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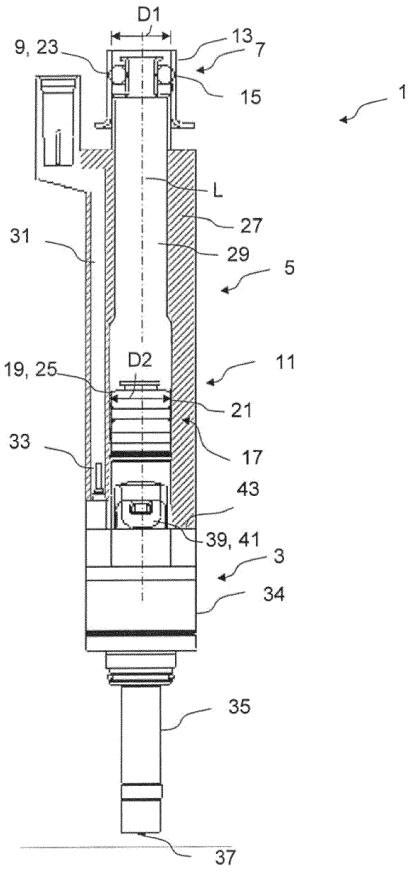
(54) **Extension part, injection valve and fuel delivery assembly**

(57) An extension part (5) for an injection valve (1) for a combustion engine, the injection valve (1) comprising a base injector part (3), is specified. The extension part (5) comprises a first fluid inlet portion (7) with a first sealing section (9) and a fluid outlet portion (11). The first fluid inlet portion (7) of the extension part (5) is designed to be coupled to a fuel rail cup (13) in such a way that the first sealing section (9) of the first fluid inlet portion (7) is coupled in a given first coupling area (15) in a force-fitting manner with the fuel rail cup (13). The fluid outlet portion (11) of the extension part (5) being designed to be coupled to a second fluid inlet portion (17) of the base injector part (3) in a given second coupling area (21) in a force-fitting manner. Further, an injection valve (1) and a fuel delivery assembly are specified.

Figure 1



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Description

[0001] The invention relates to an extension part for an injection valve for a combustion engine, to an injection valve for a combustion engine and to a fuel delivery assembly.

[0002] Injection valves are in widespread use, in particular for internal combustion engines where they may be arranged in order to dose fluid into an intake manifold of the internal combustion engine or directly into the combustion chamber of a cylinder of the internal combustion engine.

[0003] In order to enhance the combustion process in view of the creation of unwanted emissions, the respective injection valve may be suited to dose fluids under very high pressures. In the case of a gasoline engine the pressures may be in the range of up to 200 bar and in the case of a diesel engine in the range of up to 2 000 bar, for example.

[0004] Injection valves are manufactured in various forms in order to satisfy the various needs of the various combustion engines. Therefore, for example, their length, their diameter, and also various elements of the injection valve responsible for the way the fluid is dosed, may vary in a wide range. For instance, injection valves for installing on a cylinder head in a central position require a greater length compared to a standard injector size, e. g. of about 90 mm.

[0005] It is an object of the invention to create an injection valve which facilitates a cost-effective manufacturing of the injection valve.

[0006] It is a further object of the invention to specify an injection valve and a fuel rail assembly which are easy to be adapted to different mounting geometries in combustion engines.

[0007] These objects are achieved by an extension part having the features of claim 1. Advantageous embodiments of the extension part, the injection valve and the fuel rail assembly are given in the sub-claims.

[0008] According to one aspect, an extension part for an injection valve is specified. According to a further aspect, an injection valve for a combustion engine comprising a base injector part and the extension part is specified.

[0009] According to another aspect, a kit of parts comprising the extension part and the base injector part is specified. The extension part and the base injector part may be provided for being assembled to form the injection valve.

[0010] According to another aspect, a fuel delivery assembly comprising the injection valve and a fuel rail cup are specified. The fuel rail cup is in particular provided for hydraulically coupling the injection valve to a fuel rail of the fuel delivery assembly.

[0011] The extension part comprises a first fluid inlet portion with a first sealing section and a fluid outlet portion. The first fluid inlet portion of the extension part is in particular designed to be coupled to the fuel rail cup in a given first coupling area. In an advantageous development, the first fluid inlet portion is constructed in such fashion that a detachable mechanical connection may be formed with the fuel rail cup. Preferably, the first fluid inlet portion is designed to be coupled to the fuel rail cup in the first coupling area in such a way that the first sealing section of the first fluid inlet portion is coupled in a force-fitting manner with the fluid rail cup.

[0012] The base injector part comprises a second fluid inlet portion with a second sealing section. The fluid outlet portion of the extension part is in particular designed to be coupled to the second fluid inlet portion in a second coupling area, preferably in a force-fitting manner. In case of the injection valve, the second fluid inlet portion of the base injector part is preferably coupled to the fluid outlet portion of the extension part in such a way that the second sealing section of the second fluid inlet portion is coupled in a given second coupling area with the fluid outlet portion of the extension part in a force-fitting manner.

[0013] In an advantageous embodiment, the extension part is constructed to be mechanically connected to the base injector part in detachable fashion, in particular by means of the - preferably force-fitting - coupling in the second coupling area. In this way, particularly easy and cost-effective assembly and inspection of the injection valve is possible.

[0014] The base injector part comprises the functionality of a complete injection valve. For example, it comprises a valve body having an injection nozzle, a valve needle in the valve body for controlling fuel flow through the injection nozzle and an actuator assembly for driving the valve needle. The base injector part may comprise at least one external electrical terminal, for example for connecting the actuator assembly.

[0015] With advantage, the base injector part may be assembled on the same assembly and testing equipment as an injection valve comprising a standard length. This enables a higher standardization for injection valves for different applications. A similar injection valve design can be used for injection valves requiring different lengths. Furthermore, this enables a cost-effective manufacturing of the injection valves because of lower manufacturing and testing equipment costs.

[0016] As the second fluid inlet portion of the base injector part may be coupled to the fluid outlet portion of the extension part in such a way that the second sealing section of the second fluid inlet portion is coupled in a given second coupling area with the fluid outlet portion of the extension part in a force-fitting manner, the coupling is flexible. For example, the extension part has a first longitudinal axis and the base injector part has a second longitudinal axis. The first and second longitudinal axes may be tiltable with respect to each other by means of the flexible mechanical coupling.

[0017] Advantageously, this flexible connection enables to recover misalignments between the fuel rail cup and an injector pocket without, or minimally, introducing mechanical stress on components of the injection valve.

Neither a firmly bonded coupling nor a form-fitting coupling is necessary for the coupling of the extension part with the base injector part. The injector pocket may be arranged in a cylinder head of the combustion engine. It is in particular provided for receiving the injection valve.

[0018] In an advantageous embodiment a first hydraulic diameter of the fuel rail cup in the first coupling area is the same as a second hydraulic diameter of the fluid outlet portion of the extension part in the second coupling area. Advantageously, this enables that the extension part is at least nearly perfectly axially balanced by the fuel pressure.

[0019] Preferably the fuel rail cup comprises a circular cross section in the first coupling area. In this case the first hydraulic diameter of the fuel rail cup is equal to an inner diameter of the fuel rail cup in the first coupling area. Preferably the fluid outlet portion of the extension part comprises a circular cross section in the second coupling area. In this case the second hydraulic diameter of the fluid outlet portion of the extension part is equal to an inner diameter of the fluid outlet portion in the second coupling area. In other words, the extension part, in the first coupling area, is preferably sealingly coupleable with its first fluid inlet portion to a fuel rail cup having the same inner diameter as the fluid outlet portion in the second coupling area.

[0020] In a further advantageous embodiment the extension part comprises a first sealing element. The first sealing element is arranged in the first sealing section and is designed to be coupled to the fuel rail cup in the force-fitting manner. The first sealing element may comprise an O-Ring. This supports a cost-effective manufacturing of the injection valve.

[0021] In a further advantageous embodiment the base injector part comprises a second sealing element. The second sealing element is arranged in the second sealing section and is coupled in the given second coupling area with the fluid outlet portion of the extension part in the force-fitting manner. The second sealing element may comprise an O-Ring. This supports a cost-effective manufacturing of the injection valve.

[0022] In a further advantageous embodiment the extension part comprises a housing body with a central longitudinal axis L, in particular coinciding with the first longitudinal axis, and a tubular recess along this central longitudinal axis L. A cross-section diameter of the recess of the first fluid inlet portion of the extension part is smaller than a cross-section diameter of the recess of the fluid outlet portion of the extension part. Advantageously, during a mounting process the extension part may be easily put on the base injector part in such a way that the second sealing section of the second fluid inlet portion is coupled in the given second coupling area with the fluid outlet portion of the extension part in a force-fitting manner.

[0023] In a further advantageous embodiment the extension part comprises a second recess being arranged and designed for taking at least one electrical connection in such a way that the at least one electrical terminal of the base injector part can be electrically accessed via the electrical connection from the outside of the extension part. In this way an electrical interlinkage between the base injector part and the extension part can be obtained.

[0024] The second recess may be arranged at least partly parallel to the first recess. For example, it is radially offset with respect to the central longitudinal axis L.

[0025] The extension part may comprise a further electrical terminal partly arranged in the second recess, preferably in a first end area of the extension part on an fluid inlet side of the extension part. Advantageously, the electrical connection, e. g. a wire, can be routed easily and in a manner in which it is protected against damage. The at least one electrical connection, and in this regard the at least one electrical terminal, is easily accessible. The further electrical terminal of the extension part may comprise at least two different types of connectors for different customer applications. In this way installation of the injection valve may be further facilitated.

[0026] In a further advantageous embodiment the second fluid inlet portion of the base injector part comprises mainly identical or identical geometric dimensions as the first fluid inlet portion of the extension part in such a way that the second fluid inlet portion is designed to be coupled to the fuel rail cup. In other words, the fluid outlet portion of the extension part is shaped in such fashion that the - preferably force-fit - coupling in the second coupling area can be established with a base injector part the second fluid inlet portion of which basically has the type and dimensions of the first fluid inlet portion of the extension part. This supports a cost-effective manufacturing of the injection valve. For example, the base injector part is usable with or without the extension part for the same fuel rail cups.

[0027] In a further advantageous embodiment the base injector part comprises a first connector element and the extension part comprises a corresponding second connector element and the first connector element and the corresponding second connector element are designed and arranged for coupling the base injector part and the extension part for mounting and/or handling purposes. In this way the mounting and handling of the injection valve can be facilitated.

[0028] Preferably, a detachable mechanical coupling - for example a snap fit - is established by the first and second connector elements. In an expedient development, the coupling by means of the first and second connector elements is flexible so that the first and second longitudinal axes are tiltable.

[0029] Preferably the first connector element and the corresponding second connector element comprise a plastic or consist of the plastic. The first connector element and the corresponding second connector element comprising the plastic support a cost-effective manufacturing.

[0030] Exemplary embodiments of the invention are explained in the following with the aid of schematic drawings. These are as follows:

Figure 1 an exemplary embodiment of an injection valve with an extension part and a base injector part,

Figure 2 an exemplary embodiment of the extension part, and

Figure 3 an exemplary embodiment the base injection part.

[0031] Elements of the same design and function that occur in different illustrations are identified by the same reference character.

[0032] Figure 1 shows an exemplary embodiment of an injection valve 1, which comprises a base injector part 3 and an extension part 5. The injection valve 1 is in particular designed for the direct injection of fuel into a combustion chamber (not shown) of an internal combustion engine. The injection valve 1 is particularly suitable for a central installation in a comparatively long receptacle hole, also called injector pocket, of a cylinder head (not shown).

[0033] Figure 2 shows an exemplary embodiment of the extension part 5. The extension part 5 comprises a first fluid inlet portion 7 with a first sealing section 9 and a fluid outlet portion 11. The first fluid inlet portion 7 of the extension part 5 is designed to be coupled to a fuel rail cup 13 in such a way that the first sealing section 9 of the first fluid inlet portion 7 is coupled in a given first coupling area 15 in a force-fitting manner with the fuel rail cup 13.

[0034] The extension part 5 may comprise a first sealing element 23. The first sealing element 23 is arranged in the first sealing section 9 and is designed to be coupled to the fuel rail cup 13 in the force-fitting manner. For example, the sealing element comprises an O-Ring.

[0035] A housing body 27 of the extension part 5, the sealing element 23 and the fuel rail cup 13 may follow each other in this order in a radial direction in the first coupling area 15. The sealing element 23 may be squeezed - in particular it may be compressed in the radial direction - by the housing body 27 and the fuel rail cup 13 to establish the force-fit coupling.

[0036] For instance, the extension part 5 comprises a housing body 27 with a central longitudinal axis L and a tubular recess 29 along this central longitudinal axis L. The recess 29 forms a central fuel supply to the second fluid inlet portion 17 of the base injector part 3. For instance, a cross-section diameter S1 of the recess 29 of the first fluid inlet portion 7 may be smaller than a cross-section diameter S2 of the recess 29 of the fluid outlet portion 11.

[0037] For instance, the extension part 5 comprises a second recess 31 being arranged and designed for taking at least one electrical connection in such a way that at least one electrical terminal 33 of the base injector part 3 can be electrically accessed via the electrical connection from the outside of the extension part 5. For instance, the extension part 5 comprises a second recess 31 for arranging one or more electrical wires.

[0038] Figure 3 shows an exemplary embodiment of the base injector part 3 comprising a housing 34, a valve body 35 with a central longitudinal axis L2 and a not shown cavity, which is axially led through the valve body 35. The base injector part 3 comprises a valve needle, not shown, taken in the cavity of the valve body 35. On a free end of the base injector part 3 an injection nozzle 37 is formed which is closed or opened by an axial movement of the valve needle. In a closing position fuel flow through the injection nozzle 37 is prevented. In an opening position fuel can flow through the injection nozzle 37 into the combustion chamber of the internal combustion engine.

[0039] The base injector part 3 comprises a second fluid inlet portion 17 with a second sealing section 19. The base injector part 3 may comprise a second sealing element 25. The second sealing element 25 may be arranged in the second sealing section 19. The second sealing element 25 may comprise an O-Ring.

[0040] Furthermore, the base injector part 3 comprises the electrical terminal 33, which is for instance designed to be coupled to an electrical supply to actuate an actuator unit, which is not shown, of the base injector part 3. For instance, the electrical terminal 33 may be accessed by at least one electrical wire, which can be arranged in the second recess 31 of the extension part.

[0041] The base injector part 3 comprises the functionality of an injection valve and may be assembled on the same assembly and testing equipment as an injection valve comprising a standard length.

[0042] During a mounting process the extension part 5 may be put on the base injector part 3 in such a way that, as shown in Figure 1, the second sealing section 19 of a second fluid inlet portion 17 is coupled in a given second coupling area 21 with the fluid outlet portion 11 of the extension part 5 in a force-fitting manner.

[0043] The valve body 35 of the base injector part 3, the second sealing element 25 and the extension part 5 may follow each other in this order in a radial direction in the second coupling area 21. The second sealing element 25 may be squeezed - in particular it may be compressed in the radial direction - by the valve body 35 and the fuel outlet portion 11 of the extension part 5 to establish the force-fit coupling.

[0044] A first hydraulic diameter D1 of the fuel rail cup 13 in the first coupling area 15 may be the same as a second hydraulic diameter D2 of the fluid outlet portion 11 of the extension part 5 in the second coupling area 21.

[0045] In particular, the second fluid inlet portion 17 of the base injector part 3 may comprise mainly identical or identical geometric dimensions as the first fluid inlet portion 7 of the extension part 5 in such a way that the second fluid inlet portion 17 is designed to be coupled to the fuel rail cup 13. This supports a cost-effective manufacturing of the injection valve 1.

[0046] The housing 34 of the base injector part 3 may

comprise a protrusion 43 in an area where the main parts of the actuator, e. g. a magnetic coil, and/or a spring of the base injector part 3 are arranged. The extension part 5 may be arranged enclosing at least the second fluid inlet portion 17 of the base injector part and attaching on this protrusion 43.

[0047] The base injector part 3 may comprise a first connector element 39 and the extension part 5 may comprise a corresponding second connector element 41. The connector elements 39, 41 may consist of plastic. The base injector part 3 and the extension part 5 may be coupled by these plastic connector elements 39, 41 for mounting and handling purposes. The first and the corresponding second connector elements 39, 41 are preferably not designed and/or arranged to provide a sealed coupling of the base injector part 3 and the extension part 5. For example, they form a flexibe snap-fit coupling.

[0048] The invention is not limited to specific embodiments by the description on the basis of said exemplary embodiments but comprises any combination of elements of different embodiments. Moreover, the invention comprises any combination of claims and any combination of features disclosed by the claims.

Claims

1. Extension part (5) for an injection valve (1) for a combustion engine, the injection valve (1) comprising a base injector part (3),

   - the extension part (5) comprising a first fluid inlet portion (7) with a first sealing section (9) and a fluid outlet portion (11),
   - the first fluid inlet portion (7) of the extension part (5) being designed to be coupled to a fuel rail cup (13) in such a way that the first sealing section (9) of the first fluid inlet portion (7) is coupled in a given first coupling area (15) in a force-fitting manner with the fuel rail cup (13),
   - the fluid outlet portion (11) of the extension part (5) being designed to be coupled to a second fluid inlet portion (17) of the base injector part (3) in a given second coupling area (21) in a force-fitting manner.

2. Extension part (5) in accordance with claim 1, wherein a first hydraulic diameter (D1) of the fuel rail cup (13) in the first coupling area (15) is the same as a second hydraulic diameter (D2) of the fluid outlet portion (11) of the extension part (5) in the second coupling area (21).

3. Extension part (5) in accordance with claim 1 or 2, wherein the extension part (5) comprises a first sealing element (23) being arranged in the first sealing section (9) being designed to be coupled to the fuel rail cup (13) in the force-fitting manner.

4. Extension part (5) in accordance with one of the preceding claims, the extension part (5) comprising a housing body (27) with a central longitudinal axis L and a tubular recess (29) along this central longitudinal axis L, a cross-section diameter (S1) of the recess (29) of the first fluid inlet portion (7) of the extension part (5) being smaller than a cross-section diameter (S2) of the recess (29) of the fluid outlet portion (11) of the extension part(5).

5. Extension part (5) in accordance with one of the preceding claims, the extension part (5) comprising a second recess (31) being arranged and designed for taking at least one electrical connection in such a way that at least one electrical terminal (33) of the base injector part (3) can be electrically accessed via the electrical connection from the outside of the extension part (5).

6. Extension part (5) in accordance with one of the preceding claims, the fluid outlet portion (11) being shaped in such fashion that the force-fit coupling in the second coupling area is achievable with the second fluid inlet portion (17) of the base injector part (3) having mainly identical or identical geometric dimensions as the first fluid inlet portion (7) of the extension part (5).

7. Extension part (5) in accordance with one of the preceding claims, wherein the extension part (5) is constructed to be mechanically connected to the base injector part (3) in detachable fashion.

8. Kit of parts comprising an extension part (5) according to one of the preceding claims and the base injector part (3).

9. Injection valve (1) comprising an extension part (5) according to one of the preceding claims and a base injector part (3), wherein the second fluid inlet portion (17) of the base injector part (3) comprises a second sealing section (19) and the second fluid inlet portion (17) of the base injector part (3) is coupled to the fluid outlet portion (11) of the extension part (5) in such a way that the second sealing section (19) of the second fluid inlet portion (17) is coupled in the second coupling area (21) with the fluid outlet portion (11) of the extension part (5) in the force-fitting manner.

10. Injection valve (1) in accordance with claim 9, wherein the base injector part (3) comprises a second sealing element (25) being arranged in the second sealing section (19) and being coupled in the given second coupling area (21) with the fluid outlet portion (11) of the extension part (5) in the force-fitting manner.

11. Injection valve (1) in accordance with claim 9 or 10, wherein the second fluid inlet portion (17) is designed to be coupleable to the fuel rail cup (13).

12. Injection valve (1) in accordance with one of claims 9 to 11, wherein the extension part (5) has a first longitudinal axis, the base injector part (3) has a second longitudinal axis, and the force-fit coupling of the extension part (5) with the base injector part (3) in the second coupling area (21) is a flexible mechanical connection so that the first and second longitudinal axes are tiltable with respect to each other.

13. Injection valve (1) in accordance with one of claims 9 to 12, wherein the base injector part (3) comprises a first connector element (39) and the extension part (5) comprises a corresponding second connector element (41) and the first connector element (39) and the corresponding second connector element (41) are designed and arranged for coupling the base injector part and the extension part for mounting and/or handling purposes.

14. Fuel delivery assembly comprising an injection valve (1) according to one of claims 9 to 13 and the fuel rail cup (4).

Figure 1

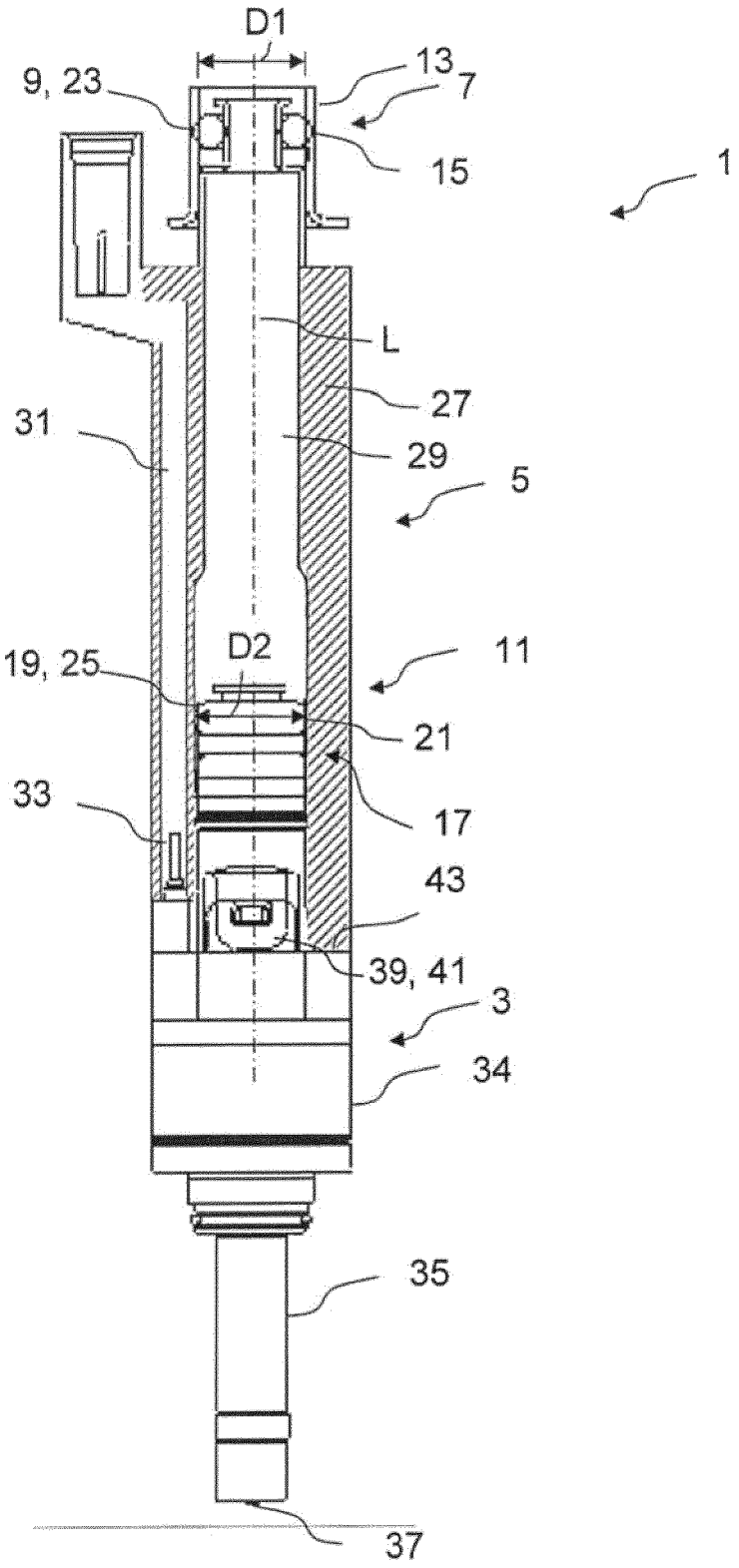


Figure 2

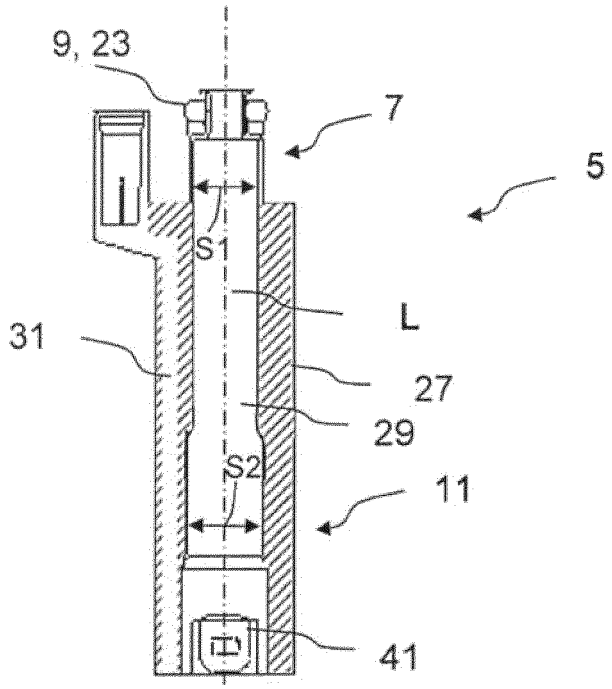
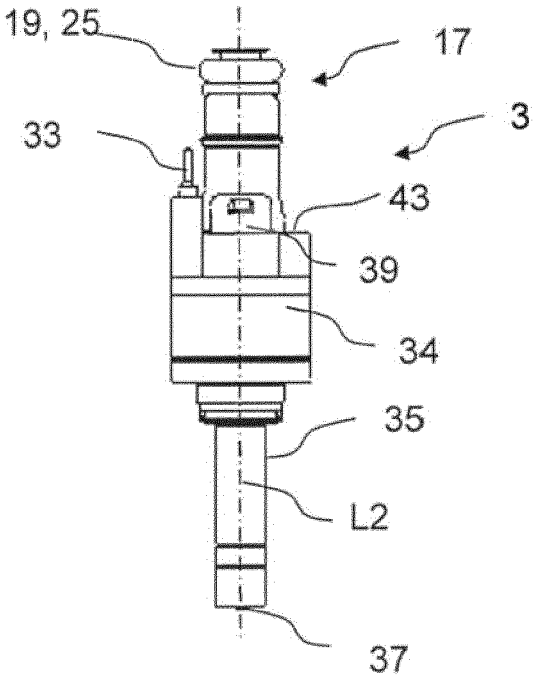


Figure 3



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EUROPEAN SEARCH REPORT

Application Number
EP 12 18 1435

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TECHNICAL FIELDS SEARCHED (IPC)

F02M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 January 2013	Godrie, Pierre

CATEGORY OF CITED DOCUMENTS

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