The task of the invention is to provide a sealing arrangement for sealing a high pressure line and a low pressure line that discharge into a common chamber, whereby the sealing arrangement is robust and enables a safe sealing of the high and the low pressure line.

[0005] The task of the invention is solved by a sealing arrangement according to claim 1. The advantage of the sealing arrangement according to claim 1 is that the first and the second pressure line are reliably sealed up. Furthermore the sealing arrangement is robust and insensitive to damages during the insertion of a sealing element.

[0006] The advantage of the sealing arrangement is attained by a first and a second sealing face that are embodied as ring faces on the surface of a sealing element and the wall of the chamber. The sealing faces are arranged perpendicularly to a longitudinal axis of the chamber. Furthermore, a first and a second sealing ring

are arranged in the first or the second sealing face, respectively. Additionally the sealing element is pressed in parallel to the longitudinal axis on the body by retaining means.

[0007] In a preferred embodiment of the invention the retaining means are embodied as a thread connection between the sealing element and the wall of the chamber. This embodiment has the advantage that it is not necessary to provide retaining means outside of the body. Therefore the size of the body is relatively small.

[0008] In a preferred embodiment of the invention the sealing element is a tube that is arranged within the chamber. The tube protrudes from an opening of the chamber that is arranged at a surface of the body. The tube provides at a section that is arranged outside of the chamber at an outer surface a nut. The nut comprises at a lower surface a ring face that is dedicated to a surface of the body. Between the nut and the body the second sealing face is arranged and a sealing ring is arranged between the nut and the body. Using a nut has the advantage that the tube could be screwed into the chamber by using the nut and the nut itself has the function of a flange that provides a ring surface.

[0009] In a further preferred embodiment of the invention the tube protrudes into a third fuel line and the tube is connected by a thread with the third fuel line. The third fuel line comprises at an outer side a second nut that is arranged above the first nut, and the second and the first nut comprise ring faces that are dedicated to each other. Between the ring faces of the first and the second nut a third sealing ring is arranged. The second nut is tightly connected with the third fuel line and the second nut is screwed down on the second nut. Therefore the tube is tightly sealed with the third line.

[0010] In a further preferred embodiment of the invention the sealing element is a pressure regulator. The pressure regulator comprises a valve that is connected with the first and the second pressure line. The pressure regulator opens an orifice between the first and the second pressure line if the pressure in the first or the second pressure line exceeds a given pressure value. Therefore it is possible to adjust the pressure in the high pressure line at a predetermined pressure value. Preferably the predetermined pressure value of the pressure regulator could be adjusted.

[0011] A preferred embodiment of the invention is explained according to Figures 1 and 2.

[0012] Figure 1 depicts an embodiment of a sealing arrangement.

[0013] The figure shows a sectional view of a body 12 which comprises a pressure chamber 8 that is connected in an upper part with a first pressure line 14 and in a lower part with a second pressure line 13. In this example the first pressure line 14 is a low pressure line and the second pressure line 13 is a high pressure line. In the high pressure line 13 fuel flows with high pressure. In the low pressure line 14 fuel flows with low pressure.

[0014] The body 12 could for example be part of a high

pressure pump or part of a common rail reservoir that delivers fuel with high pressure to injection valves for injecting the fuel in a combustion chamber of a combustion engine.

[0015] In the shown embodiment the pressure chamber 8 has basically a cylindrical shape, whereby in an upper portion an annular space 16 with a greater diameter than the cylindrical basic shape is arranged. The chamber 8 comprises an opening 17 that is arranged at an upper surface of the body 12. The high pressure line 13 discharges from below into the lower part of the pressure chamber 8. The low pressure line 14 discharges in the annular space 16. The chamber 8 comprises at the bottom a first ring face 18 that surrounds the orifice of the second pressure line 13. Furthermore the chamber 8 comprises a thread 10 that is arranged at an inner wall of the chamber 8. A tube 6 that also comprises a thread at an outer surface is screwed into the chamber 8. The tube 6 comprises at its bottom a second ring face 20 that is dedicated to the first ring face 18. Between the first and the second ring face 18, 20 a first sealing ring 21 is arranged. Preferably the first sealing ring 21 is a metallic washer that is press fit between the first and the second ring face 18, 20. The tube 6 extends above the opening of the chamber 8 comprising a nut 3 that is tightly fixed with the tube 6. The nut 3 is arranged above the body 12. At a lower face, the nut 3 comprises a third ring face 21 that is dedicated to the surface of the body 12. The surface of the body 12 comprises a fourth ring face 22. The fourth ring face 22 is dedicated to the third ring face 21. Between the third and the fourth ring face 21, 22 a second sealing ring 23 is arranged. The second sealing ring is press fit between the third and the fourth ring face 21, 22. Preferably the second sealing ring 23 is embodied as a low pressure washer preferably made of metal. In a simple embodiment of the invention, the tube 6 comprises at least a bottom face that closes the orifice of the second pressure line 13. Instead of the tube a stem could also be arranged. The closed tube or the stem and the nut 3 embody a sealing element. In this embodiment the sealing element only tightly closes the high pressure line 13 and the low pressure line 14 that are both connected to the pressure chamber 8. In another embodiment the tube 6 may be embodied as a piston with a cylindrical plane at the bottom that seals up the high pressure line 13.

[0016] In a preferred embodiment however, an upper end of the tube 6 is screwed into a fuel line 1. The fuel line 1 comprises an inner bore 24 that is connected with an inner bore of the tube 6. the inner bore 24 of the fuel line 1 comprises a thread in which the tube 6 is screwed. At the lower end of the fuel line 1 a second nut 25 is arranged at the outer side of the fuel line 1. The second nut 25 comprises at the bottom a fifth sealing face 26 that is dedicated to a sixth sealing face 27 that is arranged on the upper face of the nut 3. Between the first and the second nut 3, 25 a third sealing ring 2 is arranged. The third sealing ring 2 may be embodied as a

washer 2 that is press fit between the first and the second nut 3, 25 sealing up the screw connection between the tube 6 and the fuel line 1.

[0017] Depending on the embodiment of the invention the fuel line 1 could be connected with the high pressure line 13 by the tube 6 or with the low pressure line 14. If there is to be a connection between the fuel line 1 and the high pressure line 13 the tube 6 comprises a hollow cylindrical shape. If there is to be a connection between the fuel line 1 and the low pressure line 14 over a valve then the tube 6 comprises a valve that connects the fuel line 1 and the low pressure line 14 by the valve. For this embodiment as it is shown in the figure the bore comprises a second opening 28 to the annular space 16.

[0018] Instead of using a thread connection between the tube 6 and the body 12 also other retaining means could be used in example the tube 6 could comprise outside the body 12 a flange that is fixed to the body 12 by screws.

[0019] Figure 2 depicts a pressure regulator 30 that is arranged in a body 12 and connected with the second pressure bore 13 with high pressure and the first pressure bore 14 with low pressure. The pressure regulator 30 comprises a tube 6 that is inserted into the second bore 13. The tube 6 comprises an annular flange that abuts on a first sealing ring 19. The first sealing ring 19 lies upon an annular face of the body 12. The first sealing ring 19 seals up a chamber 8 that is arranged above the sealing ring 19 against the high pressure of the second pressure bore 13. The chamber 8 is connected to the first pressure bore 14. In the tube 6, a pressure valve 31 is arranged that connects the second pressure bore 13 with the first pressure bore 14 if the pressure in the second pressure bore 13 exceeds a maximum pressure. The pressure regulator 30 comprises an annular flange 29 which lies upon a second sealing ring 23. The second sealing ring 23 surrounds an opening of the chamber 8. The second sealing ring 23 seals up the chamber 8. The pressure regulator 30 is fixed to the body 12 by means of screws.

Claims

1. Sealing arrangement for a chamber (8) that is arranged in a body (12), whereby a first pressure line (14) is arranged in the body (12) that discharges by a first orifice into an upper part of the chamber (8), whereby a second pressure line (13) is arranged in the body (12) that discharges by a second orifice into a lower part of the chamber (8), whereby the chamber (8) comprises an opening (17) on a surface of the body (12), whereby a sealing element (6, 7, 23, 3) is arranged within the chamber (8) sealing the opening (17), the first and the second orifice, whereby the sealing element (6, 7, 23, 3) is adjacent to the first orifice of the first pressure line (14) and to the second orifice of the second pressure line

(13), whereby between the first and the second orifice a first sealing face (18, 20) is arranged between the sealing element (6) and the body (12) comprising a first sealing ring (19), whereby between the second orifice and the opening (17) a second sealing face (21, 22) is arranged between the sealing element (6) and the body (12) comprising a second sealing ring (23), whereby retaining means (19) are arranged that retain the sealing element (6) in the chamber (8),

characterised in that

the first and the second sealing faces are embodied as first, second, third and fourth ring faces (18, 20, 21, 22), that the first and third ring faces (18) are inserted into the body (12) surrounding the chamber (8), that the second and fourth ring faces (20, 22) are arranged at surfaces of the sealing element (6), that the second ring face (20) is dedicated to the first ring face (18), that the third ring face (21) is dedicated to the fourth ring face (22) that the ring faces (18, 20, 21, 22) are arranged perpendicularly to a longitudinal axis (27) of the chamber (8), that the retaining means (19) press the sealing element (6) in the longitudinal axis on the body (12).

2. Sealing arrangement according to claim 1 **characterised in that** the first sealing ring is a metallic washer (19).

3. Sealing arrangement according to claim 1 or 2, **characterised in that** the sealing element is a stem (6) that is arranged within the chamber (8), that the stem (6) protrudes from the opening (17) of the chamber (8), that the stem (6) comprises a nut (3), that a lower ring face of the nut (3) and a surface (22) of the body (12) that is dedicated to the nut (3) are the third and fourth ring face, that between the surface of the body (12) and the nut (3) the sealing ring (23) is arranged.

4. Sealing arrangement according claim 1 or 2, **characterised in that** the sealing element is a tube (6) that is arranged in the chamber (8), that the tube (6) protrudes from the opening (17) of the chamber (8), that the tube (6) comprises a nut (3), that a lower ring face of the nut (3) and a surface (22) of the body (12) that is dedicated to the nut (3) are the third and fourth ring face, that between the surface of the body (12) and the nut (3) the sealing ring (23) is arranged, that the tube (6) protrudes into a third line (1), that the tube (6) is screwed into a thread of the third line (1), that the third line (1) comprises a second nut (25) at an outer side that between the first and the second nut (3, 25) a third sealing ring (2) is arranged.

5. Sealing arrangement according to claim 4, **characterised in that** the third sealing ring is embodied as

a low pressure washer (2).

6. Sealing arrangement according to any one of the claims 1, 2, 4, 5, **characterised in that** the sealing element (6) is a pressure regulator (30), that the pressure regulator (30) comprises a valve (31) that is connected with the first and the second pressure line (13, 14) and that the valve (31) opens an orifice between the first and the second pressure line (13, 14), if the pressure in the first or second pressure line (13, 14) exceeds a given pressure value.

7. Sealing arrangement according to claim 6, **characterised in that** the pressure valve (31) at which the pressure regulator opens the orifice between the first and the second pressure line (13, 14) is adjustable.

8. Sealing arrangement according claim 1 **characterised in that** the retaining means are a thread (10) arranged on the surface of the sealing element (6) and on the surface of the chamber (8).

FIG 1

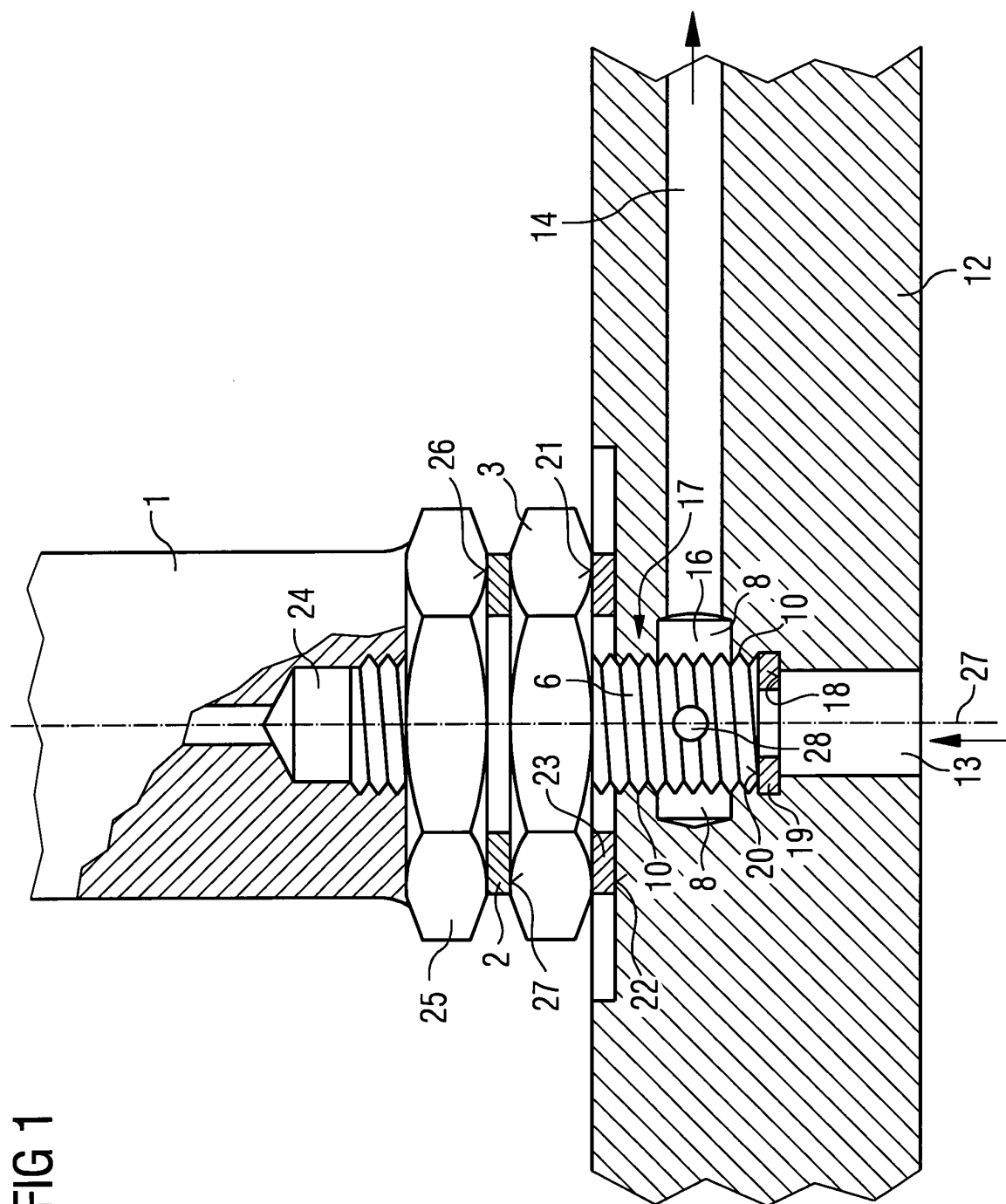
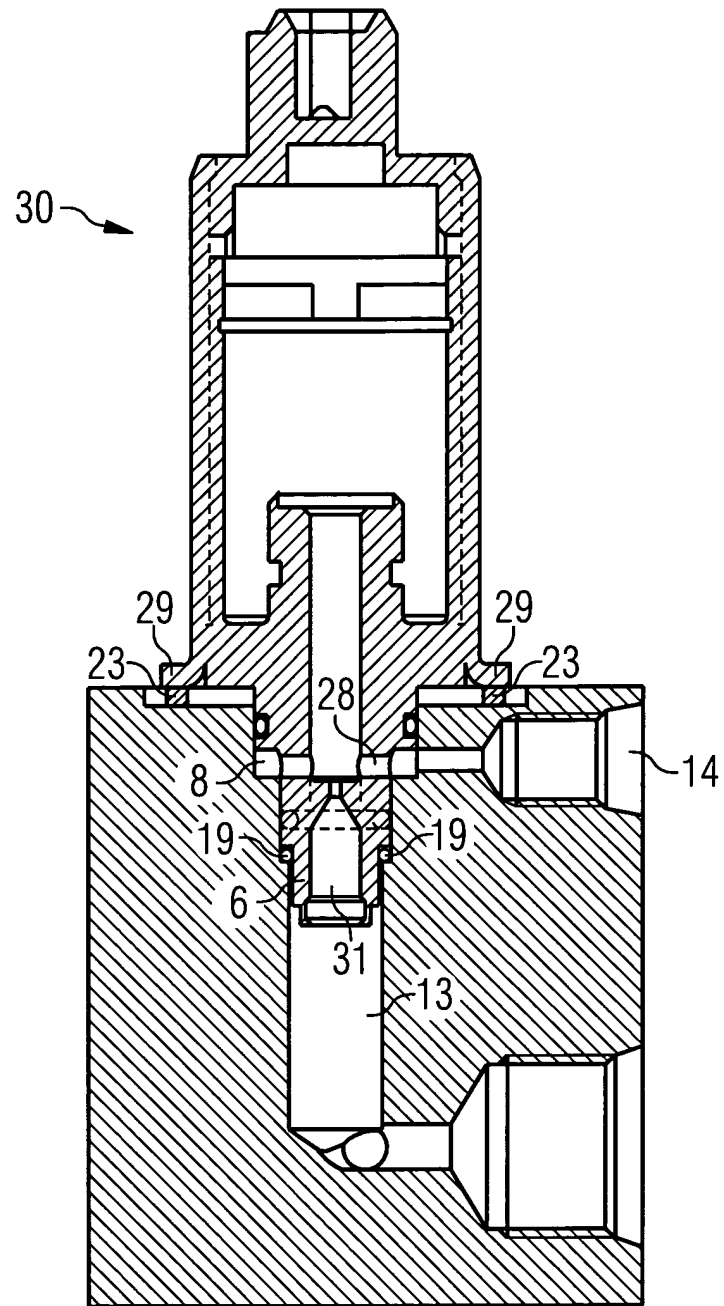


FIG 2





European Patent
Office

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Application Number
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Place of search THE HAGUE		Date of completion of the search 22 September 2003	Examiner Schmitter, T
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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