Abstract

FUEL INJECTOR AND METHOD FOR THE MANUFACTURE AND/OR ASSEMBLY OF A NOZZLE NEEDLE ASSEMBLY

A fuel injector for a fuel injection system comprising a nozzle body (1) and an injector body (2), wherein a high-pressure bore (3) is formed in the nozzle body (1) for accommodating a nozzle needle (4), which performs a stroke movement by which at least one injection opening (5) is opened up or closed off. In the injector body (2) a low-pressure chamber (6) for accommodating a piezoelectric actuator (7) is formed, which is hydraulically coupled via a coupler (8) to the nozzle needle (4) in such a way that the nozzle needle (3) assumes the closed position thereof when the piezoelectric actuator (7) is electrically discharged. In an embodiment, the coupler (8) comprises a first and a second disc-shaped coupler body (9, 10) which in each case has one cylinder bore (11, 12) for accommodating one coupler piston (15, 16) each, which delimits a coupler chamber (13, 14).

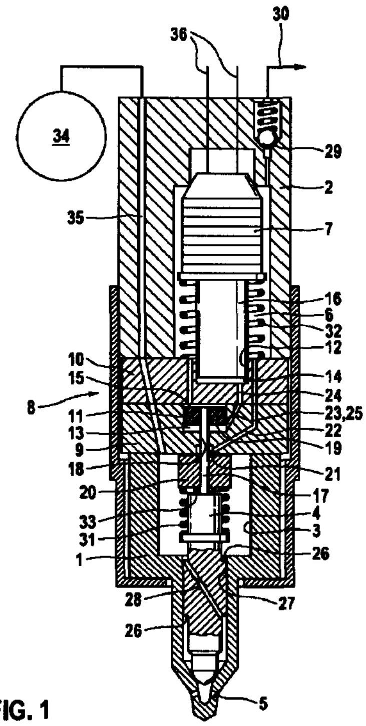

FIG. 1

I/We claim:

1. A fuel injector for a fuel injection system, particularly a common rail injection system, comprising:

a nozzle body (1); and

an injector body (2), wherein a high-pressure bore (3) is formed in the nozzle body (1) for accommodating a nozzle needle (4) that performs a stroke movement and at least one injection opening (5) is opened up or closed off by the stroke movement of the nozzle needle (4), and wherein a low-pressure chamber (6) is formed in the injector body (2) for accommodating a piezoelectric actuator (7), further wherein the low-pressure chamber (6) is hydraulically coupled via a coupler (8) to the nozzle needle (4) in such a way that the nozzle needle (3) takes a closed position when the piezoelectric actuator (7) is electrically discharged;

characterized in that,

the coupler (8) comprises a first disc-shaped coupler body (9) and a second disc-shaped coupler body (10), which in each case has one cylinder bore (11, 12) for accommodating in each case one coupler piston (15, 16) that delimits a coupler chamber (13, 14).

2. The fuel injector as claimed in claim 1, wherein the first disc-shaped coupler body (9) and the second disc-shaped coupler body (10) are disposed in an axial direction one behind the other between the nozzle body (1) and the injector body (2).

3. The fuel injector as claimed in one of the claim 1 or 2, wherein the first disc-shaped coupler body (9) axially limits a high-pressure bore (3) and/or the second disc-shaped coupler body (10) axially limits the low-pressure chamber (6).

4. The fuel injector as claimed in any one of the preceding claims, wherein a compound piston (17) is formed at the nozzle needle (4) for mechanical connection of the nozzle needle (4) with the first coupler piston (15) accommodated in the first disc-shaped coupler body (9), and wherein the connecting piston (17) is guided through a guide bore (18) formed in the coupler body (9).

5. The fuel injector as claimed in claim 4, wherein the connecting piston (17) is guided through the first coupler chamber (13) up to the first coupler piston (15) so that a pressure surface (19) is formed at the first coupler piston (15) and limits the first coupler chamber (13) in order to reduce the cross-sectional region of the connecting piston (17).

6. The fuel injector as claimed in one of the claim 4 or 5, wherein the connecting piston (17) is surrounded in the region of the high-pressure bore (3) by a sleeve (20) abutting on the first disc-shaped coupler body (9) in a sealed manner.

7. The fuel injector as claimed in any one of claims 4 to 6, wherein the guide bore (18) has a low-pressure region, for example, in the form of an annular groove (21), which stands in communication with the low-pressure chamber (6) via a bore (22).

8. The fuel injector as claimed in any one of the preceding claims, wherein the coupler chambers (13, 14) are hydraulically connected via bores (23, 24) formed into the first disc-shaped coupler body (9) and the second disc-shaped couple body (10), and wherein a throttle (25) is formed in a bore (23, 24).

9. The fuel injector as claimed in any one of the preceding claims, wherein the high-pressure bore (3) has a guide portion (27) for guiding the nozzle needle (4), and wherein adjacent regions of the high-pressure bore are hydraulically connected on the guide region (27) via a throttle (28).

10. The fuel injector as claimed in any one of the preceding claims, wherein the low-pressure chamber (6) is connected with a return (30) via a check valve (29) in order to realize a pressure increase in the low-pressure chamber (6).

11. The fuel injector as claimed in any one of claims 1 to 3 or 6 to 10, wherein the nozzle needle (4) and the first coupler piston (15) accommodated in the first disc-shaped coupler body (9) are mechanically coupled via a connecting piston (17), and wherein the connecting piston (17) is guided as a component of the first coupler piston (15) through a guide bore (18) formed in the coupler body (9).

12. The fuel injector as claimed in claim 11, wherein the connecting piston (17) is connected with the nozzle needle (4) and/or the first coupler piston (15) in a force-fit, firmly bonded and/or form-fit manner.

13. The fuel injector as claimed in claim 11 or 12, wherein the connecting piston (17) is indirectly connected with the nozzle needle (4) via a connecting piece (37).

14. A method for manufacture and/or assembly of a nozzle needle assembly for a fuel injector comprising a nozzle needle (4) and a coupler piston (15) and a connecting piston (17) having a smaller outside diameter than the coupler piston (15) and/or the nozzle needle (4) posses and is part of the mono-or multi-part coupler piston (15), the method comprising:

guiding the connecting piston (17) through a guide bore (18) of a coupler body (9); and

directly or indirectly connecting the connecting piston (17) with the nozzle needle (4) in a force-fit, firmly bonded and/or form-fit manner.

15. The method as claimed in claim 14, wherein the connecting the connecting piston (17) with the nozzle needle (4) and/or the connecting piece (37) comprises welding, soldering, pressing, screwing, and/or gluing.

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To
The Controller of Patents
The Patent Office at New Delhi

Applicant(s) Name: **ROBERT BOSCH GmbH** Sheet No.: 1

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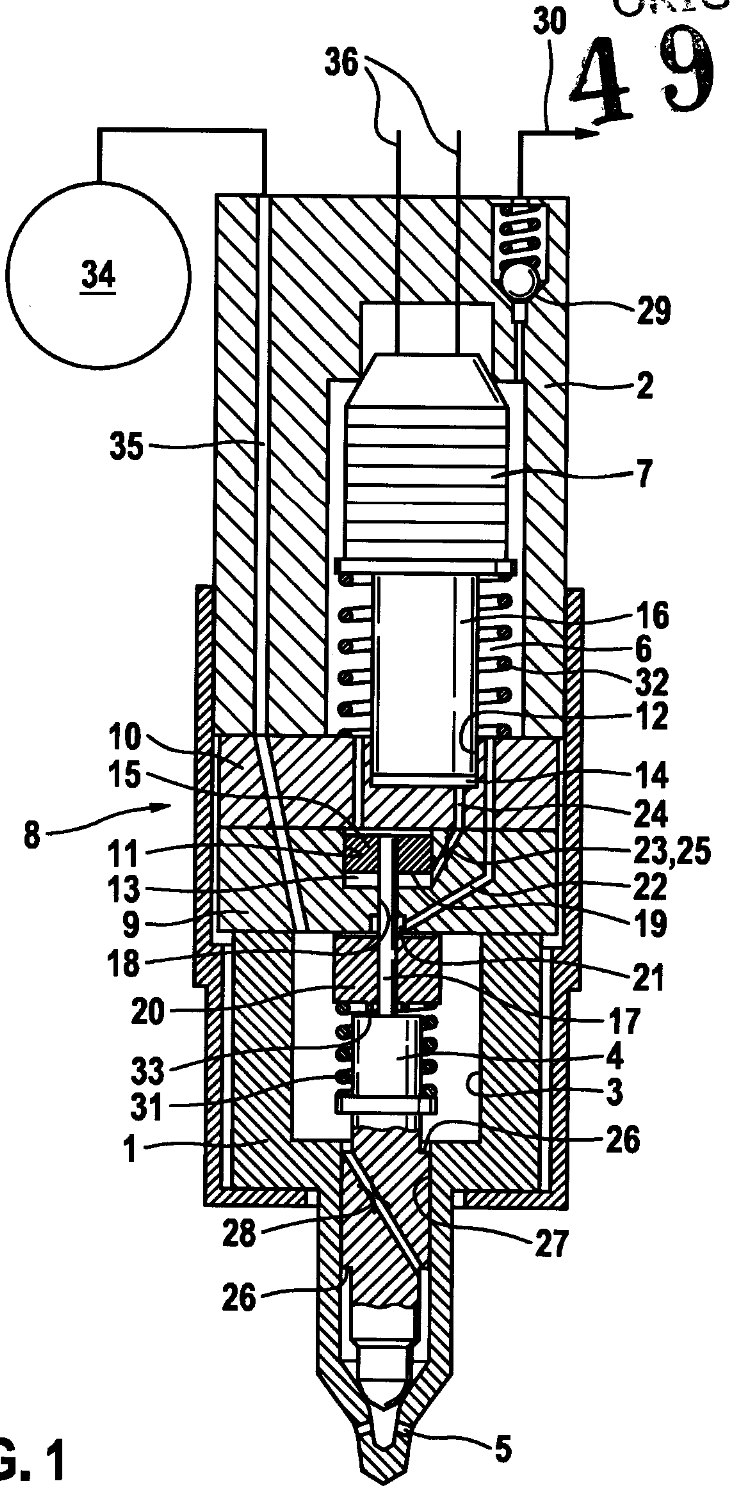

FIG. 1

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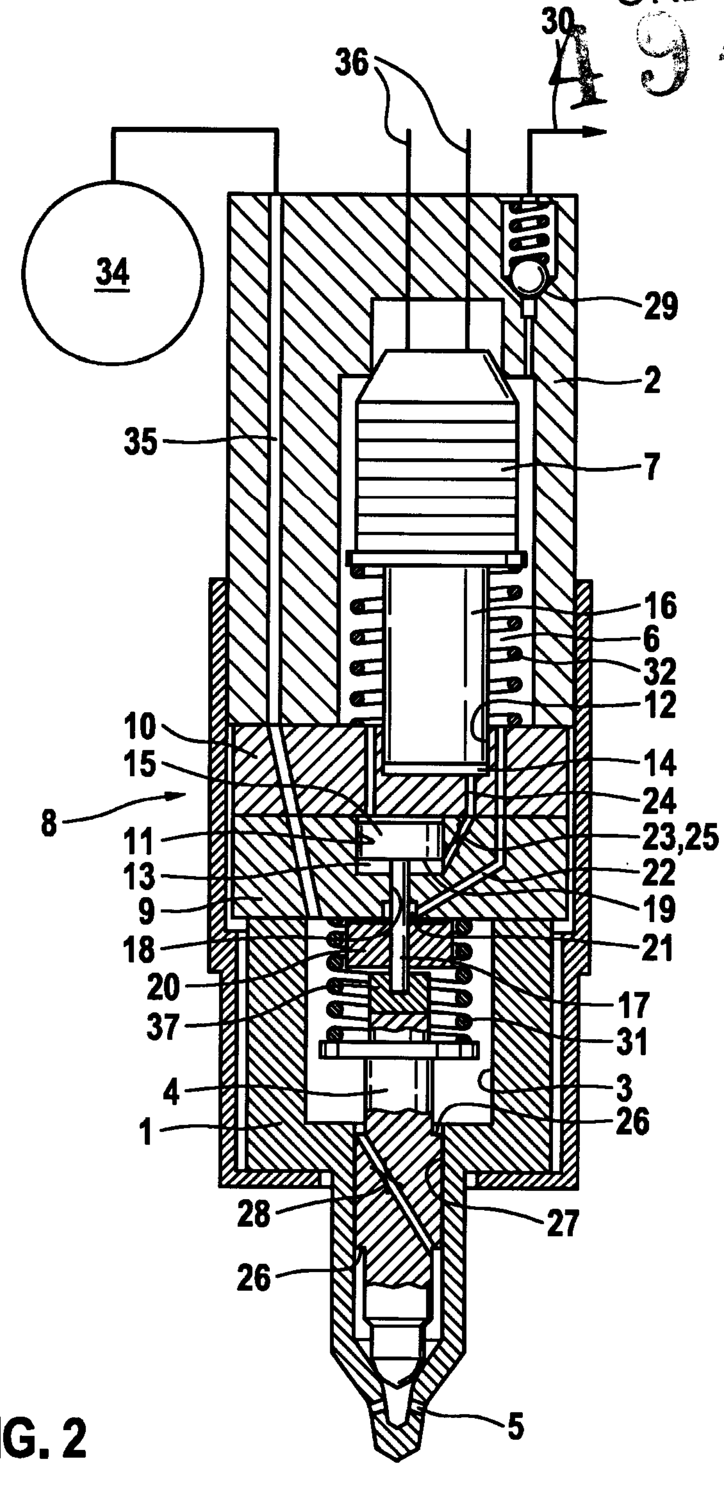

FIG. 2

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Technical Field

The present subject matter relates to a fuel injector for a fuel injection system, particularly a common rail injection system, for injecting fuel into the combustion chamber of an internal combustion engine and, to a method for manufacture and/or assembly of a needle assembly for use in such a fuel injector.

Background

A typical fuel injector is known from the published patent application DE 10 2008 002 417 A1. The fuel injector described herein comprises a piezoelectric actuator, which is housed in a relatively pressure-free actuator chamber.

The piezoelectric actuator is hydraulically coupled to a nozzle needle of the injector in such a manner that the nozzle needle assumes its closed position when the piezoelectric actuator is electrically discharged and with the connection of the piezoelectric actuator to an electrical power supply migrates into the open position. The opening stroke of the nozzle needle takes place in a direction opposite to the actuator stroke. The coupler thus effects a reversal of the direction of movement.

This has the advantage that the piezoelectric actuator gets electrically charged in short injection phases and electrically discharged in the prolonged period of rest phase of the fuel injector and thus subjected to less stress. This increases the service life of the piezoelectric actuator provided for the operation of the nozzle needle.

The affects prolonging the lifespan of the piezoelectric actuator also spatially affects the assembly of the piezoelectric actuator in a relatively pressure-free actuator chamber. The actuator is thus not acted by the high-pressure fuel. A high-pressure sealing of the piezo actuator is thus also unnecessary.

The equipment for hydraulic coupling of the piezoelectric actuator with the needle specified in the patent application also allows reduction of travel ratio between the stroke of the actuator and the stroke of the nozzle needle, as displacer-effective cross sections of the two pistons of the coupler are measured much differently. As a result even at low actuator stroke, a sufficient nozzle needle stroke can be realized.

Summary

This summary is provided to introduce concepts related to a fuel injector for a fuel injection system, and the concepts are further described below in the detailed description. This summary is neither intended to identify essential features of the claimed subject matter nor is it intended for use in determining or limiting the scope of the claimed subject matter.

In an embodiment, the subject matter disclosed herein describes a fuel injector for a fuel injection system, particularly a common rail injection system. The fuel injector includes a nozzle body and an injector body. Further, a high-pressure bore is formed in the nozzle body for accommodating a nozzle needle that performs a stroke movement and at least one injection opening is opened up or closed off by the stroke movement of the nozzle needle. Further, a low-pressure chamber is formed in the injector body for accommodating a piezoelectric actuator. The low-pressure chamber is hydraulically coupled via a coupler to the nozzle needle in such a way that the nozzle needle takes a closed position when the piezoelectric actuator is electrically discharged. According to the subject matter, the coupler includes a first disc-shaped coupler body and a second disc-shaped coupler body, which in each case has one cylinder bore for accommodating in each case one coupler piston delimiting a coupler chamber.

In another embodiment, the subject matter disclosed herein further describes a method for manufacture and/or assembly of a nozzle needle assembly for a fuel injector comprising a nozzle needle and a coupler piston and a connecting piston having a smaller outside diameter than the coupler piston and/or the nozzle needle posses and is part of the mono-or multi-part coupler piston. The method includes guiding the connecting piston through a guide bore of a coupler body, and directly or indirectly connecting the connecting piston with the nozzle needle in a force-fit, firmly bonded and/or form-fit manner.

Brief Description of the Figures

Embodiments of the present subject matter are explained in more detail with reference to the accompanying drawings.

Fig. 1 shows a longitudinal section of a fuel injector, in accordance with a first embodiment of the present subject matter.

Fig. 2 shows a longitudinal section of a fuel injector, in accordance with a second embodiment of the present subject matter.

Detailed Description

The present subject matter describes a fuel injector in which a larger space exists with regard to the design of the coupler piston region in order to optimize the reduction ratio. At the same time to the construction of the coupler and the connection of the couplers with the nozzle needle can be simplified in order to provide a simple and inexpensive fuel injector to be manufactured.

Starting from a typical fuel injector, the present subject matter describes a coupler that includes a first disc-shaped coupler body and a second disc-shaped coupler body, which in each case has a cylinder bore for receiving a respective coupler piston delimiting a coupler. The coupler with two separate coupler bodies is easy to implement and thus inexpensive to manufacture. In addition, a surface ratio of active surfaces of the coupler piston designed hydraulically for the realization of an optimal reduction ratio between the stroke of the actuator and the stroke of the nozzle needle is largely arbitrary. To the surface design, the diameter of the respective cylinder bore is drawn, in which the respective coupler piston is accommodated. The diameter of the cylinder bore is also freely selectable. By the coupler, in addition to a corresponding assembly of the coupler piston in the coupler bodies, realizes a reversal of the movement, so that the nozzle needle stroke takes place in the direction opposite to the stroke of the actuator.

This ensures that the piezoelectric actuator must be electrically charged only for the realization of an injection, while it is electrically discharged in phases between two injections. As a result, the piezoelectric actuator is subjected to less stress. It likewise effects favorable in this context that the piezoelectric actuator is arranged in a low-pressure chamber. Here, the piezoelectric actuator may be formed as a "wet" or "dry" actuator. In the latter case, the actuator possesses a corresponding seal, for example consisting of a metal shell with a membrane.

In an embodiment, the first disc-shaped coupler body and the second disc-shaped coupler body are axially arranged one after another lying between a nozzle body and an injector body.

The first disc-shaped coupler body and the second disc-shaped coupler body are formed with housing components in such a manner that a low-pressure region is separated from a high-pressure region.

Furthermore, a simple and easy coupler component to be assembled is created, which is built in the axial direction in compact manner.

In order to simplify the construction, it is further proposed that the first disc-shaped coupler body axially limits the high-pressure bore formed in the nozzle body.

Alternatively or additionally, it is provided that the second disc-shaped coupler body axially limits the low-pressure chamber formed in the injector body.

Thus, over the coupler, not only the separation of the low-pressure region from the high-pressure region is caused, but also the sealing of the low-pressure region with respect to the high-pressure region is affected. Additional measures are not necessary to seal, so that a simple and inexpensive manufacturing of the injector is ensured.

According to an embodiment of the present subject matter, a connecting piston for mechanical connection of the nozzle needle with a coupler piston accommodated in the first disc-shaped coupler body is formed at the nozzle needle. The connecting piston is connected through a guide bore formed in the coupler body. The connecting piston therefore extends the needle up into the low-pressure region. The mechanical connection of the connecting piston with the coupler piston can be effected, for example, by welding and/or by a press fit.

The connecting piston is brought through the guide bore and through the first coupler chamber up to the first coupler piston. As a consequence, a pressure surface is formed at the first coupler piston and is limiting the first coupler chamber in order to reduce the cross sectional region of the connecting piston. On the design of the respective region ratios, the required needle opening force can be reduced, so that the needle dynamics increases. At the same time, necessary positioning forces are reduced, so that a less powerful actuator is used.

The connecting piston in the region of the high-pressure bore, by a sleeve abutting on the disc-shaped coupler body in a sealed manner, is surrounded around the guide bore in the first disc-shaped coupler body, in which the connecting piston formed on the nozzle needle is accommodated to seal against the high-pressure bore. Instead of a separate sealing sleeve, the first disc-shaped coupler body may be provided with a cylindrical attachment for guiding the connecting piston and for sealing the guide bore with respect to the high-pressure bore.

As a further building measure, it is proposed that the guide bore has a low-pressure region, for example, in the form of an annular groove, which communicates in combination with the low-pressure chamber over the bore. This has the advantage that by way of leakage of the arriving fuel managed into the guide bore can be supplied via the low-pressure region and the bore of the low-pressure chamber. Thus, a defined coupling chamber pressure is ensured by the leakage removal.

In order to cause a hydraulic coupling of the nozzle needle with the piezoelectric actuator, the coupling chamber is hydraulically connected into the disc-shaped coupler bodies via bores. The volume of the coupling chamber is changed due to the lift of the coupler piston accommodated therein, wherein the fuel is displaced via the connection holes from one coupler chamber to the other coupler chamber.

Depending on the particular surface ratio of the hydraulically effective surfaces limiting the coupling chamber on the respective coupler piston, a reduction ratio is realized. The nozzle needle stroke required for releasing the injection opening may therefore be affected by a small actuator stroke. To improve the hydraulic design, in an embodiment, in one of the bores that connect the two coupler chamber, a throttle is formed. The throttle causes an attenuation of the needle speed and a reduction of characteristic field slope.

According to an embodiment of the present subject matter, the high-pressure bore formed within the nozzle body has a guide portion for guiding the nozzle needle. The regions of the high-pressure bore limiting the guide portion are hydraulically connected via a throttle. By this measure, a closing speed of the needle can be optimized. The closing movement of the nozzle needle is caused by a recoil spring supported on the nozzle needle.

In addition, it can be provided that clamping forces are generated by the couplers. As a further building measure it is therefore proposed that the low-pressure chamber is connected via a check valve with a return in order to realize a pressure increase in the low-pressure chamber. A pressure increase to, for example, 150 bars is considered as sufficient.

According to a further embodiment, an alternative to a direct connecting piston formed at the nozzle needle is proposed, wherein the nozzle needle and a first coupler piston accommodated within the first disc-shaped coupler body are mechanically coupled via a connecting piston, which is guided as a part of the first coupler piston through the guide bore formed within coupler body. This means that the connecting piston may not necessarily be a part of the nozzle needle, but can also be the part of the first coupler piston when it is guided through the guide bore during the assembly of the injector.

For example, the connecting piston may be guided integrally with the first disc-shaped coupler body or may be connected with this in such a manner that in a first assembly step, the one piece guided or assembled unit consisting of the first coupler piston and connecting piston into the guide bore of the coupler body is used and the connecting piston is then connected to the nozzle needle in a second assembly step. This has the advantage that the mechanical interface is shifted from the low-pressure region into the high-pressure region. Fitting problems in the piston guides, which are caused, for example, by welding or deformation during compression, are avoided or shifted to a less sensitive region. The high-pressure region, via a separate sealing sleeve lying at the first disc-shaped coupler body adjacent to the low-pressure region, is sealed to ensure that the sealing sleeve is placed in front of the connection of the connection piston with the nozzle needle.

Further, the connecting piston is positively connected with the nozzle needle and/or with the first coupler piston in force-fit, firmly bonded and/or form-fit manner. As already mentioned, the connection takes place by means of welding or pressing. Moreover, a screw connection may be provided. In an embodiment, at least one end portion of the connecting piston is provided with an external thread and inserted into the bore with an internal thread, which is formed in the first coupler piston and/or in the nozzle needle.

Furthermore, the connecting piston can also be indirectly connected via a connecting piece with the nozzle needle. The connecting piece has the same outer diameter as of nozzle needle and is axially attached to the nozzle needle. The connection may take place by welding. A bore, especially a blind hole, may be formed for receiving the connecting piston in the connecting piece, into which an end portion of the connecting piston is inserted. With an appropriate choice of the diameter, the connection can be a press connection. Alternatively, a screw connection or a welded connection is also executable.

The present subject matter further provides a method for manufacture and/or assembly of a nozzle needle assembly for a fuel injector comprising a nozzle needle, a coupler piston, and a connecting piston, wherein the compound piston has a smaller outside diameter than the coupler piston and/or the nozzle needle possess and is part of the single-or multi-part coupler piston. In this method, firstly the connecting piston is guided through a guide bore of a coupler body and then directly or indirectly connected to the nozzle needle in a force-fit, firmly bonded and/or form-fit manner. The method leads to a nozzle needle assembly, which is advantageous according to the present subject matter for use in a fuel injector. The nozzle needle assembly moreover can also be used in alternate designs and therefore not limited to use in an inventive injector.

In an embodiment, the connecting piston is welded, soldered, pressed, screwed and/or glued with the nozzle needle and/or a connecting piece for the indirect connection of the connecting piston with the needle.

The connection of the connecting piston to the nozzle needle takes place indirectly over a connecting piece, wherein the connecting piece and the nozzle needle are butt-jointed and welded together.

The subject matter disclosed herein is described with reference to the figures in the description hereinafter.

In Fig. 1, a longitudinal section of the fuel injector is shown having a nozzle body 1 for receiving a nozzle needle 4, and an injector body 2 for supporting a piezoelectric actuator 7 for the actuation of the nozzle needle 4. The nozzle needle 4 is accommodated in a high-pressure bore 3 of the nozzle body 1 in a lifting movement, so that one injection opening 5 formed in the nozzle body 1 is opened or closed over the nozzle needle stroke. The nozzle needle 4 is in its open position, under high-pressure is injected via the at least one injection opening 5 into the combustion chamber of the internal combustion engine. The fuel is supplied to the fuel injector from a high-pressure accumulator 34, in this case a common reservoir line (common rail). A feed channel 35 is formed in the injector body 2, by which the fuel reaches the high-pressure bore 3 and thus reaches at least one injection opening 5.

For actuating the nozzle needle 4, the piezoelectric actuator 7 is connected with an electrical power supply (not shown) via electrical connections 36. The electrically charged piezoelectric actuator 7 undergoes a linear extension representing the actuator stroke, which is implemented due to a coupler 8 in the stroke movement of the nozzle needle 4. The present coupler 8 is designed such that the linear expansion of the piezoelectric actuator 7 causes the movement of the nozzle needle 4 opposite to the movement direction of the piezoelectric actuator 7. This means that the piezoelectric actuator 7 is electrically charged during the opening stroke of the nozzle needle 4, and is discharged between two injection processes or in the closed position of the nozzle needle 4. Thereby, the stress of the piezoelectric actuator 7 is reduced.

It has also a favorable effect on the lifetime of the piezoelectric actuator 7 as the injector body 2 is accommodated in a low-pressure chamber 6. The piezoelectric actuator 7 is therefore not acted upon by high-pressure.

The coupler 8 comprises a first disc-shaped coupler body 9 and a second disc-shaped coupler boy 10, which are arranged in the axial direction one behind the other lying between the injector body 2 and the nozzle body 1. The first disc-shaped coupler body 9 and the second disc-shaped coupler body 10 thus separate the low-pressure region associated to the injector body 2 from the high-pressure region associated to the nozzle body 1.

At the same time disc-shaped coupler body 9 lying on the nozzle body 1 seals the high-pressure bore 3 and the disc-shaped coupler body 10 lying at the injector body 2 seals the low-pressure chamber 6. The coupler 8 can thus be moved completely into the low-pressure region.

The cylinder bore 11, 12 for receiving the coupler pistons 15, 16 is formed in the two disc-shaped coupler bodies 9, 10, wherein each coupler piston 15, 16 axially limits a coupler chamber 13, 14 within the respective cylinder bore 11, 12. The coupler piston surface limiting the respective coupler chamber 13, 14 forms pressure surfaces, whose region ratios determine the transmission ratio between the actuator stroke and the nozzle needle stroke. In the present case, a significantly greater pressure surface for limiting the second coupler chamber 14 formed at the second coupler piston 16, which is assigned to the piezoelectric actuator 7 than at the first coupler piston 15 which is connected with the nozzle needle 4 by the connecting piston 17.

For the purpose, the connecting piston 17 is guided by a guide bore 18 in the first disc-shaped coupler body 9 and by the first coupler chamber 13 so that pressure surface 19 limiting the coupling space 13 on the first coupler piston 15 is reduced to the cross sectional region of the connecting piston 17. The fact that the first coupler chamber 13 is disposed between the nozzle needle 4 and the first coupler piston 15 causes a pressure rise in the first coupler chamber 13 that the first coupler piston 15 and thus the nozzle needle 4 are raised. A pressure rise in the first coupler 13 takes place, if the second coupler piston 16 dips deeper into the second coupler chamber 14 due to the linear expansion of the piezoelectric actuator 7 and thereby fuel is displaced.

Over bores 23, 24 and a throttle 25 formed therein, the fuel in the first coupler chamber 13 is displaced to the second coupler chamber 14. Due to the chosen surface ratio, i.e., the size of hydraulically effective surface formed on a coupler piston 15, 16, a significantly larger nozzle needle stroke for opening the at least one injection orifice 5 is caused by a relatively small actuator stroke. The throttle 25 formed in the bores 23 and 24 causes a damping of the needle speed, so that the hydraulic design is further improved.

In order to seal the guide bore 18 relative to the high-pressure bore 3, the connecting piston 17 is surrounded in the region of high-pressure bore 3 of the sleeve 20. The sleeve 20 is supported on the first disc-shaped coupler body 9. For this purpose, the sleeve 20 has a front-sided support surface formed as a biting edge. Over a closing spring

31 supported on the nozzle needle 4, the sleeve 20 is held in engagement with the disc-shaped coupler body 9. The closing spring 31 also ensures that the nozzle needle 4 takes up its closed position with the discharged piezoelectric actuator 7. The assembly of the sleeve 20 around the connecting piston 17 cannot prevent leakage in the region of the guide bore 18, thus the leakage quantity reaching the guide bore 18 via an annular groove 21 and a bore 22 that connects the annular groove 21 with the low-pressure chamber 6, is fed to a return 30. In this way a defined coupler chamber pressure is ensured. Between the return 30 and the low-pressure chamber 6, a check valve 29 may be disposed, which allows an increase in pressure in the low-pressure chamber 6. By increasing the fuel pressure in the low-pressure chamber 6, for example at 150 bars, clamping forces can also be realized over the coupler 8, which is capable to support a closing movement of the nozzle needle 4.

A bias spring 32 is disposed in the low-pressure chamber 6, by means of which the piezoelectric actuator 7 is biased relative to the injector housing 2.

For further optimization of the closing stroke of the nozzle needle 4, the represented fuel injector exhibits a guide region 27 for guiding the nozzle needle 4 and is formed in the high-pressure bore 3. The regions of the high-pressure bore 3 adjacent to the guide region 27 are hydraulically connected by a throttle 28. The throttle 28 has a damping effect on the movement of the nozzle needle 4. Within the guide region 27, the nozzle needle 4 shows an enlarged diameter so that radially extending shoulders 26 are formed, which form a pressure stage.

Further, a needle stop 33 is provided for limiting the nozzle needle stroke, which is formed at the front face of the sleeve 20 facing the nozzle needle 4. Instead of the high-pressure region, the needle stop 33 may be arranged in a low-pressure region.

The embodiment of a fuel injector according to the present subject matter shown in Fig. 2 differs from the Fig. 1, where the connecting piston 17 by means of which the nozzle needle 4 and the first coupler piston 15 are mechanically coupled, is a part of the first coupler piston 15. During assembly of the injector, the connecting piston 17 and the first coupler piston 15 as an assembled unit are employed into the guide bore 18. This means that the connecting piston 17 initially connected to the coupler piston 15, is welded herein, and is then guided by the guide bore 18. The sleeve 20 is placed on the guided end of the connecting piston 17, which seals the high-pressure region opposite to the low-pressure region. Only then the nozzle needle 4 is fitted to a connecting piece 37 and welded to the connecting piston. The connecting piece 37 forms a unit with the nozzle needle 4, wherein the connecting piece 37 and the nozzle needle 4 may also be made in one piece. In the present case the connecting piece 37 is axially attached to the nozzle needle 4 and is welded to this.

Regarding the operation, the fuel injector shown in Fig. 2 is not different from that shown in Fig. 1, so that reference is made in this respect to the foregoing.

The alternate embodiment shown in Fig. 2 substantially facilitates the assembly of the fuel injector as described herein and reduces the production costs. In addition, the risk of imperfect fit is reduced in the guide regions, because the mechanical joint from the low-pressure region moves to the high-pressure region.

Any welding or pressing causing deformations of the connecting piston 17 are of minor importance in the region of the high-pressure bore 3, so that the assembly of a mechanical joint has proven to be advantageous in this region.