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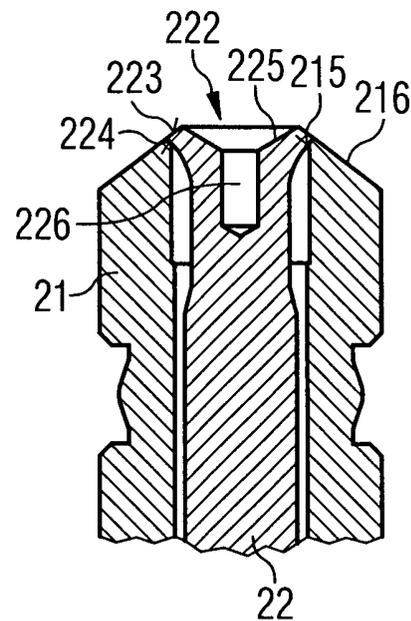
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(54) **Fluid injector with a deformable valve needle**

(57) A fluid injector comprises a housing, an actuator unit and a valve body. The valve body comprises a cartridge (21) with a recess, that forms an injection nozzle on one end and with a needle (22), that is arranged in the recess and closes the injection nozzle, if it rests with its seat area (224) on a needle seat (215) of the cartridge (21). The needle tip (222), which is adjacent to the seat area (224) comprises a centrally dished area (225).

FIG 3



Description

[0001] The invention relates to a valve body and a fluid injector. The valve body comprises a cartridge, with a recess that forms an injection nozzle on one end. The valve body further comprises a needle, that is arranged in the recess and closes the injection nozzle, if it rests with its seat area on a needle seat of the cartridge.

[0002] Fluid injectors, in particular fuel injectors for diesel or gasoline internal combustion engines, comprise a housing, an actuator unit and a valve body. The valve body comprises a needle that opens or closes a nozzle and in that way controls the injection of fuel. In an increasing number of applications actuator units with a piezoelectric actuator are used. They have the advantage of having a very fast response time to actuating signals and enable like that multiple injections into a cylinder of the internal combustion engine during one working cycle of the cylinder. In order to improve the spray characteristics of the fluid injector the fluid pressure is increased. In current gasoline internal combustion engines the fluid injectors are supplied with fuel which has a pressure of up to 200 bars.

[0003] WO 03/016707 A1 discloses a fluid injector with a connector to a fuel supply, a housing, an actuator unit, and a valve body. The housing is double tubed and has a recess, which takes up the actuator unit. The actuator unit comprises a piezoelectric actuator, which acts on the needle. Between the walls of the double tube-shaped housing the fuel is led from the connector to a fuel inlet of the valve body. The valve body has a housing part with a recess, that takes up a needle. Depending on the position of the needle a nozzle is opened or closed and respectively fuel is injected or not.

[0004] Increasingly strict legislation concerning emissions of internal combustion engines, where a valve body or a fluid injector with valve body is arranged, make it necessary to put a lot of effort in measures, that reduce the emissions. Very important for the prevention of exhaust emissions is, that fluid injectors used for the internal combustion engine can be controlled in a closed position of the needle, in which a fuel leakage through the injection nozzle is very low.

[0005] The object of the invention is to create a valve body and a fluid injector, which is simple and ensures a very low leakage of fluid through the valve body or respectively the fluid injector.

[0006] The object concerning the valve body is achieved by the features of claim 1. The object concerning the fluid injector is achieved by the features of claim 5. Advantageous embodiments of the invention are given in the subclaims.

[0007] The valve body is distinguished by a cartridge with a recess, that forms an injection nozzle on one end and with a needle, that is arranged in the recess and closes the injection nozzle, if it rests with its seat area on a needle seat of the cartridge. The needle tip, which is adjacent to the seat area, comprises a centrally

dished area.

[0008] The invention concerning the valve body is based on the finding, that the dished area makes the needle tip flexible and enables micrometric tip movements of the needle in the needle seat, which improves the sealing quality between the needle seat and the seat area of the needle very much. The valve body has further the advantage that it is simple to manufacture.

[0009] In an advantageous embodiment of the invention concerning the valve body the needle tip is dished in a way, that the most inward located point of the dished area is at least as close to an actuator unit sided end of the needle as the most inward point of a needle seat of the cartridge. By this surprisingly good sealing quality can be achieved.

[0010] In a further advantageous embodiment of the invention concerning the valve body the needle comprises a blind hole in the needle tip. The blind hole is simple to manufacture and improves to a high extent the sealing quality between the needle and the cartridge.

[0011] In a further advantageous embodiment of the invention concerning the valve body the cartridge comprises a conically-shaped tip, this improves in combination with the dished area of the needle further the sealing quality between the cartridge and needle and enables to easily set the spray angle.

[0012] The object of the invention concerning the fluid injector is achieved by the features of claim 5. The fluid injector is distinguished by a housing, an actuator unit and the valve body.

[0013] Exemplary embodiments of the invention are explained in the following with the aid of schematic drawings. These are as follows:

Figure 1 a fluid injector,
Figure 2 a valve body and
Figure 3 an enlargement of parts of the valve body.

[0014] Elements of the same design and function, that occur in different illustrations, are identified by the same reference character.

[0015] A fluid injector, that is used as a fuel injector for an internal combustion engine, comprises a housing 1, a valve body 2, an actuator unit 3 and a fuel connector 4. The fuel connector 4 is designed to be connected to a high pressure fuel chamber of the internal combustion engine, where fuel is stored under high pressure, for example under the pressure of about 200 Bar.

[0016] The housing 1 is preferably formed out of a double-tubed housing. In the space between the walls of the double-tubed housing the fuel is led from the fuel connector to a fuel inlet 214 of the valve body 2.

[0017] The valve body 2 comprises a cartridge 21, which is permanently fixed to the housing 1 at one of its free ends, preferably by welding, especially by laser-welding. The cartridge 21 comprises a recess 211 (Figure 2) which forms at one of its ends an injection nozzle 213 and which takes in a needle 22.

[0018] A spring rest 24 is connected to the needle 22. A return spring 25 rests on the spring rest 24 and pre-tensions the needle 22 in a direction away from the injection nozzle 213. In that way the needle 22 closes the injection nozzle 213 with its tip 23, if no further external forces act on the needle 22.

[0019] The fuel is led from the fuel inlet 214 in the space between the needle 22 and the wall of the recess 213 of the cartridge 21 to the injection nozzle 213. The needle 22 further comprises a guided zone 221, by which the needle 22 is guided within the recess 213.

[0020] In the position where the needle 22 closes the injection nozzle 213 the needle 22 rests with its seat area 224 on a needle seat 215 of the cartridge 21. The needle seat 215 and the seat area 224 are conically shaped in a preferred embodiment. This enables to set a desired spray angle.

[0021] The cartridge 21 further comprises in a preferred embodiment of the invention a conically-shaped tip 216 and the needle 22 comprises a respectively conically-shaped area 223 in the needle tip area 222 of the needle 22. This improves the sealing quality and enables to set the spray angle as desired depending on the slope of the cone.

[0022] The needle tip 222 comprises a centrally dished area 225. The centrally dished area 225 reduces the stiffness of the needle in its seat area 224. By this the seat area 224 becomes slightly more flexible which enables micrometric movements of the needle tip 222 in the seat area 224 and like that improves the sealing quality between the seat area 224 of the needle 22 and the needle seat 215.

[0023] In a preferred embodiment of the invention the needle tip 222 (Figure 3) is dished in a way, that the most inward located point of the dished area 225 is at least as close to an actuator unit sided end 227 of the needle 22 as the most inward point of the needle seat 215 of the cartridge 21. By this a surprisingly good sealing quality is achieved.

[0024] The dished area 225 may be as shown in Figure 3 but it may also be formed in another way, that also makes the needle tip flexible and enables the micrometric movements of the needle 22 in its seat area 224 when it is pushed against the needle seat 215 of the cartridge 21. The dished-shaped area 225 may, for example, be in an alternative embodiment formed in a ring-shaped manner, so that the central area of the needle tip 222 projects outwards.

[0025] It is however preferred to have a blind hole 226 in the center of the needle tip 222, which projects inwards to the needle 22. Experiments have shown that this further improves the sealing quality to a high extent.

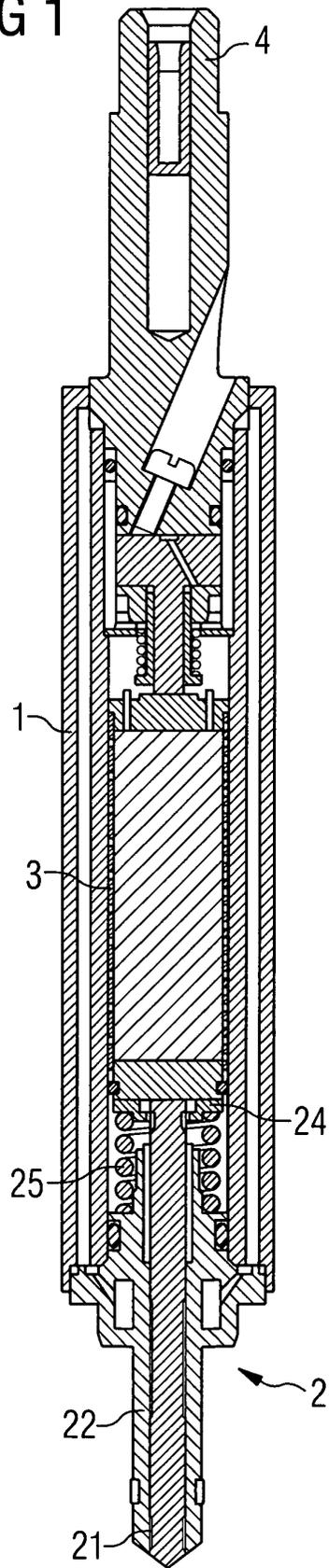
Claims

1. Valve body with a cartridge (21) with a recess (211), that forms an injection nozzle (213) on one end and

with a needle (22), that is arranged in the recess (211) and closes the injection nozzle (213), if it rests with its seat area (224) on a needle seat (215) of the cartridge (21), where the needle tip (222), which is adjacent to a seat area (224), comprises a centrally dished area (225).

2. Valve body in accordance with claim 1, where the needle tip (222) is dished in a way, that the most inward located point of the dished area (225) is at least as close to an actuator unit sided end (227) of the needle (22) as the most inward point of the needle seat (215) of the cartridge (21).
3. Valve body in accordance with one of the preceding claims, with the needle (22) comprising a blind hole (226) in the needle tip (222).
4. Valve body in accordance with one of the preceding claims, where the cartridge (21) comprises a conically-shaped tip (216).
5. Fluid injector with a housing (1), an actuator unit (3) and a valve body (2) in accordance with one of the preceding claims.

FIG 1





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4	Place of search MUNICH	Date of completion of the search 23 March 2004	Examiner Jackson, S
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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EUROPEAN SEARCH REPORT

Application Number
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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