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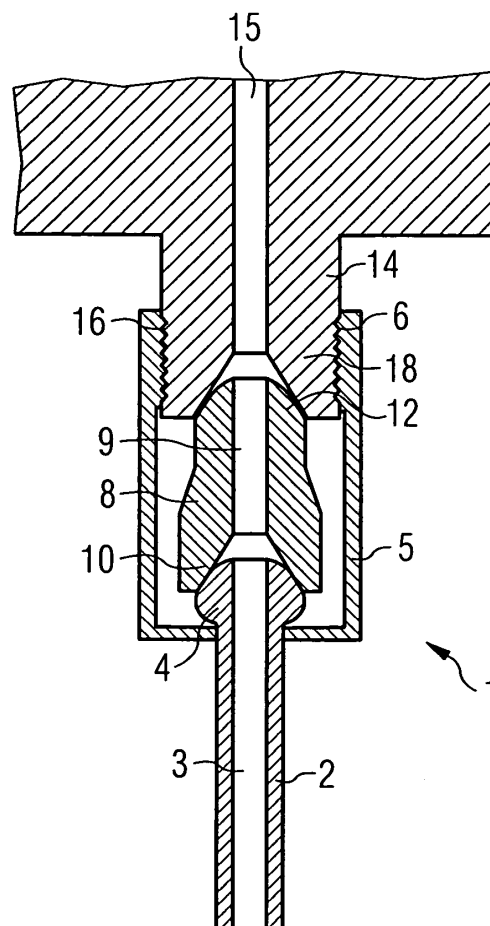
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(54) **Connecting system**

(57) A connecting device (1) and a connector (14) form a connecting arrangement. The connecting device (1) comprises a connecting element (2) having a tubular recess (3) and having a first connecting part (4). The connecting device (1) further comprises a thread part (5) being designed for forming a threading connection with a mating thread (16) formed in the connector (14). The connecting device (1) further comprises an intermediate connecting element (8) having a tubular recess (9) and having on one of its free ends a second connecting part (10) and having on the other one of its free ends a third connecting part (12). The first and second connecting parts (4, 10) are designed for forming a joint with either the first or the second connecting part (4, 10) having a tapered recess and the other one of the first or second connecting part (4, 10) being spherically shaped. The third connecting part (12) is designed for forming a joint with a fourth connecting part (18) of the connector (14) with either the third or the fourth connecting part (12, 18) having a tapered recess and the other one of the third or fourth connecting part (12, 18) being spherically shaped.

FIG 2



Description

[0001] The invention relates to a connecting device that is suitable for connecting to a connector. The invention further relates to a connecting arrangement comprising a connecting device and a connector. The connecting device of this kind of a connecting arrangement is particularly suitable for use in a fuel supply device of an internal combustion engine.

[0002] From WO 01/71179 A2, an injection valve for an internal combustion engine is known and the arrangement of the injection valve in a fuel feed device of an internal combustion engine. The injection valve has a connecting element that is fitted into a tubular recess of a connection of a fuel rail. The connecting element of the injection valve also has a tubular recess. The injection valve has a sealing ring that is arranged radially around the connecting element. Furthermore, a thread, a mating thread, a ring and a taper are provided that interact with each other in such a way that when the thread is screwed onto the mating thread the ring tensions the taper radially in the direction of the connecting element of the injection valve and thus fixes the connecting valve. To use this arrangement for fuel feed devices with very high pressures, such as for example occur in internal combustion engines with direct fuel injection, where pressures of 180 bar occur for gasoline and up to 2000 bar for diesel, the individual elements must be very precisely manufactured to guarantee a good seal. An arrangement of this kind is therefore extremely expensive for use at high fuel pressures.

[0003] The object of the invention is to create a connecting device that is designed to compensate manufacturing tolerances of the connecting device or connector for which it is designed to connect to.

[0004] It is furthermore the object of the invention to create a connecting arrangement with a connecting device and a connector, with a connecting device being designed to compensate manufacturing tolerances of the connecting device or the connector.

[0005] This object is achieved with regard to the connecting device by the features of claim 1. The object is achieved with regard to the connecting arrangement by the features of claim 3.

[0006] Advantageous embodiments of the invention are given in the subclaims.

[0007] The invention is distinguished by a connecting device that is suitable for connecting to a connector, comprising a connecting element having a tubular recess and having a first connecting part, further comprising a thread part being designed for forming a threading connection with a mating thread formed in a connector and in an intermediate connecting element having a tubular recess and having on one of its free ends a second connecting part and having on the other one of its free ends a third connecting part. The first and second connecting parts are designed for forming a joint with either the first or the second connecting part having a tapered

recess and the other one of the first or second connecting part being spherically shaped. The third connecting part is designed for forming a joint with a fourth connecting part of the connector with either the third or the fourth connecting part having a tapered recess and the other one of the third or fourth connecting part being spherically shaped. The term "spherically shaped" includes for the purpose of this invention all shapes that are suited for forming a line-like sealing connection with the tapered recess. It therefore includes a geometrical sphere but also, for example, a mushroom head or an ellipse.

[0008] By providing the connecting device with the intermediate connecting element manufacturing tolerances within the connecting device, especially in the connecting element or also within the connector, can simply be compensated for, that means a slight misalignment of the connecting element in respect to the connector can simply be compensated for. This means that the connecting device and/or the connector may be manufactured with higher manufacturing tolerances without a loss of quality.

[0009] In an advantageous embodiment of the connecting device the intermediate connecting element comprises a material, the hardness of which is less than the hardness of the material of the connecting element. This ensures a good sealing connection between the connecting element and the intermediate connecting element.

[0010] The invention is further distinguished by a connecting arrangement with the connecting device and the connector.

[0011] In an advantageous embodiment the connecting arrangement has the intermediate connecting element comprising a material, the hardness of which is less than the hardness of a material of the connecting element.

[0012] Exemplary embodiments of the invention are explained in the following with the aid of schematic drawings. These are as follows:

Figure 1 an internal combustion engine with a fuel feed device and

Figure 2 a connecting arrangement.

[0013] Elements of the same design or function that occur in different illustrations are identified by the same reference character.

[0014] A fuel feed device is assigned to an internal combustion engine (Figure 1). The fuel feed device is designed for use in internal combustion engines with direct metering of the fuel to the cylinders of the internal combustion engine at high pressure, for example 200 bar. It includes a fuel tank 20, that is connected via a first fuel line to a low-pressure pump 21. At the output end, the low-pressure pump 21 is connected to an inlet 23, of a high-pressure pump 24. Furthermore, at the outlet of the low-pressure pump 21, a mechanical regulator

22 is provided, the output of which is actively connected via a further fuel line to the fuel tank 20. The inlet 23 is connected to the high-pressure pump 24 that at its output end pumps fuel to the fuel accumulator 25. The high-pressure pump 24 is usually driven by the crankshaft or camshaft of the internal combustion engine and thus at a constant speed of the crankshaft delivers a constant fuel volume to the fuel accumulator 25.

[0015] Injection valves 29 are actively connected to the fuel accumulator 25. The fuel is thus fed to the injection valves 29 via the fuel accumulator 25. The injection valves 29 have a sealed connection to the fuel accumulator 25.

[0016] Figure 2 shows a connecting arrangement with a connecting device 1 and a connector 14. The connecting device 1 may, for example, be part of the injection valve 29. The connector 14 may, for example, be part of the fuel accumulator 25.

[0017] The connecting device 1 has a connecting element 2 with a tubular recess 3. In the preferred embodiment the tubular recess 3 is a high-pressure fuel feed line. The connecting element 2 has a first connecting part 4. The connecting device 1 further comprises a thread part 5 with a thread 6. The thread part 5 is preferably joined to the connecting element 2, for example by welding. However, in an alternative embodiment it may be simply pushed onto the connecting element 2 and rest on a protuberance of the connecting element 2 when the connecting device is threaded onto a mating thread 16 of the connector 14.

[0018] The connecting device 1 further comprises an intermediate connecting element 8 with also a tubular recess 9, which is basically aligned with the tubular recess 3, when the connecting device is threaded onto the mating thread 16 of the connector 14. The intermediate connecting element 8 further comprises on one of its free ends a second connecting part 10 and on the other one of its free ends a third connecting part 12. The first and second connecting parts 4, 10 are designed for forming a joint with either the first or the second connecting part 4, 10 having a tapered recess and the other one of the first or second connecting parts 4, 10 being spherically shaped.

[0019] The connector 14 comprises a tubular recess 15 which is basically aligned with the tubular recess 3 of the connecting element 2 and the tubular recess 9 of the intermediate connecting element 8, when the connecting device 1 is screwed onto the mating thread 16 of the connector 14.

[0020] The connector 14 further comprises a fourth connecting part 18. The third and fourth connecting parts are designed for forming a joint with either the third or fourth connecting part 12, 18 having a tapered recess and the other one of the third or fourth connecting part 12, 18 being spherically shaped. The intermediate connecting element 8 can compensate misalignments of the connecting element 2 and the connector 14. In addition to that its material may be chosen advantageously

to having a hardness, which is less than the hardness of the material of the connecting element 2.

Claims

1. Connecting device that is suitable for connecting to a connector (14) comprising a connecting element (2) having a tubular recess (3) and having a first connecting part (4), further comprising a thread part (5) being designed for forming a threading connection with a mating thread (16) formed in the connector (14) and an intermediate connecting element (8) having a tubular recess (9) and having on one of its free ends a second connecting part (10) and having on the other one of its free ends a third connecting part (12), the first and second connecting part (4, 10) being designed for forming a joint with either the first or the second connecting part (4, 10) having a tapered recess and the other one of the first or second connecting part (4, 10) being spherically shaped, the third connecting part (12) being designed for forming a joint with a fourth connecting part (18) having a tapered recess and the other one of the fourth connecting part (12, 18) being spherically shaped.
2. Connecting device in accordance with claim 1, with the intermediate connecting element (8) comprising a material, the hardness of which is less than the hardness of the material of the connecting element (2).
3. Connecting arrangement with a connecting device (1) and a connector (14), the connecting device (1) comprising a connecting element (2) having a tubular recess (3) and having a first connecting part (4), further comprising a thread part (5) being designed for forming a threading connection with a mating thread (16) formed in the connector (14) and an intermediate connecting element (8) having a tubular recess (9) and having on one of its free ends a second connecting part (10) and having on the other one of its free ends a third connecting part (12), the first and second connecting part (4, 10) being designed for forming a joint with either the first or the second connecting part (4, 10) having a tapered recess and the other one of the first or second connecting part (4, 10) being spherically shaped, the third connecting part (12) being designed for forming a joint with a fourth connecting part (18) of the connector (14) with either the third or the fourth connecting part (12, 18) having a tapered recess and the other one of the third or fourth connecting part (12, 18) being spherically shaped.
4. Connecting arrangement in accordance with claim 3 with the intermediate connecting element (8) com-

prising a material the hardness of which is less than the hardness of the material of the connecting element (2).

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FIG 1

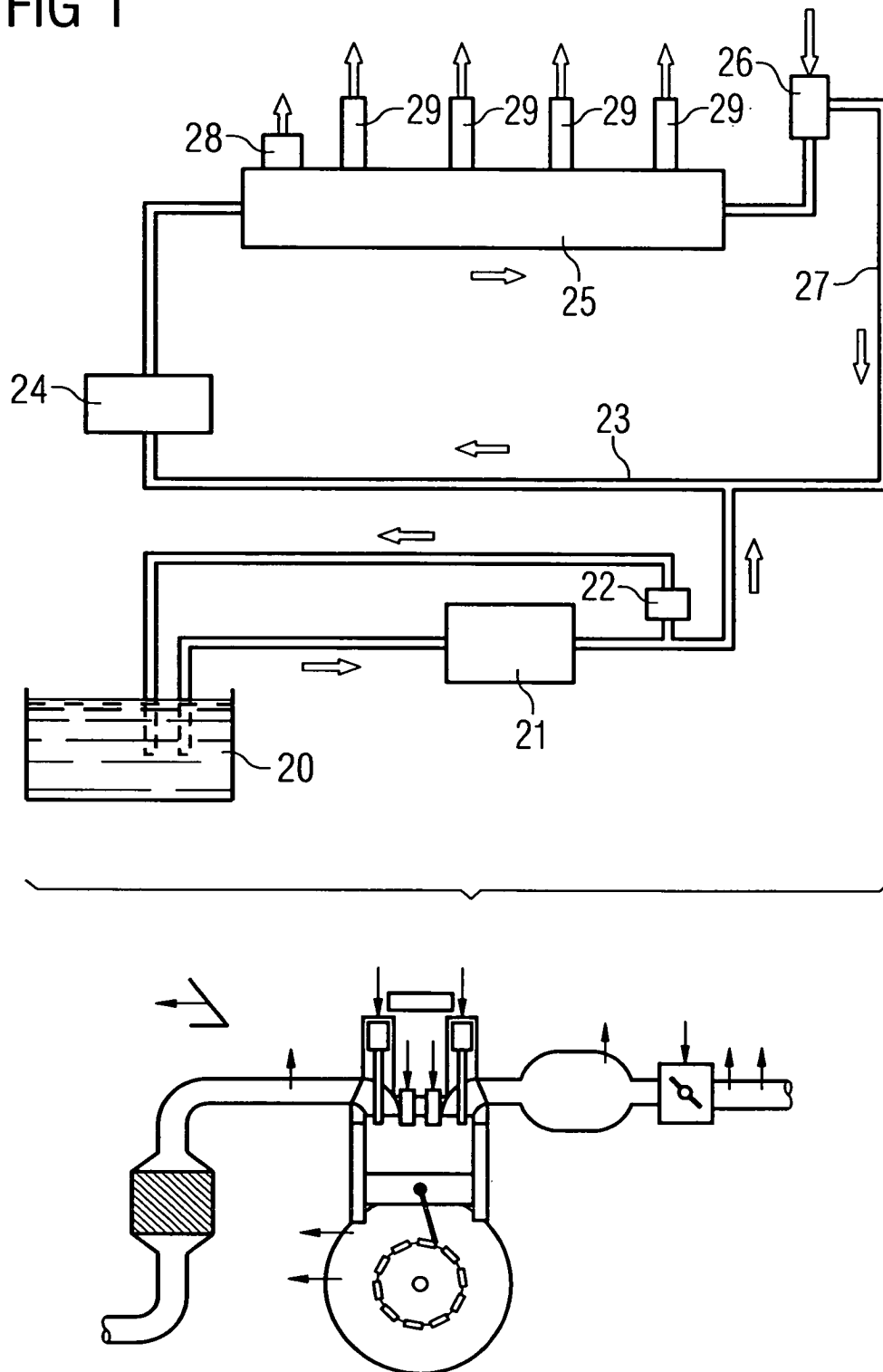
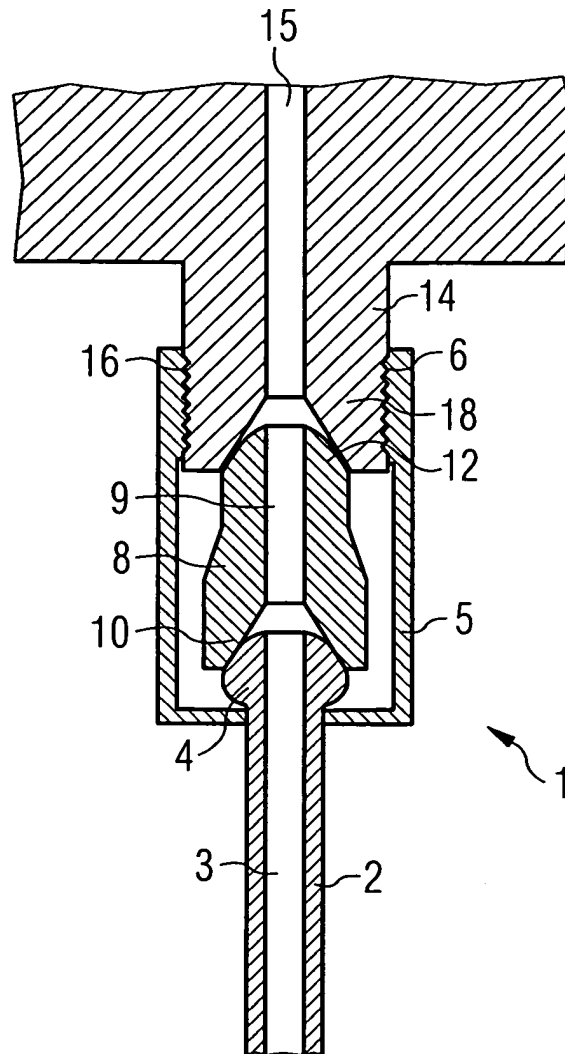


FIG 2





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EUROPEAN SEARCH REPORT

Application Number
EP 04 01 2810

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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 27 August 2004	Examiner Jackson, S
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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EUROPEAN SEARCH REPORT

Application Number
EP 04 01 2810

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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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