

(19)



(11)

**EP 2 080 893 A1**

(12)

**EUROPEAN PATENT APPLICATION**

(43) Date of publication:

**22.07.2009 Bulletin 2009/30**

(51) Int Cl.:

**F02M 55/00** (2006.01)

**F02M 61/14** (2006.01)

**F02M 61/16** (2006.01)

(21) Application number: **08000959.0**

(22) Date of filing: **18.01.2008**

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR  
HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT  
RO SE SI SK TR**

Designated Extension States:

**AL BA MK RS**

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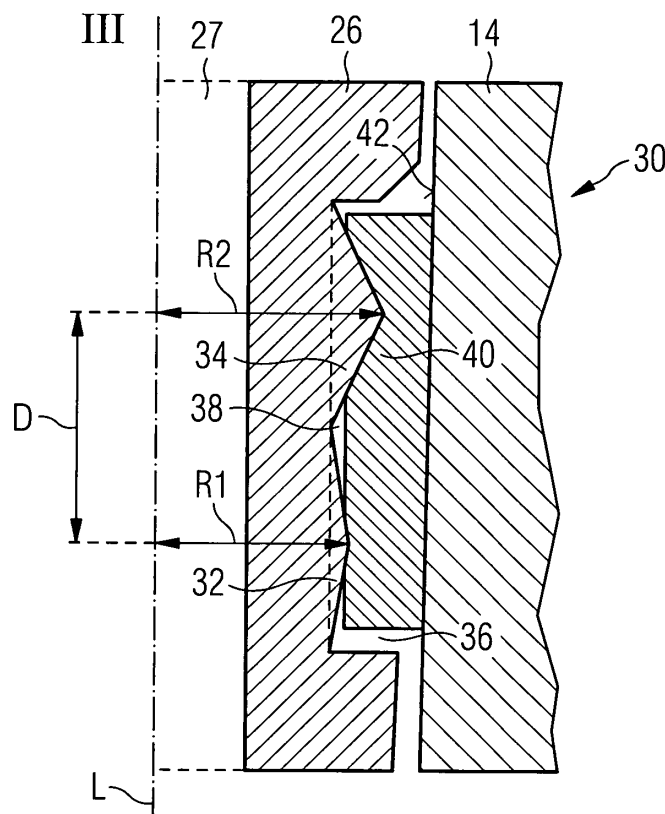
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(54) **Valve assembly for an injection valve and injection valve**

(57) Valve assembly (24) for an injection valve (18), comprising a valve body (26) with a central longitudinal axis (L), an injection nozzle (28), and a sealing arrangement (30) being designed to sealingly couple the valve assembly (24) with a cylinder head (14) of a combustion engine (22). The sealing arrangement (30) comprises a first sealing element (32) being in one piece with the valve

body (26) and being designed to be arranged between the valve body (26) and the cylinder head (14), and a second sealing element (34) being in one piece with the valve body (26) and being designed to be arranged between the valve body (26) and the cylinder head (14) and being arranged in a given distance (D) from the first sealing element (32) in direction of the central longitudinal axis (L) facing away from the injection nozzle (28).

**FIG 3**



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## Description

**[0001]** The invention relates to a valve assembly for an injection valve and an injection valve.

**[0002]** Injection valves are in wide spread use, in particular for internal combustion engines where they may be arranged in order to dose fuel into an intake manifold of the internal combustion engine or directly into the combustion chamber of a cylinder of the internal combustion engine. Fuel can be supplied to the internal combustion engine by the injection valve that comprises the sealing arrangement. The injection valves can be coupled to the cylinder head of the internal combustion engine in different manners.

**[0003]** The coupling of the injection valves to the cylinder head needs to be very precise to get a correct injection angle.

**[0004]** The object of the invention is to create a valve assembly for an injection valve being coupable to a cylinder head of a combustion engine which is simply to be manufactured and which facilitates a reliable and precise coupling between the valve assembly and the cylinder head of the combustion engine.

**[0005]** It is furthermore the object of the invention to create an injection valve that ensures a precise dosing of fuel.

**[0006]** The objects are achieved by the features of the independent claims. Advantageous embodiments of the invention are given in the sub-claims.

**[0007]** According to a first aspect the invention is distinguished by a valve assembly for an injection valve. The valve assembly comprises a valve body with a central longitudinal axis, an injection nozzle, and a sealing arrangement which is designed to sealingly couple the valve assembly with a cylinder head of a combustion engine. The sealing arrangement comprises a first sealing element being in one piece with the valve body and being designed to be arranged between the valve body and the cylinder head, and a second sealing element being in one piece with the valve body and being designed to be arranged between the valve body and the cylinder head and being arranged in a given distance from the first sealing element in direction of the central longitudinal axis facing away from the injection nozzle.

**[0008]** This has the advantage that a secure sealing coupling of the valve assembly in the cylinder head is possible even if only one of the sealing elements is in function.

**[0009]** In an advantageous embodiment the valve assembly has a groove which is arranged between the first sealing element and the second sealing element. This has the advantage that the groove can take up sections of a gasket which can be arranged radially outside the first sealing element and the second sealing element in particular in the case of a thermal expansion of the gasket.

**[0010]** In a further advantageous embodiment the first sealing element and the second sealing element have a

circular shape, and the first sealing element extends to a first radius and the second sealing element extends to a second radius. The second radius is bigger than the first radius. This has the advantage that it is possible to obtain a high contact pressure in particular between the second sealing element and the cylinder head even in the case that only the second sealing elements is in function.

**[0011]** According to a second aspect the invention is distinguished by an injection valve comprising a valve assembly.

**[0012]** Exemplary embodiments of the invention are explained in the following with the aid of schematic drawings. These are as follows:

Figure 1 an internal combustion engine in a schematic view,

Figure 2 an injection valve with a valve assembly and a cylinder head in a longitudinal section view, and

Figure 3 a cut-out III of figure 2 with the valve assembly and the cylinder head in a detailed longitudinal section view.

**[0013]** Elements of the same design and function that occur in different illustrations are identified by the same reference character.

**[0014]** Figure 1 shows an internal combustion engine 22, with an intake air tract 10, a motor block 12, a cylinder head 14 and an exhaust gas tract 16. In the motor block 12 a combustion chamber 20 is arranged.

**[0015]** The cylinder head 14 comprises an injection valve 18 and a sparking plug 19. A sealing arrangement 30 enables the sealing of the injection valve 18 in the cylinder head 14 of the combustion engine 22.

**[0016]** The fuel injector 18 (figures 2) comprises an injector coupling portion 23 and a valve assembly 24. The injector coupling portion 23 is designed to be coupled to a high-pressure fuel chamber of the internal combustion engine 22, the fuel is stored under high pressure, for example, under the pressure of about 200 bar in the case of a gasoline engine or of about 2,000 bar in the case of a diesel engine.

**[0017]** Furthermore, the injection valve 18 is designed to be coupled to an electrical supply to actuate a not shown actuator unit of the injection valve 18.

**[0018]** The valve assembly 24 comprises a valve body 26 with a central longitudinal axis L and a cavity 27 which is axially led through the valve body 26 (figure 3). The valve assembly 24 further comprises a not shown valve needle taken in the cavity 27 of the valve body 26. On a free end of the valve assembly 24 an injection nozzle 28 is formed which is closed or opened by an axial movement of the valve needle. In a closing position a fuel flow through the injection nozzle 28 is prevented. In an opening position fuel can flow through the injection nozzle 28

into the combustion chamber 20 of the internal combustion engine 22.

**[0019]** The cylinder head 14 has a recess 15 being designed to take up at least parts of the injection valve 18. The cylinder head 14 has an inner surface 44 and an outer surface 46. The inner surface 44 is facing the combustion chamber 20, and the outer surface 46 is facing the injector coupling portion 23 outside the cylinder head 14.

**[0020]** As can be best seen in figure 3 the valve body 26 has a valve body groove 36 wherein a first sealing element 32 and a second sealing element 34 are arranged. The first sealing element 32 and the second sealing element 34 are part of the sealing arrangement 30. The first sealing element 32 and the second sealing element 34 are in one piece with the valve body 26. Thus, the first sealing element 32 and the second sealing element 34 are forming projections of the valve body 26 and are arranged between the valve body 26 and the cylinder head 14. The first sealing element 32 and the second sealing element 34 are preferably designed to be arranged circumferentially over the valve body 26. Preferably, the first sealing element 32 and the second sealing element 34 have a circular shape. Consequently, the first sealing element 32 and the second sealing element 34 are forming ring elements with their centres on the central longitudinal axis L.

**[0021]** The first sealing element 32 and the second sealing element 34 are arranged in a predetermined distance D from each other in direction of the central longitudinal axis L. The second sealing element 34 is arranged in a larger distance from the injection nozzle 28 as the first sealing element 32.

**[0022]** Between the first sealing element 32 and the second sealing element 34 a groove 38 is arranged.

**[0023]** Furthermore, the recess 15 of the cylinder head 14 and the valve body groove 36 take up a gasket 40 which is arranged between the sealing elements 32, 34 of the valve body 26 and an inner wall 42 of the recess 15 of the cylinder head 14. Preferably, the gasket 40 is of a material which comprises PTFE which is suited to the temperatures usually occurring in the internal combustion engine 22. Preferably, the gasket 40 comprises particles of carbon.

**[0024]** The first sealing element 32 has a first radius R1 and the second sealing element 34 has a second radius R2 relative to the central longitudinal axis L. The second radius R2 is bigger than the first radius R1. By this a high contact pressure between the second sealing element 34 and the cylinder head 14 is available.

**[0025]** In the following, the function of the sealing arrangement 30 will be described in detail:

**[0026]** During the operation of the internal combustion engine 22, the temperatures in the cylinder head 14 and in the valve body 26 usually decrease in direction of the central longitudinal axis L from the inner surface 44 to the outer surface 46 of the cylinder head 14. Consequently, the area of the first sealing element 32 and its adjacent

area of the gasket 40 are usually exposed to a higher temperature than the second sealing element 34 and its adjacent area of the gasket 40.

**[0027]** During operation of the internal combustion engine 22, usually the first sealing element 32 and the second sealing element 34 together with the gasket 40 act as a sealing arrangement to prevent hot exhaust gases in the combustion chamber 20 to exit through the recess 15 in the cylinder head 14 which takes up the injection valve 18.

**[0028]** Even in the case that due to the high temperatures near the first sealing element 32, the second sealing element 34 together with the gasket 40 is able to prevent the hot exhaust gases of the combustion chamber 20 to leave the combustion chamber 20 through the recess 15 in the cylinder head 14.

**[0029]** The groove 38 which is arranged between the first sealing element 32 and the second sealing element 34 can take up parts of the gasket 40 in the case of a thermal expansion of the gasket 40. By this, a further sealing function of the first sealing element 32 and the second sealing element 34 together with the gasket 40 is possible.

**[0030]** As the second radius R2 of the second sealing element 32 is larger than the first radius R1 of the first sealing element 32, the contact pressure between the second sealing element 34 and the gasket 40 is high. In particular, the contact pressure between the second sealing element 34 and the gasket 40 is very high in the case of the thermal expansion of the gasket 40. This makes it possible to obtain a good sealing function between the valve body 26 and the cylinder head 14.

## Claims

1. Valve assembly (24) for an injection valve (18), comprising

- a valve body (26) with a central longitudinal axis (L),
- an injection nozzle (28), and
- a sealing arrangement (30) being designed to sealingly couple the valve assembly (24) with a cylinder head (14) of a combustion engine (22), the sealing arrangement (30) comprising
  - a first sealing element (32) being in one piece with the valve body (26) and being designed to be arranged between the valve body (26) and the cylinder head (14), and
  - a second sealing element (34) being in one piece with the valve body (26) and being designed to be arranged between the valve body (26) and the cylinder head (14) and being arranged in a given distance (D) from the first sealing element (32) in direction of the central longitudinal axis (L) facing away from the injection nozzle (28).

2. Valve assembly (24) in accordance with claim 1, with a groove (38) being arranged between the first sealing element (32) and the second sealing element (34).

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3. Valve assembly (24) in accordance with claim 1 or 2, with

- the first sealing element (32) and the second sealing element (34) having a circular shape,
- the first sealing element (32) extending to a first radius (R1) and the second sealing element (34) extending to a second radius (R2), wherein the second radius (R2) is bigger than the first radius (R1).

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4. Injection valve (18) comprising a valve assembly (24) according to one of the preceding claims.

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FIG 1

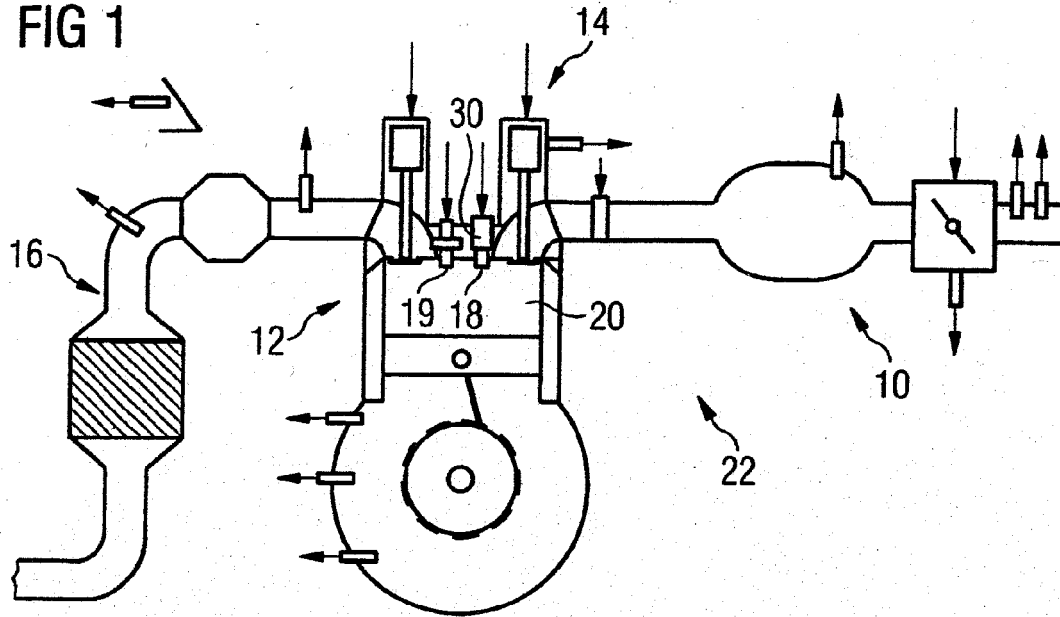


FIG 2

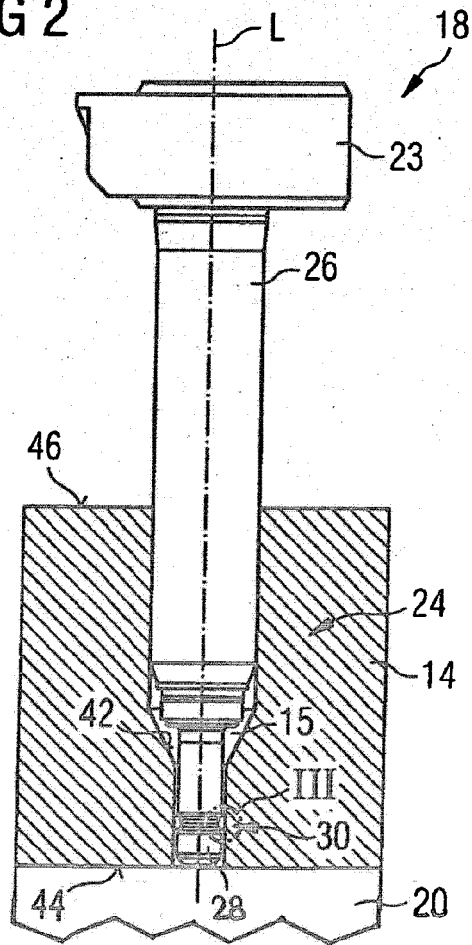
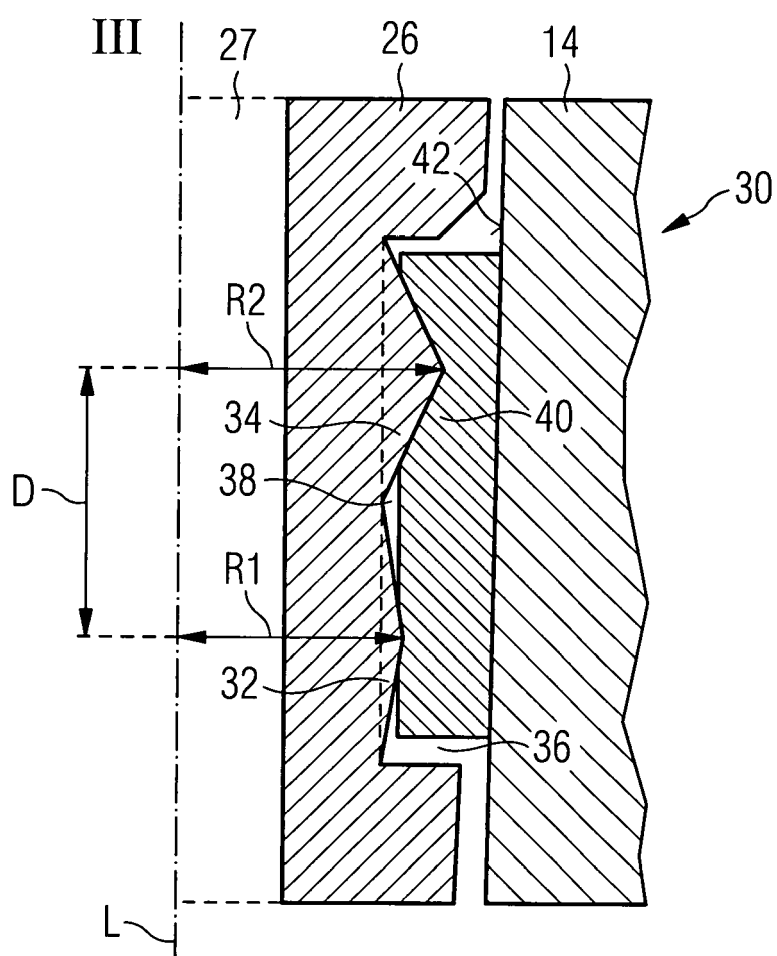


FIG 3





European Patent  
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# EUROPEAN SEARCH REPORT

Application Number  
EP 08 00 0959

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 1 July 2008	Examiner Etschmann, Georg
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>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 &amp; : member of the same patent family, corresponding document</p>			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
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