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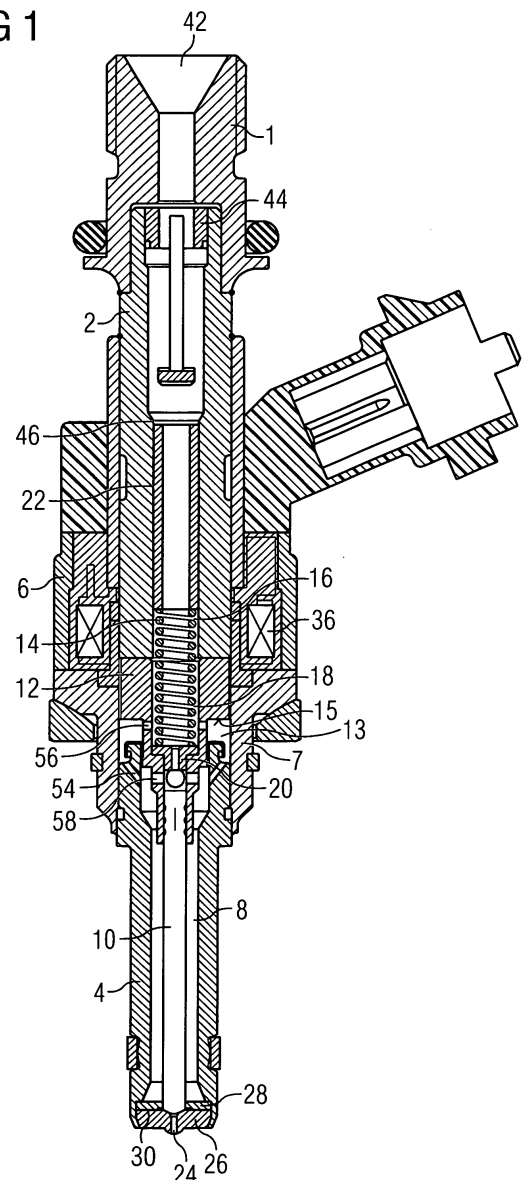
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(54) **Valve group for an injector and corresponding injector**

(57) A Valve group for an injector comprises a valve body shell (7) and a valve body (4). The valve body (4) has a first valve body recess (8). The valve group further comprises a needle body which is arranged in the first valve body recess (8). The needle body is arranged movable in axial direction preventing in a closed position of the needle body a fluid flow through an injection nozzle (24) and otherwise enabling the fluid flow through the injection nozzle (24). The needle body has a needle body recess (18) extending in axial direction from one axial end of the needle (10), which is faced away from the injection nozzle (24). A first fluid path enables a fluid flow to the injection nozzle (24). The first fluid path comprises the needle body recess (18), a first fluid line (56) of the needle body (4), a fluid line (54) of the valve body (4), and the valve body recess (8). A second fluid path extends hydraulically parallel to the first fluid path. The second fluid path as well enables a fluid flow to the injection nozzle (24) and comprises the needle body recess (18), a second fluid line (58) of the needle body (4), and the valve body recess (8).

FIG 1



Description

[0001] The invention relates to an injector and a valve group for the injector. The valve group comprises a valve body shell and a valve body having a first valve body recess. The valve group further comprises a needle body which is arranged in the first valve body recess movable in axial direction, preventing in a closed position of the needle body a fluid flow through an injection nozzle and otherwise enabling the fluid flow through the injection nozzle.

[0002] The object of the invention is to create an injector and a valve group for the injector, which enables in a simple way a precise dosing of fluid.

[0003] The object of the invention is achieved by the independent claims.

[0004] The invention is distinguished by an injector and a valve group for the injector. The valve group comprises a valve body, a valve body shell, and a needle body. The valve body has a first valve body recess. The needle body is arranged in the first valve body recess movable in axial direction, preventing a fluid flow through an injection nozzle in a closed position of the needle body and otherwise enabling the fluid flow through the injection nozzle. The needle body has a needle body recess which extends in axial direction from one axial end of the needle body, which is facing away from the injection nozzle. A first fluid path enables a fluid flow to the injection nozzle. The first fluid path comprises the needle body recess, a first fluid line of the needle body, a fluid line of the valve body, and the valve body recess. A second fluid path extends hydraulically parallel to the first fluid path and enables as well a fluid flow to the injection nozzle. The second fluid path comprises the needle body recess, a second fluid line of the needle body, and the valve body recess.

[0005] The first and the second fluid path enable an accurate fluid flow to the injection nozzle. The first fluid line of the needle body, the second fluid line of the needle body, and the fluid line of the valve body enable a fine adjustment of the fluid flow and a fine adjustment of a damping effect on the fluid flow and on the movement of the needle body.

[0006] In an advantageous embodiment of the valve group the needle body comprises a surface which borders a free volume in axial direction away from the injection nozzle. The first fluid path comprises the free volume. The free volume connects the first fluid line of the needle body with the fluid line of the valve body. A pressure of the fluid in the free volume may force the needle body in axial direction at a surface of the needle body which borders the free volume. In that way the pressure of the fluid in the free volume may cause a damping effect on the needle body. The damping effect may lower oscillations of the needle body. The oscillations may for example occur when the needle body takes in its closing position.

[0007] In a further advantageous embodiment of the valve group the diameters of the first fluid line of the needle body and of the fluid line of the valve body are different from each other. The different diameters enable in a simple way to create given pressure characteristics in the free volume dependent on the different diameters of the fluid lines while operating the injector.

[0008] In a further advantageous embodiment of the valve group the needle body comprises a needle and an armature. The needle prevents in the closed position of the needle the fluid flow to the injection nozzle and otherwise enables the fluid flow to the injection nozzle. The armature is fixed to the needle at one axial end of the needle facing away from the injection nozzle. The armature comprises the needle body recess, the first and the second fluid line of the needle body, and the surface of the needle body bordering the free volume. If a drive of the injector is an electromagnetic drive, the armature of the needle body may be a part of the electromagnetic drive and comprises preferably a large diameter compared to the diameter of the needle. Because of the large diameter the surface bordering the free volume provides an accurate influence of the pressure of the fluid in the free volume on the needle body. Further the multipart needle body enables a low cost production of the needle body recess, and the first and the second fluid line of the needle body.

[0009] Exemplary embodiments of the invention are explained in the following with the aid of schematic drawings.

[0010] These are as follows:

Figure 1 a schematic drawing of an injector,

Figure 2 a valve group for the injector.

[0011] Elements of the same design or function are identified by the same reference character.

[0012] An injector (figure 1), which is in particular suited for dosing fuel into a combustion chamber of an internal combustion engine, comprises a fitting adapter 1 for connecting the injector to a fluid reservoir, such as a fuel rail. The injector further comprises an inlet tube 2, a housing 6 and a valve group. The valve group comprises a valve body 4, a valve body shell 7, and a needle body with a needle body recess. A recess 8 in the valve body 4 is provided which takes in part of the needle body movable in axial direction.

[0013] The needle body may comprise a needle 10 and an armature 12. If the needle body comprise the needle 10 and the armature 12, the needle body recess comprises an recess 18 of the armature 12, the armature 12 is fixed to the needle 10, and the recess 8 in the valve body 4 takes in the needle 10 and preferably part of the armature 12. A surface 15 of the armature 12, the valve body shell 7, and the valve body 4 border a free volume 13. Alternatively the needle body may be made in one piece or the needle body may comprise further parts of the needle body.

[0014] A recess 16 of the inlet tube 2 is provided which

further extends to the recess 18 of the armature 12. A spring 14 is arranged in the recess 16 of the inlet tube 2 and/or the recess 18 of the armature 12. Preferably it rests on a spring seat being formed by an anti-bounce disk 20. The spring 14 is in this way mechanically coupled to the needle 10. An adjusting tube 22 is provided in the recess 16 of the inlet tube 2. The adjusting tube 22 forms a further seat for the spring 14 and may during the manufacturing process of the injector be axially moved in order to preload the spring 14 in a desired way.

[0015] In a closing position of the needle 10 it rests sealing up on a seat 26 and prevents in this way a fluid flow through at least one injection nozzle 24. The injection nozzle 24 may, for example, be an injection hole it may however also be of some other type suitable for dosing fluid. The seat 26 may be made in one part with the valve body 4 or may also be a separate part from the valve body 4. In addition to that preferably a lower guide 28 for guiding the needle 10 is provided. In addition preferably a swirl disk 30 may be provided.

[0016] The injector is provided with a drive, that is preferably an electromagnetic drive, comprising a coil 36, which is preferably extrusion-coated, the valve body shell 7, the armature 12 and the inlet tube 2 all forming an electromagnetic circuit. The armature 12 preferably comprises a large diameter compared to the diameter of the needle 10. The large diameter enables a proper electromagnetic flow through the armature 12 which contributes to a proper controllability of the needle body.

[0017] If the coil 36 is energized this results in an electromagnetic force acting on the needle body 4. The electromagnetic force acts against the mechanical force obtained from the spring 14. After a given time the coil 36 may be de-energized again. By appropriately energizing the coil 36, the needle body 4, in particular the needle 10 may in that way be moved away from its closing position which results in a fluid flow through the injection nozzle 24.

[0018] A fluid inlet 42 is provided in the fitting adapter 1 which then may communicate with a filter 44. The fluid may flow from the fluid inlet 42 through the adjusting tube 22 towards the recess 18 of the armature 12. The adjusting tube 22 may be provided with a damper 46. The damper 46 may be designed for dampening the fluid flow and comprises at least one orifice, through which the fluid may flow. Then the fluid may flow through a first fluid path. The first fluid path comprises the needle body recess 18, a first fluid line 56 (figure 2) of the needle body 4, a fluid line 54 of the valve body 4, and the valve body recess 8. In this embodiment the first fluid path further comprises the free volume 13 connecting the first fluid path 56 of the armature 12 with the fluid line 54 of the valve body 4. The fluid may also flow through a second fluid path. The second fluid path comprises the recess 18 of the armature 12, preferably a recess of the anti-bounce disk 20, a second fluid line 58 of the armature 12, and the valve body recess 8. The second fluid path extends hydraulically parallel to the first fluid path, in par-

ticular, the first fluid line 56 of the armature, the free volume 13 and the fluid line 54 of the valve body 4 are hydraulically parallel to at least a part of the armature recess 18 downstream the first fluid line 54 of the armature 12 and the second fluid line 58 of the armature 12. Alternatively there may be further fluid lines of the valve body 4 and/or the armature 12 extending hydraulically parallel to the fluid line 54 of the valve body 4 and/or the first and/or the second fluid line 56, 58 in order to increase the flow through the first and/or the second fluid path.

[0019] The fluid line 54 of the valve body 4 and the first and the second fluid line 56, 58 enable an accurate and stable fluid flow towards the injection nozzle 24. The characteristic flow of the fluid through the first fluid path is unequal to the characteristic flow of the fluid through the second fluid path. The characteristic flow for example may comprise the pressure differences downstream of one of the fluid lines 54, 56, 58 respectively the pressure upstream the fluid lines 54, 56, 58 and/or the velocity of the fluid and/or possible oscillations of the pressure and/or the velocity of the fluid. The characteristic flow may be characterized by further parameters which are representative for the dynamics of the fluid. The unequal characteristic flow of the fluid contributes to low oscillations in the whole fluid flow through the injector and to low oscillations of the needle body and in particular of the needle 10 which contributes to a precise dosing of the fluid.

[0020] The pressure of the fluid in the free volume 13 and in the recess 8 of the valve body 4 forces the needle body for example at the surface 15 in direction away from the injection nozzle 24. The large diameter of the armature 12, in particular of the surface 15 enables the force of the pressure of the fluid on the needle body. Different diameters of the fluid lines 54, 56, 58 lead to different pressures in the free volume 13 and the recess 8 of the valve body 41 while operating the injector. Also the different diameters of the first fluid line 56 of the armature 12 and the fluid line 54 of the valve body 4 in relation to each other may create a special fluid flow and a special pressure characteristic of the free volume 13. This affects the movement of the whole needle body. So one may be able to adjust the movement of the needle body by adjusting the different diameters of the fluid lines 54, 56, 58 and/or create a damping effect which affects the needle body. This contributes to a precise dosing of the fluid.

[0021] The design is made taking into consideration that a pressure drop due to the dampening should be minimized, the pressure oscillations after moving the needle 10 out of its closing position should be minimized, and the oscillation of the needle 10 after hitting the seat 26 should also be minimized. In this way by making simulations or just simply trying different properties of the fluid lines 54, 56, 58 an optimum or nearly optimum solution may be found. The properties comprise the diameter of the fluid lines 54, 56, 58 and may also comprise different shapes of the fluid lines 54, 56, 58, for example a conical shape. At the price of a small pressure drop the

oscillations may be reduced and therefore especially opening times with respective short energization time of the coil 36 ranging in the area of the oscillations of the pressure of the fluid without the dampening effect lead to a more precise dosing of the fluid.

(18), the first and the second fluid line (56, 58) of the needle body, and the surface (15) of the needle body (4) bordering the free volume (13).

- 5 5. Injector comprising the valve group in accordance with one of the preceding claims.

Claims

1. Valve group for an injector comprising 10
 - a valve body shell (7),
 - a valve body (4) having a first valve body recess (8),
 - a needle body which is arranged in the first 15
 - valve body recess (8) movable in axial direction preventing in a closed position of the needle body a fluid flow through an injection nozzle (24) and otherwise enabling the fluid flow through the injection nozzle (24), 20
 - the needle body having a needle body recess (18) extending in axial direction from one axial end of the needle body, which is facing away from the injection nozzle (24),
 - a first fluid path enabling a fluid flow to the in- 25
 - jection nozzle (24) comprising the needle body recess (18), a first fluid line (56) of the needle body (4), a fluid line (54) of the valve body (4), and the valve body recess (8),
 - a second fluid path which extends hydraulically 30
 - parallel to the first fluid path, as well enabling a fluid flow to the injection nozzle (24), comprising the needle body recess (18), a second fluid line (58) of the needle body (4), and the valve body recess (8). 35
 - 2. Valve group in accordance with claim 1 with the needle body comprising a surface (15) which borders a free volume (13) in axial direction away from the in- 40
 - jection nozzle (24) and with the first fluid path comprising the free volume (13) connecting the first fluid line (56) of the needle body (4) with the fluid line (58) of the valve body (4).
 - 3. Valve group in accordance with one of the preceding 45
 - claims with the diameters of the first fluid line (56) of the needle body and of the fluid line (54) of the valve body (4) being different from each other.
 - 4. Valve group in accordance with one of the claims 2 50
 - or 3 with the needle body comprising a needle (10) preventing in a closed position of the needle body the fluid flow through the injection nozzle (24) and otherwise enabling the fluid flow and with the needle body further comprising an armature (12) which is 55
 - fixed to the needle (10) at one axial end of the needle (10) facing away from the injection nozzle (24), the armature (12) comprising the needle body recess

FIG 1

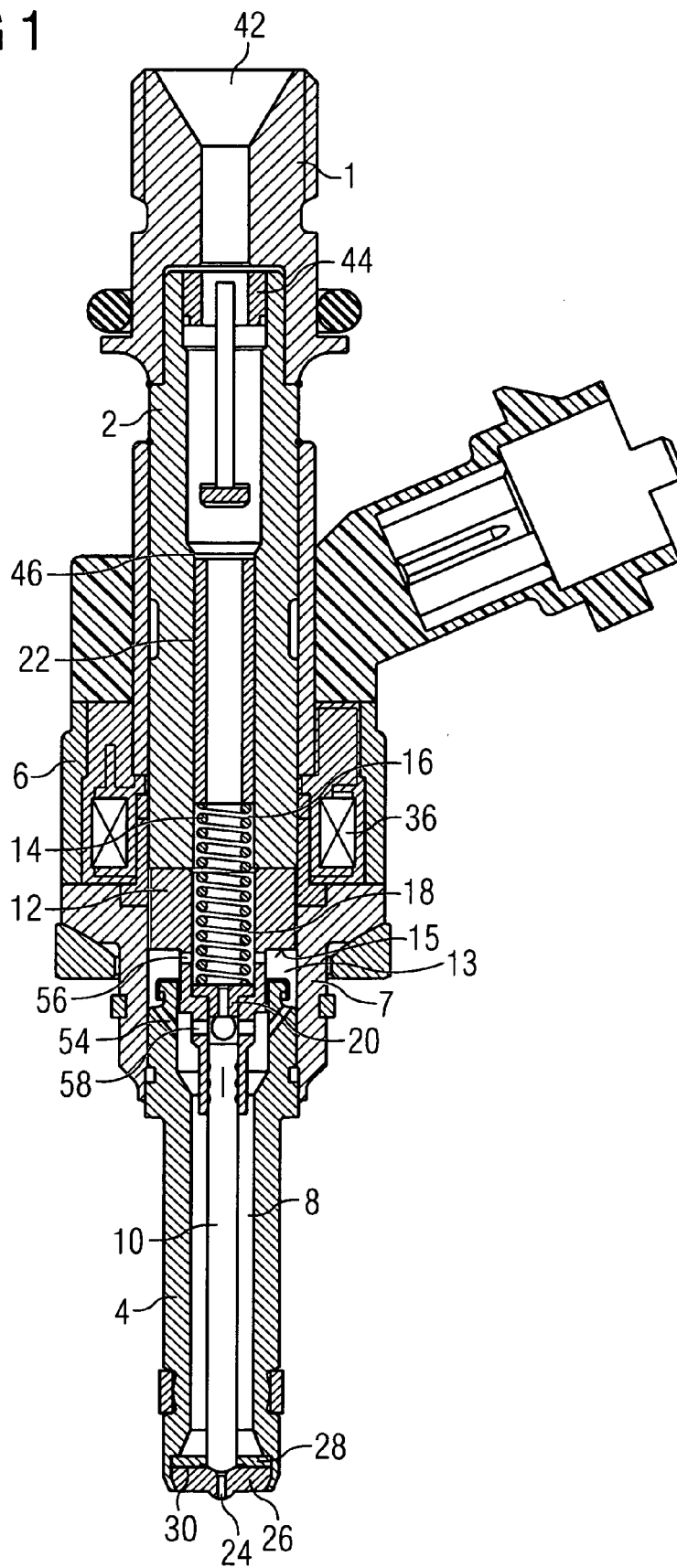
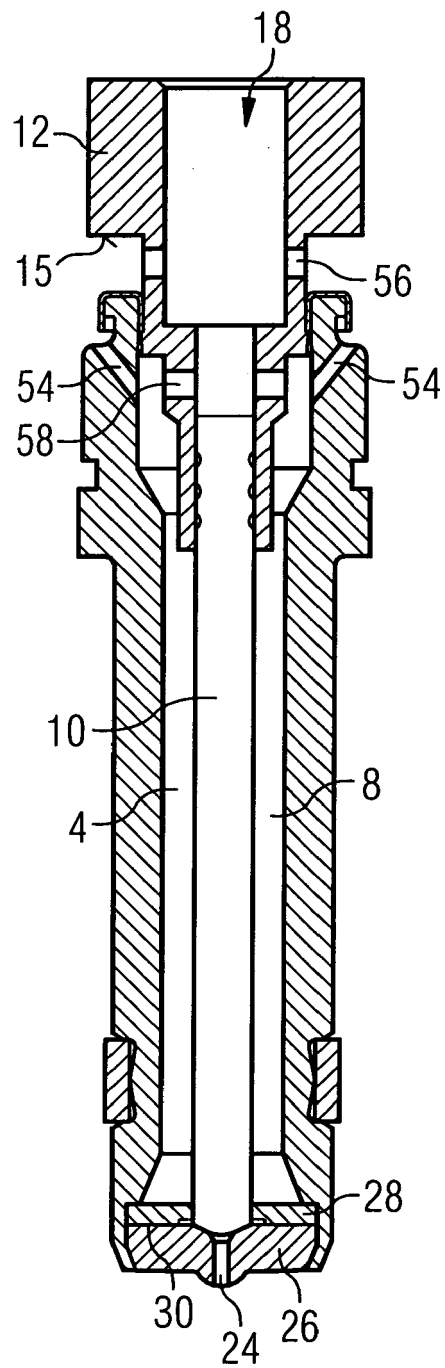


FIG 2





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 02 0932

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 5 069 189 A (SAITO ET AL) 3 December 1991 (1991-12-03) * column 3, line 29 - column 4, line 24; figure 2 *	1,2,4,5	F02M61/10 F02M51/06
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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 19 December 2005	Examiner Landriscina, V
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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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 05 02 0932

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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