



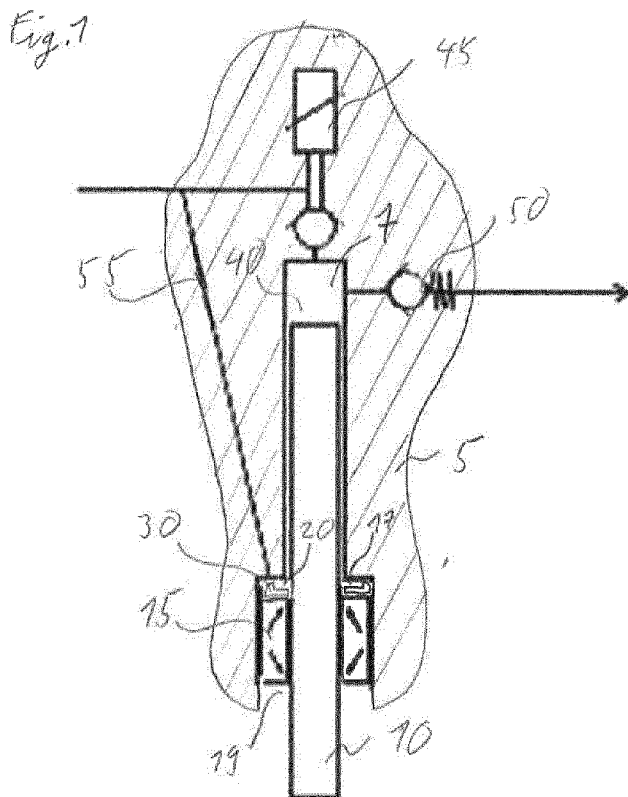
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(54) **Title:** HIGH PRESSURE PUMP



(57) **Abstract:** A high pressure pump (1) for the delivery of a fluid comprises a pump housing (5) with a housing cavity (7) and a longitudinal axis (9), a piston (10) being axially movable within the housing cavity (7), a seal (15) being arranged radially outside of the piston (10), so that a first part (17) of the housing cavity (7) is sealed fluid-tight to a second part (19) of the housing cavity (7), wherein the first part (17) of the housing cavity (7) comprises a chamber (20), which is connected to the seal (15), a thermal spacer (30), being arranged in the chamber (20) and being designed to build a thermal barrier between the fluid and the seal (15).



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Description

High Pressure Pump

- 5 The invention relates to a high pressure pump for the delivery of a fluid.

In today's automotive engine systems, there is an increased demand for low cost direct injection with high reliability. In
10 common rail injection systems, the fuel is delivered by means of a high pressure pump from a fuel tank to a fuel rail which serves as a storage reservoir for the fuel. The fuel is under a high pressure in the fuel rail, or common rail, and can be injected directly into the cylinder via injection valves connected to the
15 rail.

The object of the invention is to provide a high pressure pump which has a high reliability.

- 20 This object is achieved by the features of the independent claim. Advantageous embodiments of the invention are given in the sub-claims.

The invention is distinguished by a high pressure pump for the
25 delivery of a fluid. The high pressure pump comprises a pump housing with a housing cavity and a longitudinal axis. The high pressure pump comprises a piston being axially movable within the housing cavity. The high pressure pump comprises a seal being arranged radially outside of the piston, so that a first part of
30 the housing cavity is sealed fluid-tight to a second part of the housing cavity, wherein the first part of the housing cavity comprises a chamber which is connected to the seal. The high pressure pump comprises a thermal spacer being arranged in the

chamber and being designed to build a thermal barrier between the fluid and the seal.

5 In an operation of the high pressure pump fluid can leak into the chamber. This fluid can become very hot or even vaporize due to high pressures or due to high piston speed. If the hot fluid or vapour comes into contact with the seal, the lifetime of the seal can be decreased, because the seal can get damaged by the hot temperature of the fluid or the vapour. With the use of the thermal
10 spacer the hot fuel does not come into direct contact with the seal or at least less fluid comes into direct contact with the seal. Thus the lifetime of the seal can be increased, because the seal does not get damaged by the hot temperature of the fluid or the vapour. Thus a high reliability of the high pressure pump can
15 be achieved.

According to an embodiment the thermal spacer comprises a first side which is directed axially away from the seal. The thermal spacer comprises a bulge on a radial outer ending area of the first
20 side.

With the use of the bulge a defined amount of fluid circulation in the chamber is provided. By the circulation the hot temperature of the fluid can be reduced very effectively. Also an unwanted
25 movement of the seal in axial direction to the longitudinal axis can be prevented by the bulge.

According to a further embodiment the bulge comprises at least one recess.
30

By the at least one recess the fluid circulation can be adjusted very exactly and thus the hot temperature of the fluid can be reduced very effectively.

According to a further embodiment, the maximum height of the thermal spacer in direction to the longitudinal axis corresponds approximately to a height of the chamber.

- 5 Hereby the thermal spacer cannot be moved in axial direction. In addition unwanted axial movement of the seal can be prevented in a very effective manner.

- 10 According to a further embodiment a maximum outer diameter of the thermal spacer corresponds approximately to an inner diameter of the chamber in an area of the chamber where the thermal spacer is arranged.

- Hereby no radial movement of the thermal spacer is possible.
15 Because no radial movement is possible, the piston cannot come into contact with the thermal spacer. Thus, the piston is not affected by the thermal spacer and the high pressure pump can be operated very reliably.

- 20 According to a further embodiment the thermal spacer comprises a first side which is directed away from the seal. The thermal spacer comprises a bevel on a radial outer ending area of the first side.

- 25 By the bevel a fluid circulation in the radial outer ending area can be increased for a very effective cooling. In addition the assembly of the high pressure pump can be simplified by the bevel.

- 30 Exemplary embodiments of the invention are explained in the following with the aid of schematic drawings.

These are as follows:

Figure 1 shows a high pressure pump;

Figure 2 shows a detailed schematic drawing of the high pressure pump;

5 Figure 3 shows a thermal spacer of the high pressure pump.

Figure 1 and Figure 2 show a high pressure pump 1 with a pump housing 5. The high pressure pump 1 is, for example, a high pressure pump 1 for the delivery of a fluid, for example of fuel
10 or diesel in a vehicle. The high pressure pump 1 is for example designed to create pressures up to to 200 bar for fuel and/or to create pressures up to 2,500 bar and more for diesel.

The pump housing 5 comprises a housing cavity 7. A piston 10 is
15 arranged in the housing cavity 7. The piston 10 is axially movable within the housing cavity 7 related to a longitudinal axis 9 (Figure 2) of the high pressure pump 1.

The piston 10 is, for example, coupled with a drive shaft (not
20 shown) as for example with a camshaft. By the use of the drive shaft the piston 10 can be moved in the axial direction.

Radially outside of the piston 10 a seal 15 is arranged. The seal 15 is arranged so that a first part 17 of the housing cavity 7
25 is sealed fluid-tight to a second part 19 of the housing cavity 7. The first part 17 of the housing cavity 7 comprises a chamber 20 which is connected to the seal 15.

The first part 17 of the housing cavity 7 further comprises a high
30 pressure chamber 40. The high pressure chamber 40 extends from an axial end of the piston 10 to an axial end of the housing cavity 7 which faces the axial end of the piston 10.

The high pressure pump 1 can further comprise an inlet valve 45 for the high pressure chamber 40. By the use of the inlet valve 45 a fluid flow into the high pressure chamber 40 can be controlled.

5

The high pressure pump 1 can further comprise an outlet valve 50 for letting the fluid out of the high pressure chamber 40.

10 The high pressure pump 1 can further comprise a drainage channel 55 which connects the chamber 20 with an inlet of the high pressure pump 1. By the use of the drainage channel 55 fluid which leaks into the chamber 20 can flow back to the inlet.

15 The high pressure pump 1 further comprises a thermal spacer 30. The thermal spacer 30 is arranged in the chamber 20 and is designed to build a thermal barrier between the fluid and the seal 15.

Figure 3 shows the thermal spacer 30 in detail.

20 The thermal spacer 30 comprises, for example, a first side 31 which is directed axially away from the seal 15.

The thermal spacer 30 comprises, for example, a bulge 33 on a radial outer ending area of the first side 31.

25

The bulge 33 comprises, for example, at least one recess 34. As shown in Figure 3 the bulge 33 comprises, for example four recesses 34. A width of the relative recess 34 can vary depending on a fluid flow which shall be adjusted by the relative recess 34.

30

A maximum height of the thermal spacer 30 in direction to the longitudinal axis 9 corresponds, for example, approximately to a height of the chamber 20, whereby the chamber 20 extends from

an axial end of the seal 15 to an axial end of the pump housing 5 which faces the seal 15.

5 A maximum outer diameter of the thermal spacer 30 corresponds, for example, approximately to an inner diameter of the chamber 20 in an area of the chamber 20 where the thermal spacer 30 is arranged.

10 The thermal spacer 30 comprises, for example, a bevel 35 on a radial outer ending area of the first side 31, for example, on the bulge 33.

In the following the function of the high pressure pump 1 is described in brief.

15

By a rotary movement of the not shown driving shaft the piston 10 is moved from an upper dead center to a lower dead center. If the inlet valve 45 is opened, fluid flows into the high pressure chamber 40. By another rotary movement of the not shown driving
20 shaft the piston 10 is moved in a stroke movement from the lower dead center to the upper dead center. Meanwhile the inlet valve 45 is closed. By the stroke movement the fluid in the high pressure chamber 40 is compressed. After the stroke movement the compressed fluid in the high pressure chamber 40 can be released via
25 the outlet valve 50.

Due to the high pressure of the compression fluid can leak during the stroke movement from the high pressure chamber 40 into the chamber 20. This fluid can become very hot or even vaporize due
30 to high pressures or due to high piston speed. Because the thermal spacer 30 acts as a barrier, the hot fluid does not come directly into contact with the seal 15. The shape of the thermal spacer 30 contributes to a circulation of the fluid in the chamber 20, so that hotter fluid gets mixed with colder fluid. Also the hot

fluid can flow back to the inlet via the drainage channel 55. Thus a high reliability of the high pressure pump 1 can be achieved.

Reference signs

	1	high pressure pump
	5	pump housing
5	7	housing cavity
	9	longitudinal axis
	10	piston
	15	seal
	17	first part
10	19	second part
	20	chamber
	30	thermal spacer
	31	first side
	33	bulge
15	34	recess
	35	bevel
	40	high pressure chamber
	45	inlet valve
	50	outlet valve
20	55	drainage channel

Claims (We claim)

1. High pressure pump (1) for the delivery of a fluid,
comprising
 - 5 - a pump housing (5) with a housing cavity (7) and a longitudinal axis (9),
 - a piston (10) being axially movable within the housing cavity (7),
 - a seal (15) being arranged radially outside of the piston
10 (10), so that a first part (17) of the housing cavity (7) is sealed fluid-tight to a second part (19) of the housing cavity (7), wherein the first part (17) of the housing cavity (7) comprises a chamber (20), which is connected to the seal (15),
 - 15 - a thermal spacer (30), being arranged in the chamber (20) and being designed to build a thermal barrier between the fluid and the seal (15).
2. High pressure pump (1) according to claim 1, wherein the
20 thermal spacer (30) comprises a first side (31), which is directed axially away from the seal (15) and wherein the thermal spacer (30) comprises a bulge (33) on a radial outer ending area of the first side (31).
- 25 3. High pressure pump (1) according to claim 2, wherein the bulge (33) comprises at least one recess (34).
4. High pressure pump (1) according to one of the claims 1 to 3, wherein a maximum height of the thermal spacer (30) in
30 direction to the longitudinal axis (9) corresponds approximately to a height of the chamber (20).
5. High pressure pump (1) according to one of the claims 1 to 4, wherein a maximum outer diameter of the thermal spacer

(30) corresponds approximately to an inner diameter of the chamber (20) in an area of the chamber (20) where the thermal spacer (30) is arranged.

- 5 6. High pressure pump (1) according to one of the claims 1 to 5, wherein the thermal spacer (30) comprises a first side (31), which is directed axially away from the seal (15) and wherein the thermal spacer (30) comprises a bevel (35) on a radial outer ending area of the first side (31).

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Fig. 7

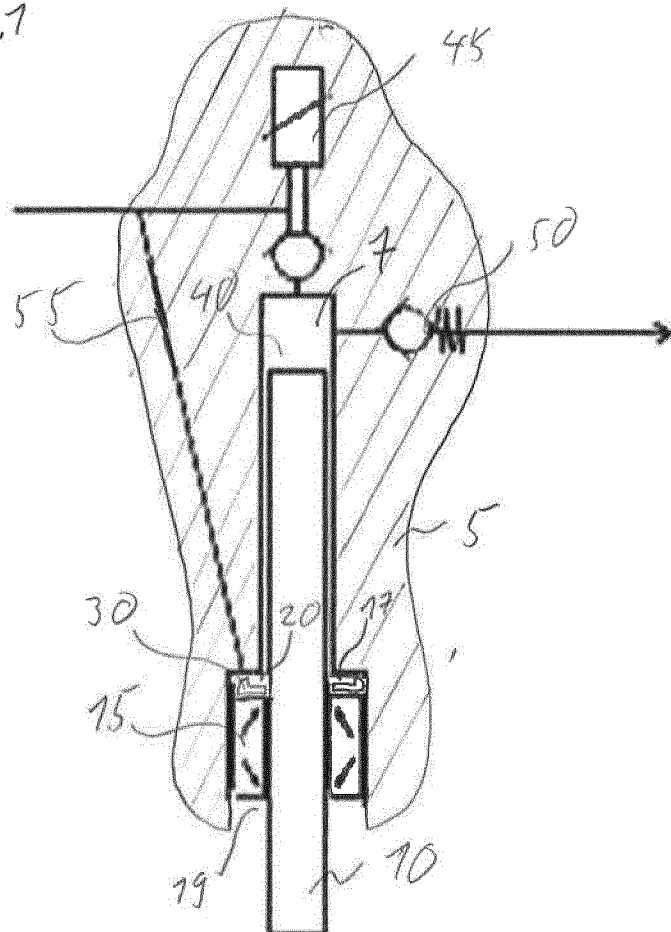


Fig 2

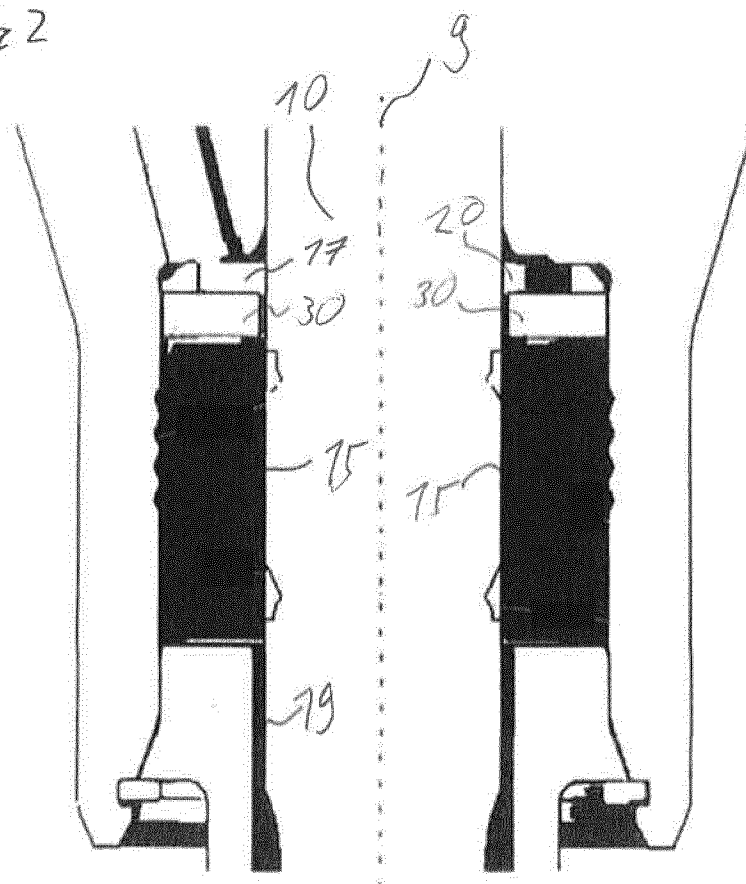
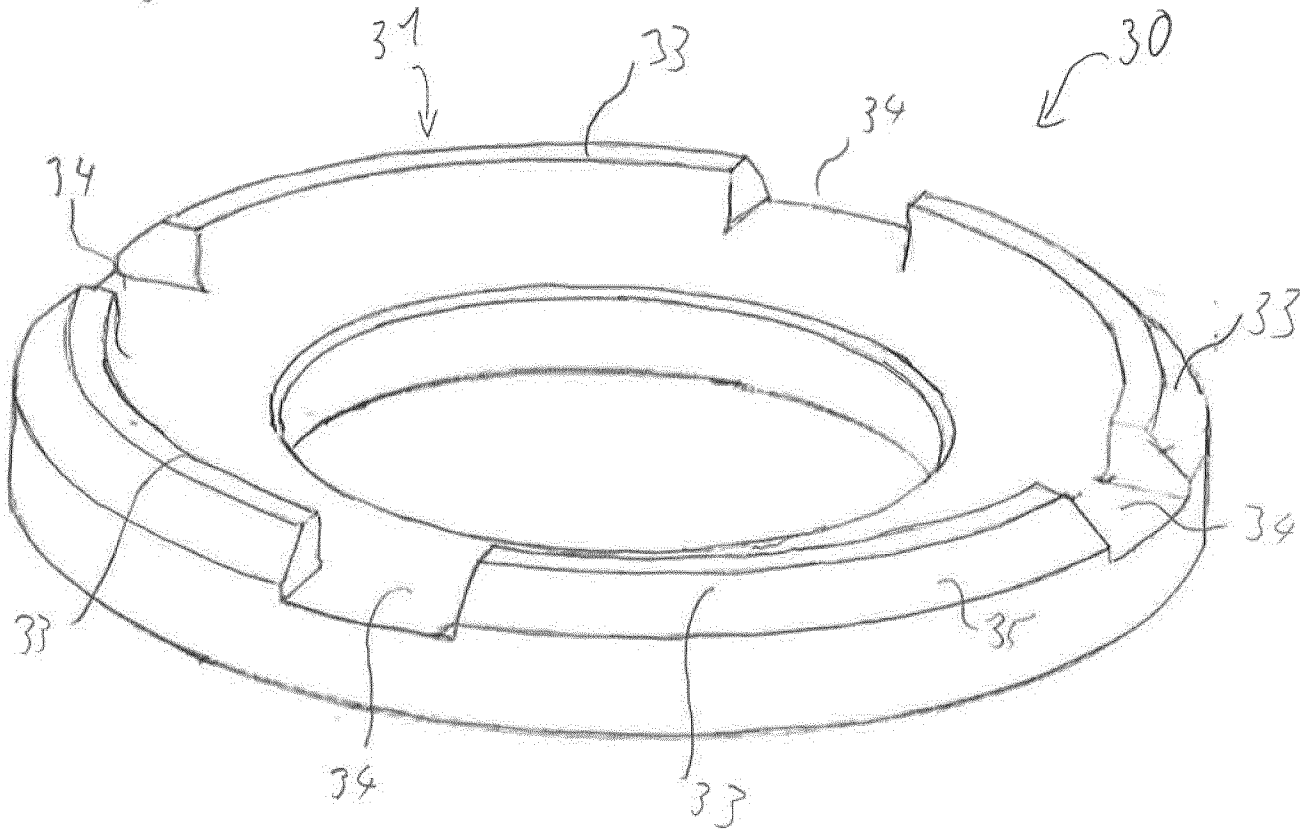


Fig. 3



INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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ADD.

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)
F02M F04B

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2010 190105 A (DENSO CORP) 2 September 2010 (2010-09-02) abstract; figures 1,4,5,6 paragraph [0046] paragraph [0050] paragraph [0039] - paragraph [0040] paragraph [0012] paragraph [0027] paragraph [0021] paragraph [0056] - paragraph [0057] paragraph [0053] - paragraph [0054] paragraph [0002] paragraph [0051] claims 1-6 ----- -/-	1-6



Further documents are listed in the continuation of Box C.



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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/064791

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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