



(11) **EP 1 795 741 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.06.2007 Bulletin 2007/24

(51) Int Cl.: **F02M 61/04** ^(2006.01) **F02M 61/12** ^(2006.01)
F02M 61/08 ^(2006.01)

(21) Application number: **05026624.6**

(22) Date of filing: 06.12.2005

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
 HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
 SK TR**
 Designated Extension States:
AL BA HR MK YU

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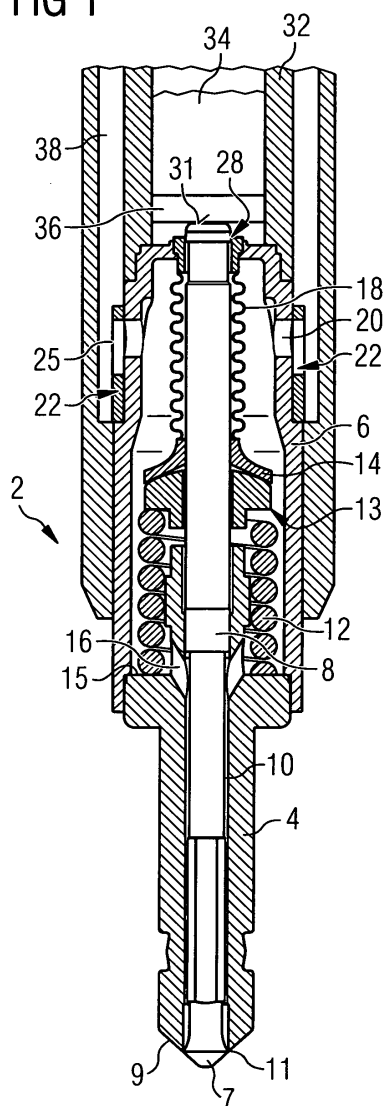
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(54) **Needle device**

(57) A Needle device for a valve group (2) comprises a needle body, a spring (12) and a transferring element (13). The spring (12) is arranged concentric to the needle body. The transferring element (13) surrounds the needle body and has a clearance to the needle body in radial direction. Further, the transferring element (13) forms a first rest for the spring (12) at a first side of the transferring element (13). The transferring element (13) and a step of the needle body at a second side of the transferring element (13) facing away from the first side of the transferring element (13) are coupled by a sphere/cone coupling.

FIG 1



Description

[0001] The invention relates to a needle device for a valve group. The needle device comprises a needle body and a spring. The spring is arranged concentric to the needle body.

[0002] WO 2005/083264 A1 discloses a fluid injector which has a housing, a valve body, and an actuator unit that is inserted into the housing. The valve body comprises a nozzle body with a recess that takes in a needle. A receptance is formed in the needle and fixes a locking element in an axial direction relative to the needle. A return spring rests on a spring rest body which is pretensioned in a way that it presses the spring rest body against the locking element.

[0003] The object of the invention is to create a needle device for a valve group which enables in a simple way a precise dosing of fluid.

[0004] The object of the invention is achieved by the independent claims 1, 4, and 5. Advantageous embodiments of the invention are given in the sub-claims.

[0005] The invention is distinguished by a needle device for a valve group. Further, the invention is distinguished by the valve group and by an injector which comprises the valve group. The needle device comprises a needle body, a spring, and a transferring element. The spring is arranged concentric to the needle body. The transferring element surrounds the needle body and has a clearance to the needle body in radial direction. The transferring element forms a first spring rest for the spring at a first side of the transferring element. The transferring element and a step of the needle body at a second side of the transferring element facing away from the first side of the transferring element are coupled by a sphere/cone coupling.

[0006] If the needle device is arranged in the valve group, the clearance of the transferring element to the needle body and the sphere/cone coupling of the step and the transferring element enable a tilting of the transferring element relative to the needle body. The tilting of the transferring element contributes to avoid a force, which has a force component rectangular to an axis of the needle body, and/or stress on the needle body which contributes in a simple way to a precise dosing of fluid by the valve group.

[0007] In an advantageous embodiment of the needle device the transferring element has a first and a second axial section separated by a step of the transferring element. The first axial section axially overlaps with the spring. The spring radially surrounds the first axial section and is coupled to the transferring element at the step of the transferring element. In this way the first axial section contributes in a simple way to center the spring.

[0008] In a further advantageous embodiment of the needle device the needle body comprises a needle and a spring washer which comprises the step of the needle body. Manufacturing the needle and the spring washer from two pieces may contribute to an easy and low cost

manufacturing of the needle body.

[0009] The invention is distinguished concerning the valve group by the valve group comprising the needle device and a nozzle body. The nozzle body has a recess which partly takes in the needle. Further, the nozzle body has a step of the nozzle body which forms a second rest for the spring at that axial end of the spring facing away from the transferring element.

[0010] Advantageous embodiments of the invention are explained in the following with the help of schematic drawings.

[0011] These are as follows:

Figure 1 a valve group,

Figure 2 a first embodiment of a needle device for the valve group,

Figure 3 a second embodiment of the needle device,

Figure 4 a third embodiment of the needle device.

[0012] Elements with the same design and function that appear in the different illustrations are identified by the same reference characters.

[0013] A fluid injector (figure 1) comprises an injector housing 1 and a valve group 2. The valve group 2 comprises a nozzle body 4, a valve cap 6, and a needle device. The needle device comprises a needle body, a spring 12, and a transferring element 13. The needle body has a step of the needle body. The needle body preferably comprises a needle 8 and a spring washer 14 which comprises the step of the needle body. The injector 1 may be used to inject fluid into a combustion chamber of an internal combustion engine. The fluid injector may be connected to a high pressure fluid chamber, for example a common rail, of an internal combustion engine, where fuel is stored under high pressure, for example under the pressure of about 200 Bar.

[0014] The valve cap 6 comprises at a side facing away from the nozzle body 4 a control recess 17 through which the needle 8 exits the valve cap 6. The fluid is prevented from exiting the valve cap 6 through the control recess 17 by bellows 18. The bellows 18 prevent leaking of the fluid through the control recess 17 of the valve cap 6. The needle 8 comprises an end face 31 at that side of the needle 8 facing away from the needle tip 13. The end face 31 protrudes in an actor housing 32. An actor 34 is arranged in the actor housing 32 and comprises a ground plate 36. Via the ground plate 36 the actor 34 affects the needle 8 at the end face 31 of the needle 8.

[0015] The nozzle body 4 is connected to the valve cap 6. Further, the nozzle body 4 has a nozzle body recess 10 and at least two boreholes 16 through which the fluid may flow to the nozzle body tip 9. The nozzle body recess 10 partly takes in the needle 8. The needle 8 prevents in a closed position of the needle 8 a fluid flow through a nozzle body opening 11 at one axial end of the

nozzle body recess 10 at a nozzle body tip 9. In the closed position of the needle 8 a tip 7 of the needle 8 is pressed to a wall of the nozzle body recess 10 from the outside of the nozzle body recess 10 covering it and sealing up the nozzle body recess 10. Therefore, the needle 8 prevents the fluid flow through the nozzle body recess 10 in the closed position of the needle 8. Beyond the closed position of the needle 8 the tip 7 of the needle 8 is moved away from the nozzle body recess 10. In that way beyond the closed position of the needle 8 the tip 7 of the needle 8 and the nozzle body tip 9 form a cylindrical shaped nozzle and the fluid can be dosed into the combustion chamber of the combustion engine.

[0016] The axial position of the needle 8, which determines whether the needle 8 is in its closed position or not and whether the nozzle body opening 11 is closed or, respectively, opened, depends on a force balance. A first force in the closing direction of the needle 8 is affected by the spring 12 and a second force in opened direction of the needle 8 is affected by the actor 34.

[0017] In the explained embodiments the fluid injector is designed to be normally closed, that means that if no control signal is applied to the actor 34 the needle 8 is pushed against the nozzle body opening 11 by the spring 12 and closes the nozzle body opening 11. If a suitable control signal is applied to the actor 34, the actor 34 changes its axial length and in that way controls whether the nozzle body opening 11 is opened or closed by the needle 8. The fluid injector 1 may, however, also be designed to be normally open or may be of an inward-opening type. Then the nozzle body opening 11 may be formed as a small hole through the nozzle body tip 9.

[0018] The transferring element 13 is arranged in axial direction intermediate the spring 12 and a spring washer 14. The transferring element 13 and the needle 8 are formed in such a way that there is a clearance between the inner diameter of the transferring element 13 and the needle 8. The transferring element 13 forms a first spring rest for the spring 12 at a first axial end of the spring 12. At a second axial end of the spring 12 facing away from the first axial end of the spring 12 the spring 12 rests on a step 15 of the nozzle body 4. The spring 12 is preloaded in such a way that the spring presses the transferring element 13 in axial direction against the spring washer 14. The spring 12 forces the transferring element 13 not only in axial direction. The loaded spring 12 always has a force component which is rectangular to an axis X of the needle body and of the spring 12, which for example leads to a force on the needle body which is parallel to an axis Y (figure 2) which includes an acute angle with an axis X of the spring 12. Without the transferring element 13 said force component is transferred to the spring washer 14 and via the spring washer 14 to the needle 8. So, without the transferring element 13 this leads to a bending of the needle 8 which may affect the sealing of the nozzle body opening 11 by the needle 8 and which may lead to leakage of fluid into the combustion chamber while the needle 8 is in its closed position. Further, the

bending of the needle 8 may lead to an irregular spray shape of the fluid in the combustion chamber and/or to a deviation of the time of injection respectively a given time of injection.

[0019] The transferring element 13 and the spring washer 14 are coupled to each other by a sphere/cone coupling. The sphere/cone coupling in general comprises a spherical area which is coupled to a conical area. In this embodiment the needle body, especially the spring washer 14 has a conical surface 48, which is the conical area of the sphere/cone coupling, at the side of the spring washer 14 facing towards the transferring element 13. The transferring element 13 comprises a spherical surface 40 of the transferring element 13, which is the spherical area of the sphere/cone coupling, facing towards the spring washer 14. If the force component which is not parallel to the axis X acts on the transferring element 13, the sphere/cone coupling and the clearance between the transferring element 13 and the needle 8 enable a tilting movement of the transferring element 13 relative to the axis X without the transferring element 13 losing contact to the spring washer 14. The axis Y of the transferring element 13 then includes an acute angle with the axis X of the needle 8. So the force component non-parallel to the axis x is compensated by the tilting of the transferring element 13. This contributes to a proper guidance of the needle 8. The proper guidance of the needle 8 contributes to a proper dosing of fluid by the injector, especially by the valve group.

[0020] The transferring element 13 may comprise a first and a second axial section 42, 44. The first axial section 42 may be used for centering the spring 12 and/or for a proper holding of the transferring element 13. In an alternative embodiment (figure 3) there may be only one axial section of the transferring element 13.

[0021] As an alternatively embodiment of the sphere/cone coupling the transferring element 13 comprises a conical surface 50 (figure 4) of the transferring element 13 and the needle body, especially the spring washer 14, comprises a spherical surface 52 of the spring washer 14.

[0022] The invention is not restricted on the explained embodiments. For example, the explained embodiments may be combined. For example, the transferring element 13 may comprise the conical surface 50 of the transferring element and does not comprise the first and the second axial section 42, 44 of the transferring element 13.

Claims

1. Needle device for a valve group (2) comprising a needle body, a spring (12) which is arranged concentric to the needle body, and a transferring element (13) which surrounds the needle body and which has a clearance to the needle body in radial direction and which forms a first rest for the spring (12) at a first side of the transferring element (13) and the transferring element (13) and a step of the

needle body at a second side of the transferring element (13) facing away from the first side are coupled by a sphere/cone coupling.

2. Needle device in accordance with claim 1 with the transferring element (13) having a first and a second axial section (42, 44) separated by a step (46) of the transferring element (13), with the first axial section (42) axially overlapping with the spring (12) and with the spring (12) radially surrounding the first axial section (42) and being coupled to the transferring element (13) at the step (46) of the transferring element (13). 5
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3. Needle device in accordance with one of the preceding claims with the needle body comprising a needle (8) and a spring washer (14) which comprises the step of the needle body. 15
4. Valve group (2) for an injector comprising the needle device in accordance with one of the preceding claims and comprising a nozzle body (4) having a recess (10) which partly takes in the needle (8) and having a step (15) of the nozzle body (4) which forms a second rest for the spring (12) at that axial end of the spring (12) facing away from the transferring element (13). 20
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5. Injector comprising the valve group (2) in accordance with claim 4. 30

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FIG 1

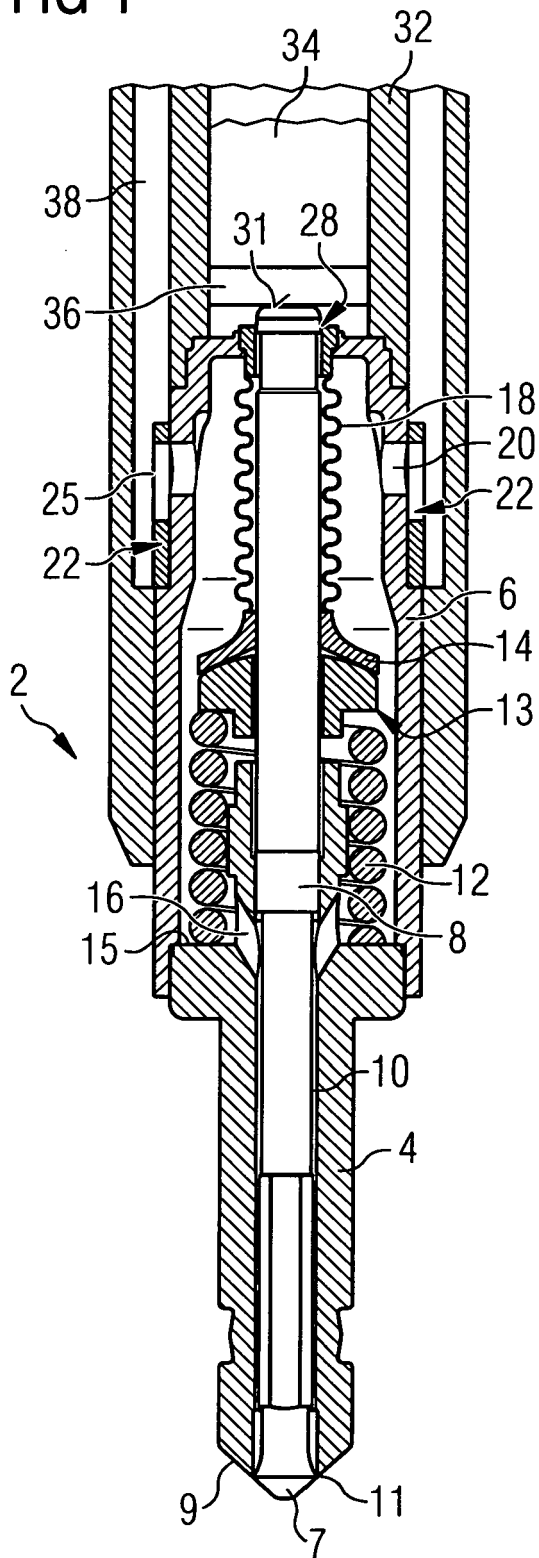


FIG 2

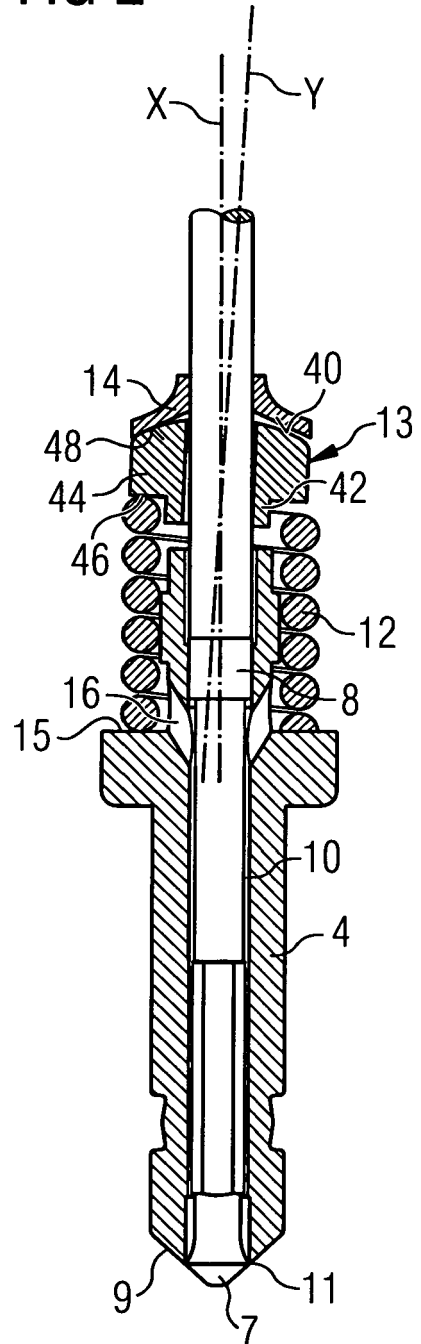


FIG 3

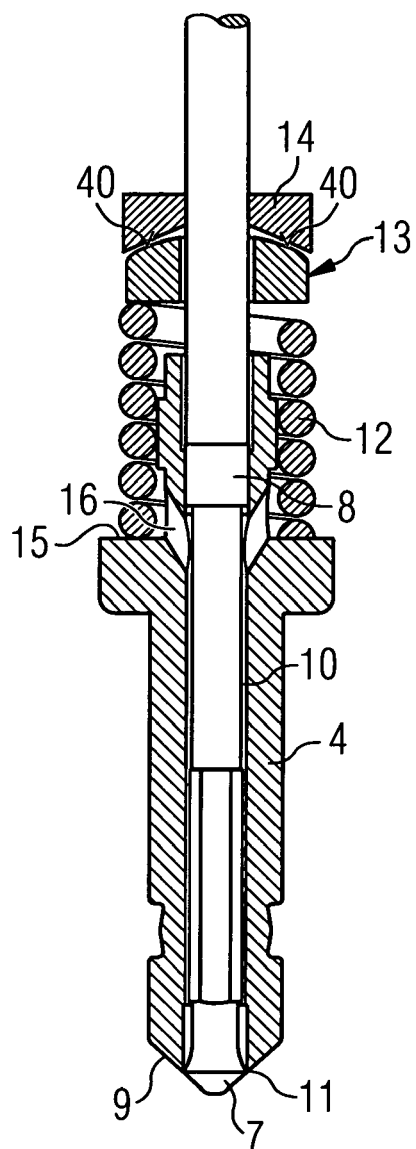
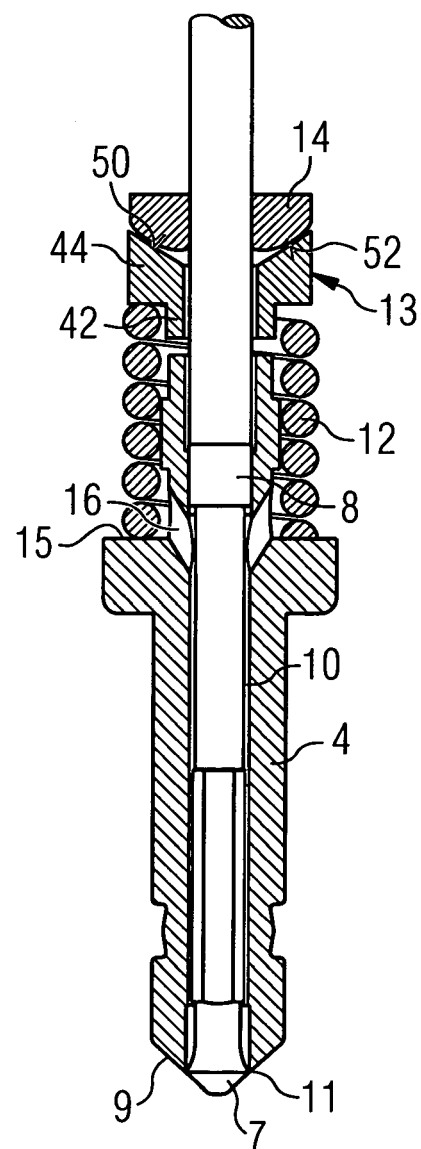


FIG 4





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 02 6624

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Place of search		Date of completion of the search	Examiner
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CATEGORY OF CITED DOCUMENTS 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 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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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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