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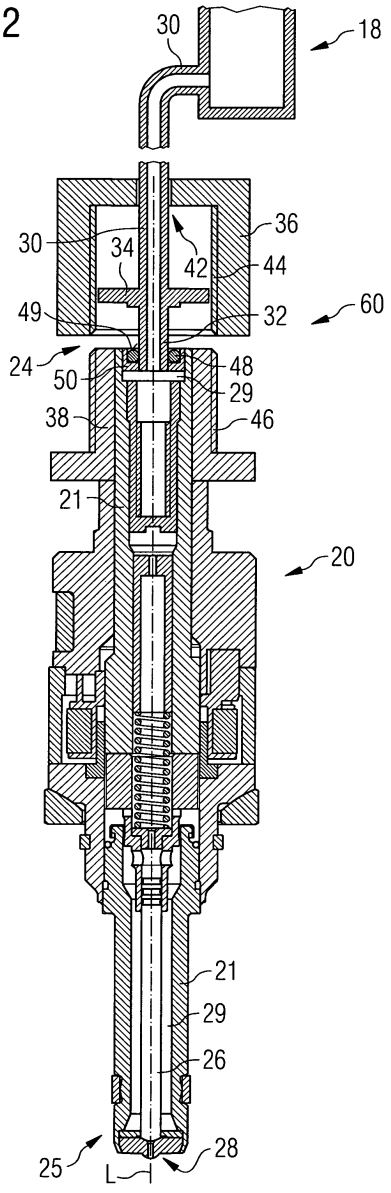
(54) Coupling assembly

(57) Coupling assembly (60) for hydraulically and mechanically coupling a fuel injector (20) to a fuel rail (18) of a combustion engine (22). The coupling assembly (60) comprises a fuel injector (20) with a fuel injector body (21) and a central longitudinal axis (L), the fuel injector body (21) comprising a cavity (29), and a fuel tube (30) being hydraulically coupable to the fuel rail (18) at a first end and having a free end section (32) at a second end. The free end section (32) of the fuel tube (30) is arranged in the cavity (29) of the fuel injector body (21).

FIG 2



EP 2 090 772 A1

Description

[0001] The invention relates to a coupling assembly for hydraulically and mechanically coupling a fuel injector to a fuel rail of a combustion engine.

[0002] Coupling assemblies for hydraulically and mechanically coupling a fuel injector to a fuel rail are in widespread use, in particular for internal combustion engines. Fuel can be supplied to an internal combustion engine by the fuel rail assembly through the fuel injector.

[0003] In order to keep pressure fluctuations during the operation of the internal combustion engine at a very low level, internal combustion engines are supplied with a fuel accumulator to which the fuel injectors are connected and which has a relatively large volume. Such a fuel accumulator is often referred to as a common rail.

[0004] Known fuel rails comprise a hollow body with recesses wherein the fuel injectors are arranged. The connection of the fuel injectors to the recesses that supply the fuel from a fuel tank via a low or high-pressure fuel pump needs to be very precise to get a correct injection angle and a sealing of the fuel.

[0005] The object of the invention is to create a coupling assembly for hydraulically and mechanically coupling a fuel injector to a fuel rail which is simply to be manufactured and which facilitates a reliable and precise connection between the fuel rail and the fuel injector without a resting of the fuel injector on the cylinder head.

[0006] The objects are achieved by the features of the independent claim. Advantageous embodiments of the invention are given in the sub-claims.

[0007] The invention is distinguished by a coupling assembly for hydraulically and mechanically coupling a fuel injector to a fuel rail of a combustion engine, the coupling assembly comprising a fuel injector with a fuel injector body and a central longitudinal axis, the fuel injector body comprising a cavity, and a fuel tube being hydraulically coupable to the fuel rail at a first end and having a free end section at a second end. The free end section of the fuel tube is arranged in the cavity of the fuel injector body.

[0008] This has the advantage that a fast and secure coupling between the fuel tube and the fuel injector in view of high fuel pressure is possible. Furthermore, the coupling assembly allows an assembly of the fuel injector and the fuel rail without a further metallic contact between the fuel injector and further parts of the combustion engine. Consequently, a noise transmission between the fuel injector and further parts of the combustion engine can be kept small.

[0009] In an advantageous embodiment of the invention a sealing element is arranged coaxially between the free end section of the fuel tube and the fuel injector body to sealingly couple the fuel tube to the fuel injector. This may allow a simple and compact construction of the sealing arrangement.

[0010] In a further advantageous embodiment of the invention a first coupling element is mechanically coupled to the fuel tube and a second coupling element is coupled to the fuel injector. The first coupling element is designed to be in engagement with the second coupling element to retain the fuel tube in the fuel injector in direction of the central longitudinal axis. By this a simple and fast construction to fix the fuel tube in axial direction is possible.

[0011] In a further advantageous embodiment of the invention the first coupling element is a ring element and comprises a first screw thread. The second coupling element is a ring element and comprises a second screw thread being in engagement with the first screw thread. By this a simple, fast and secure screwing coupling between the fuel tube and the fuel injector is possible.

[0012] In a further advantageous embodiment of the invention the first screw thread is a female screw thread and the second screw thread is a male screw thread. This has the advantage that a simple and compact construction of the screw coupling device is possible. Furthermore, this enables to carry out a fast and secure but reversible coupling of the fuel tube to the fuel injector.

[0013] In a further advantageous embodiment of the invention the first coupling element is designed to be in a snap-in engagement with the second coupling element. This has the advantage that a simple, fast and secure coupling between the fuel tube and the fuel injector is possible.

[0014] In a further advantageous embodiment of the invention at least one of the coupling elements is designed to be rotatable around the central longitudinal axis relative to the fuel injector and the fuel tube. By this a simple and fast screw coupling or spring coupling between the first coupling element and the fuel injector is possible.

[0015] In a further advantageous embodiment of the invention the second coupling element is in one piece with the fuel injector body. This makes it possible to obtain a compact construction of the fuel injector. Furthermore, high pressure applications for the coupling assembly are obtainable.

[0016] In a further advantageous embodiment of the invention the fuel tube comprises a collar extending in radial direction and being arranged axially between the fuel injector and the first coupling element in a way to prevent a movement of the fuel tube relative to the fuel injector in direction of the central longitudinal axis. By this a secure coupling between the fuel tube and the fuel injector is possible.

[0017] In a further advantageous embodiment of the invention the injector body has a supporting ring being arranged in the cavity and being designed to support the sealing element.

[0018] In a further advantageous embodiment of the invention the supporting ring is in one piece with the injector body. By this a compact construction of the fuel injector is possible. Furthermore, the coupling assembly can be used for high pressure applications.

[0019] Exemplary embodiments of the invention are explained in the following with the aid of schematic draw-

ings. These are as follows:

Figure 1 an internal combustion engine in a schematic view,

Figure 2 a longitudinal section through a coupling assembly, and

Figure 3 a partial longitudinal section through a coupling assembly.

[0020] Elements of the same design and function that occur in different illustrations are identified by the same reference character.

[0021] A fuel feed device 10 is assigned to an internal combustion engine 22 (figure 1) which can be a diesel engine or a gasoline engine. It includes a fuel tank 12 that is connected via a first fuel line to a fuel pump 14. The output of the fuel pump 14 is connected to a fuel inlet 16 of a fuel rail 18. In the fuel rail 18, the fuel is stored for example under a pressure of about 200 bar in the case of a gasoline engine or of about 2,000 bar in the case of a diesel engine. Fuel injectors 20 are connected to the fuel rail 18 and the fuel is fed to the fuel injectors 20 via the fuel rail 18.

[0022] Figure 2 shows a coupling assembly 60 with the fuel injector 20 in detail. The fuel injector 20 has a fuel injector body 21 and is suitable for injecting fuel into a combustion chamber of the internal combustion engine 22. The fuel injector 20 comprises a central longitudinal axis L. The fuel injector 20 has a fuel inlet portion 24 and a fuel outlet portion 25. The fuel inlet portion 24 of the fuel injector 20 comprises a sealing ring 48 with an outer surface 49.

[0023] Furthermore, the fuel injector 20 comprises a valve needle 26 taken in a cavity 29 of the fuel injector body 21. On a free end of the fuel injector 20 an injection nozzle 28 is formed which is closed or opened by an axial movement of the valve needle 26. In a closing position a fuel flow through the injection nozzle 28 is prevented. In an opening position fuel can flow through the injection nozzle 28 into the combustion chamber of the internal combustion engine 22.

[0024] The coupling assembly 60 is designed to be coupled to the fuel rail 18 of the internal combustion engine 22. The coupling assembly 60 has a fuel tube 30, a first coupling element 36 and a second coupling element 38.

[0025] The fuel tube 30 has an outer surface 33 and is hydraulically coupled to the fuel rail 18 at a first end. At a second end the fuel tube 30 comprises an end section 32. Furthermore, the fuel tube 30 is in engagement with the fuel inlet portion 24 of the fuel injector 20.

[0026] Additionally, the fuel tube 30 has a collar 34 which is formed as a disk and is extending in radial direction between the fuel tube 30 and the first coupling element 36. The collar 34 is arranged axially between the fuel injector 20 and the first coupling element 36. As the collar 34 is in one piece with the fuel tube 30 a movement of the fuel tube 30 relative to the fuel injector 20 in direction of the central longitudinal axis L can be prevented (Figure 3).

[0027] The sealing ring 48 is arranged coaxially between the fuel tube 30 and the second coupling element 38 of the fuel injector 20. The outer surface 49 of the sealing ring 48 is in sealing contact with the outer surface 33 of the fuel tube 30. The fuel injector body 21 has a supporting ring 50 which is arranged in the cavity 29 and which is preferably in one piece with the injector body 21. The sealing ring 48 is supported by the supporting ring 50.

[0028] The first coupling element 36 is coupled to the fuel tube 30. The first coupling element 36 is formed as a ring element and has a centrally arranged through hole 42 and a first screw thread 44 which is a female screw thread.

[0029] The second coupling element 38 is formed as a ring element and is in one part with the fuel injector 20. By this a very rigid and very secure coupling between the fuel injector 20 and the second coupling element 38 is possible. The second coupling element 38 has a second screw thread 46 which is a male screw thread. The first coupling element 36 and the second coupling element 38 are fixedly coupled with each other by the screw threads 44, 46 (figure 3).

[0030] As the first coupling element 36 is in engagement with the fuel tube 30, the second coupling element 38 is fixedly coupled to the fuel injector 20 and the first coupling element 36 is fixedly coupled to the second coupling element 38 by the screw threads 44, 46, the fuel tube 30 is retained in the fuel injector 20 in direction of the central longitudinal axis L.

[0031] In a further embodiment the first coupling element 36 and the second coupling element 38 are forming an arrangement wherein the first coupling element 36 and the second coupling element 38 are in a snap-in engagement. In another embodiment the first coupling element 36 and the second coupling element 38 are forming a flange coupling.

[0032] In the following, the assembly and disassembly of the fuel injector 20 with the fuel tube 30 will be described:

[0033] For assembling, the fuel tube 30 is inserted into the cavity 29 of the fuel injector 20. The first coupling element 36 is shifted towards the second coupling element 38 of the fuel injector 20. The first coupling element 36 is screwed together with the second coupling element 38 by a rotational movement of the first coupling element 36 around the central longitudinal axis L in a way that the threads 44, 46 of the first coupling element 36 and the second coupling element 38 come into engagement with each other. Figure 3 shows the coupling assembly 60 after the mounting of the fuel tube 30 and the first coupling element 36 to the fuel injector 20.

[0034] After the assembly process a positive fitting coupling of the fuel tube 30 and the first coupling element

36 with the fuel injector 20 can be obtained. Furthermore, the outer surface 33 of the fuel tube 30 is in sealing engagement with the outer surface 49 of the sealing ring 48. After the assembly process fuel can flow through the fuel tube 30 into the fuel inlet portion 24 of the fuel injector 20 without fuel leakage.

[0035] To disassemble the fuel injector 20 from the fuel tube 30, the first coupling element 36 is unscrewed from the second coupling element 38 by a rotational movement of the first coupling element 36 around the central longitudinal axis L relative to the fuel injector 20. The threads 44, 46 of the first coupling element 36 and the second coupling element 38 come out of engagement with each other. Then the fuel injector 20 can be shifted away from the fuel tube 30 in axial direction and the fuel tube 30 and the fuel injector 20 can be separated from each other.

[0036] The coupling of the fuel injector 20 with the fuel rail 18 by the coupling elements 36, 38 allows an assembly of the fuel injector 20 and the fuel tube 30 without a further metallic contact between the fuel injector 20 and the further parts of the internal combustion engine 22. A sealing between the fuel injector body 21 and a combustion chamber of the internal combustion engine 22 can be carried out by a plastic element, in particular by a PTFE element. Consequently, noise transmission between the fuel injector 20 and further parts of the internal combustion engine can be kept small.

Claims

1. Coupling assembly (60) for hydraulically and mechanically coupling a fuel injector (20) to a fuel rail (18) of a combustion engine (22), the coupling assembly (60) comprising

- a fuel injector (20) with a fuel injector body (21) and a central longitudinal axis (L), the fuel injector body (21) comprising a cavity (29), and
- a fuel tube (30) being hydraulically coupable to the fuel rail (18) at a first end and having a free end section (32) at a second end, wherein the free end section (32) of the fuel tube (30) is arranged in the cavity (29) of the fuel injector body (21).

2. Coupling assembly (60) in accordance with claim 1, with a sealing element (48) being arranged coaxially between the free end section (32) of the fuel tube (30) and the fuel injector body (21) to sealingly couple the fuel tube (30) to the fuel injector (20).

3. Coupling assembly (60) in accordance with one of the preceding claims, with a first coupling element (36) being mechanically coupled to the fuel tube (30) and a second coupling element (38) being coupled to the fuel injector (20), the first coupling element (36) being designed to be in engagement with the second coupling element (38) to retain the fuel tube (30) in the fuel injector (20) in direction of the central longitudinal axis (L).

4. Coupling assembly (60) in accordance with claim 3, with the first coupling element (36) being a ring element and comprising a first screw thread (44), and the second coupling element (38) being a ring element and comprising a second screw thread (46) being in engagement with the first screw thread (44).

5. Coupling assembly (60) in accordance with claim 4, the first screw thread (44) being a female screw thread and the second screw thread (46) being a male screw thread.

6. Coupling assembly (60) in accordance with claim 3, with the first coupling element (36) being designed to be in a snap-in engagement with the second coupling element (38).

7. Coupling assembly (60) in accordance with one of the claims 3 to 6, with at least one of the coupling elements (36, 38) being designed to be rotatable around the central longitudinal axis (L) relative to the fuel injector (20) and the fuel tube (30).

8. Coupling assembly (60) in accordance with one of the claims 3 to 7, with the second coupling element (38) being in one piece with the fuel injector body (21).

9. Coupling assembly (60) in accordance with one of the claims 3 to 8, with the fuel tube (30) comprising a collar (34) extending in radial direction and being arranged axially between the fuel injector (20) and the first coupling element (36) in a way to prevent a movement of the fuel tube (30) relative to the fuel injector (20) in direction of the central longitudinal axis (L).

10. Coupling assembly (60) in accordance with one of the claims 2 to 9, with the injector body (21) having a supporting ring (50) being arranged in the cavity (29) and being designed to support the sealing element (48).

11. Coupling assembly (60) in accordance with claim 10, with the supporting ring (50) being in one piece with the injector body (21).

FIG 1

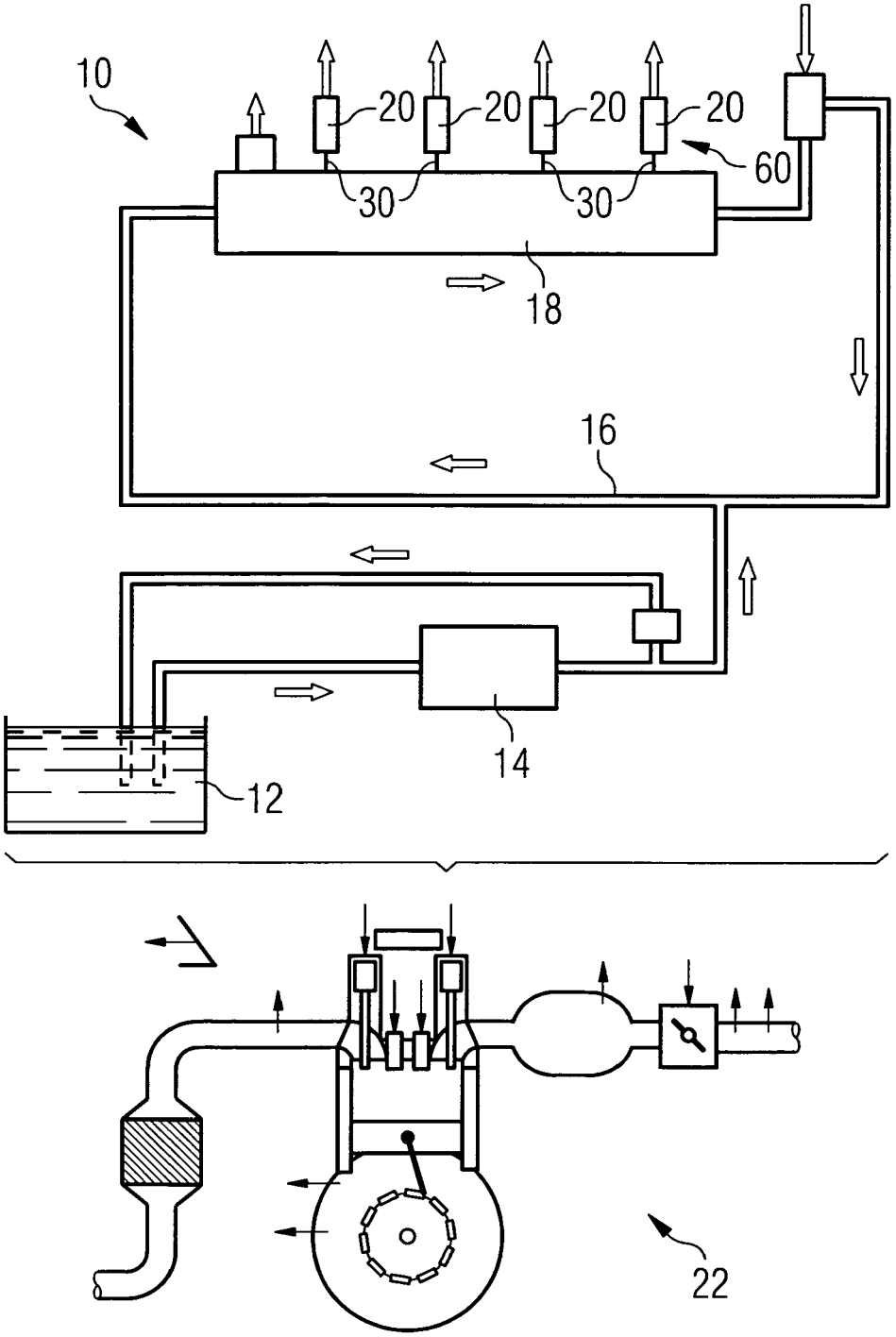


FIG 2

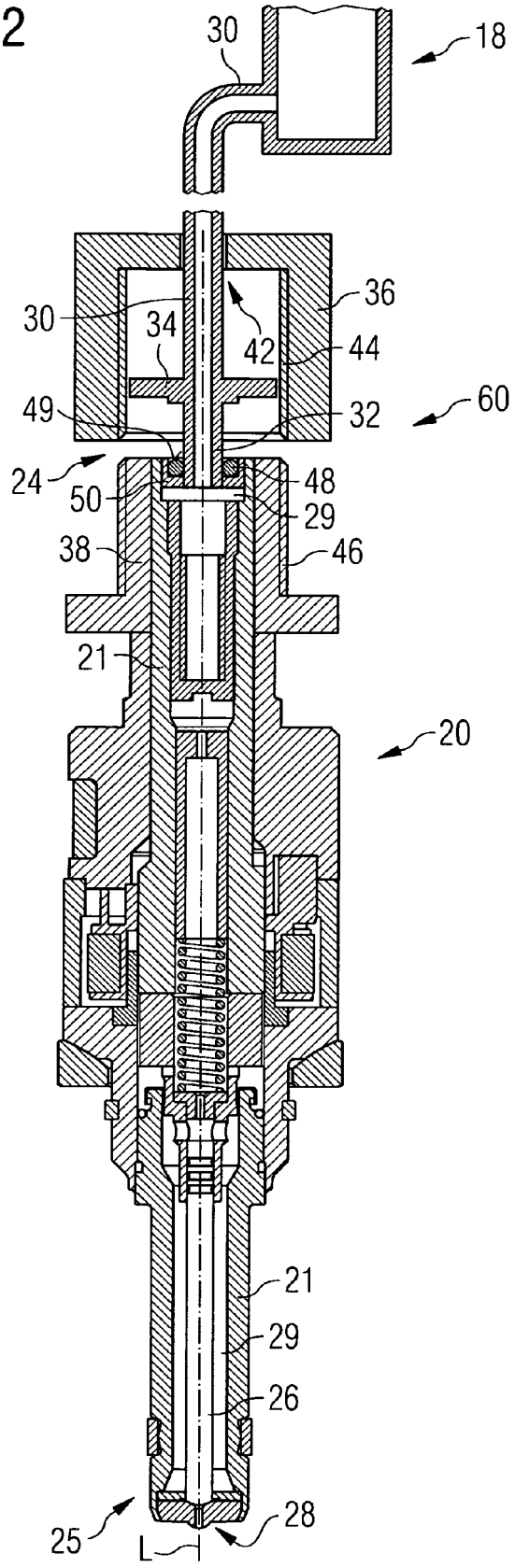
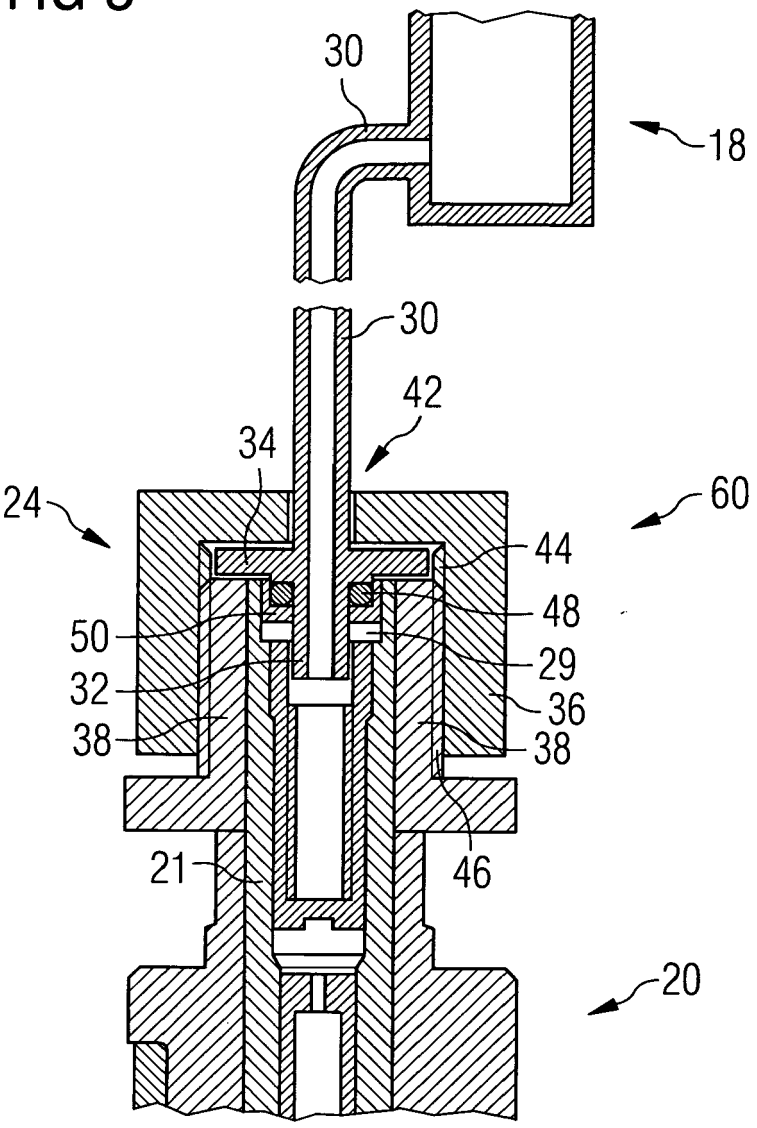


FIG 3



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Application Number
EP 08 00 2855

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F02M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	21 July 2008	Landriscina, V

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