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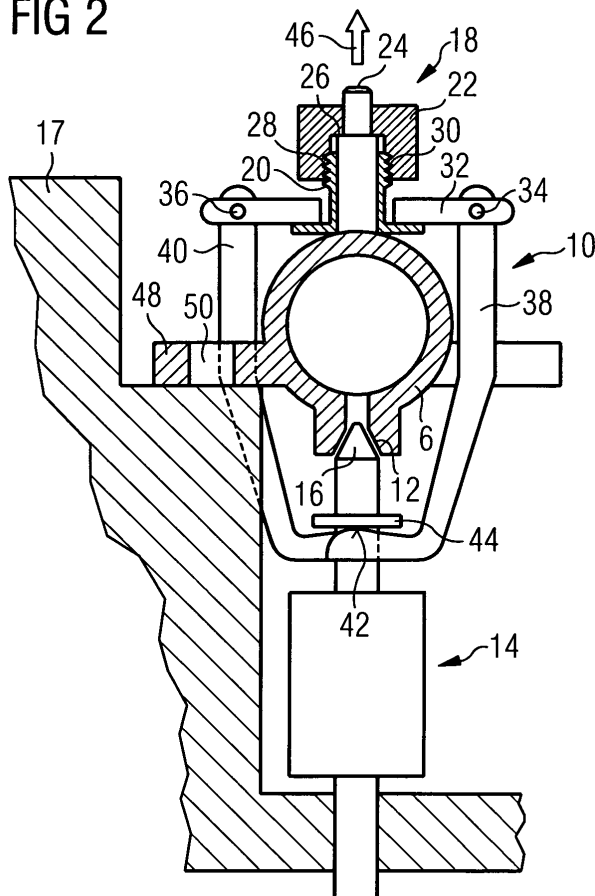
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(54) **Connector and system**

(57) A system comprises at least one connector (10) and at least one connecting device (14) with a counter connecting part (16). The connector (10) has a connecting part (12) being designed for mating with a counter connecting part (16) of a connecting device (14). The connector (10) comprises at least one lever (38, 40, 56, 58, 60) being mechanically coupled to a lifting unit (18),

such that a change in the lift of the lifting unit (18) is transformed into an axial movement of the lever in an axial direction of the connecting part (12). The lever is designed and arranged such, that the axial movement results in an axial displacement in the axial direction of the connecting part (12) of a coupling area (42) of the lever being provided for being coupled with the connecting device (14).

FIG 2



Description

[0001] The invention relates to a connector that is suitable for connecting to a connector device. The invention further relates to a system with the connector and the connecting device. The connector and the system are in particular 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.

[0003] An object of the invention is to provide a connector which is reliable and also simple. It is a further object of the invention to provide a system which is reliable and simple.

[0004] The object is achieved with regard to the connector by the features of independent claim 1. The object is achieved with regard to the system by the features of claim 6.

[0005] Advantageous embodiments of the invention are given in the sub claims.

[0006] The invention is distinguished according to a first aspect by a connector having a connecting part being designed for mating with a counter connecting part of a connecting device. The connector comprises at least one lever being mechanically coupled to a lifting unit, such that a change in lift of the lifting unit is transformed into an axial movement of the lever in an axial direction of the connecting part. The lever is designed and arranged such, that the axial movement results in an axial displacement in the axial direction of the connecting part of a coupling area of the lever. The coupling area of the lever is provided for being coupled with the connecting device. In this way a torque stress free connection between the connecting part and the counter connecting part is enabled. This further enables to dimension the parts more compact due to the absence of the need to over dimension parts and order to withstand high torque stress.

[0007] The connector further is distinguished by, that the connector device may be pre-assembled with the connector by changing the lift of the lifting unit in the given

first way and then when finally assembling the connector with the connecting device further changing the lift in order to reach a final assembly position.

[0008] According to a preferred embodiment of the first aspect of the invention the lifting unit comprises a slide bushing for setting the lift of the lifting unit cooperating with a nut being arranged such, that turning of the nut leaves a displacement of the nut relative to the connecting part unchanged. This enables in a simple way the axial movement by turning the nut.

[0009] In a further preferred embodiment of the first aspect of the invention the connector comprises a fuel rail with the connecting device comprising a fuel injector. This enables to connect the fuel rail in a simple way with the fuel injector.

[0010] According to a further preferred embodiment of the first aspect of the invention the connector comprises more than one connecting part and respective levers associated to the respective connecting parts and the lifting unit is associated to respective levers associated to multiple connecting parts. This may be very cost effective as less lifting units compared to levers are needed.

[0011] In this respect it is advantageous, if adjustment elements are provided, which are associated to the respective levers and are in their effect interposed between the lift unit and the respective lever. This enables to compensate for individual differences in the levers or respectively the connecting part of the counter connecting part or the connecting device.

[0012] According to a second aspect of the invention a system is provided comprising at least one connector according to the first aspect of the invention and at least one connecting device with a counter connecting part. The advantages of the system correspond to the advantages of the first aspect of the invention. Also the preferred embodiments correspond to each other.

[0013] 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,

Figure 2 a system with a connector and

Figure 3 a plate of the connector.

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

[0015] 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 1, that is connected via a first fuel line to a low-pressure pump 2. At its output the low-pressure pump 2 is connected to an inlet 4, of a high-

pressure pump 5. Furthermore, at the output of the low-pressure pump 2, a mechanical regulator 3 is provided, the output of which is actively connected via a further fuel line to the fuel tank 1. The inlet 4 is connected to the high-pressure pump 5 that at its output pumps fuel to the fuel rail 6. The high-pressure pump 5 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 rail 6.

[0016] Injection valves 8 are actively connected to the fuel rail 6. The fuel is thus fed to the injection valves 8 via the fuel rail 6. The injection valves 8 have a sealed connection to the fuel rail 6.

[0017] A system (figure 2) comprises a connector 10 with a connecting part 12. It further comprises a connecting device 14 with a counter connecting part 16. The connector preferably comprises the fuel rail 6. The connecting device 14 preferably comprises the injection valve 8. The connecting part 12 and the counter connecting part 16 are sealingly coupled with each other in an assembled state of the system and in this way enable a fluid flow, in particular a fuel flow, from the fuel rail into the fuel injector for dosing a fuel to a combustion chamber of an internal combustion engine. Preferably the system is mounted

on a cylinder head 17 of the internal combustion engine. **[0018]** The connector 10 comprises a lifting unit 18 with a slide bushing 20 being axially moveable mounted on a pin 24. The lifting unit 18 further comprises a nut 22 being in its axial movement restricted by a ledge 26 of pin 24 and being provided with a thread 28. The nut 22 is coupled to the slide bushing 22 via a respective mating thread 30 in the slide bushing 20. The slide bushing 20 is coupled to a plate 32 such, that a change in the lift of the lifting unit 18 caused by threading the nut 22 relative to the slide bushing 22 is transferred to the plate 32. The plate 32 may in one embodiment be preferably shaped in the form of a disc. It may however also have a different shape, such as for example a rectangular shape as shown in figure 3.

[0019] First and second levers 38, 40 are mechanically coupled to the plate via bearings 34, 36 and in that way pivotably mounted. Each of the levers 38, 40 comprises a coupling area 42, which is designed such that an axial movement of the respective lever 38, 40 is transformed into an axial displacement in the axial direction, indicated by arrow 46, of the connecting part in the coupling area 42 of the lever 38, 40. The coupling area 42 of the lever 38, 40 is provided for being coupled with the connecting device, preferably via a ledge 44 of the connecting device 14.

[0020] When assembling the system, the first and second levers 38, 40 are preferably first of all pivoted in a way, that the connecting device 14 may be inserted with its counter connecting part 16 into the connecting part 12. Then the levers 38, 40 are pivoted in the opposite direction in order to come in contact with the ledge 44 of the connecting device 14. Then the nut 22 is turned for a given first rotational angle in order to fix the connecting

device 14 with the connector 10 preferably loosely as a pre-assembling step. After that also other connectors and connecting devices being present in the connecting device may be pre-assembled in the same way. The connector is then fixed to the cylinder head 17 by use of a screw to be arranged in a recess 50 of a fixing bracket 48. Preferably then a nut 22 is further turned until the counter connecting part 16 rests with a given force in the connecting part 12. The connector may be associated to multiple connecting devices. For that reason more than one lifting unit and respective plates 32 may be provided. However also only one lifting unit 18 may be provided for multiple levers associated to different connecting devices 14. This is shown the way of example in figure 3.

[0021] In the case of the embodiment of the plate according to figure 3 preferably adjustment elements are provided for adjusting axial displacement and in that way forces transmitted to the respective different connecting devices 14. The adjustment elements are preferably coupled to the bearings.

[0022] Of course also only one or more than two levers may be provided being associated to the respective connecting device 14.

Claims

1. Connector having a connecting part (12) being designed for mating with a counter connecting part (16) of a connecting device (14), the connector (10) comprising at least one lever (38, 40, 56, 58, 60) being mechanically coupled to a lifting unit (18) such that a change in lift of the lifting unit (18) is transformed into an axial movement of the lever (38, 40, 56, 58, 60) in an axial direction of the connecting part (12) and the lever (38, 40, 56, 58, 60) being designed and arranged such, that the axial movement results in an axial displacement in the axial direction of the connecting part (12) of a coupling area (42) of the lever (38, 40, 56, 58, 60) being provided for being coupled with the connecting device (14).
2. Connector according to claim 1, with a lifting unit (18) comprising a slide bushing (20) for setting the lift of the lifting unit (18) cooperating with a nut (22) being arranged such, that turning of the nut (22) leaves a displacement of the nut (22) relative to the connecting part (12) unchanged.
3. Connector according to one of the previous claims comprising a fuel rail (6) and with the connecting device comprising a fuel injector (8).
4. Connector according to one of the previous claims, comprising more than one connecting part (12) and respective levers (38, 40, 56, 58, 60) associated to the respective connecting parts (12) and the lifting unit (18) being associated to respective levers asso-

ciated to multiple connecting parts (12).

5. Connector according to claim 4 being provided with adjustment elements being associated to the respective levers (38, 40, 56, 58, 60) and being in their effect interposed between the lifting unit (18) and the respective lever (38, 40, 56, 58, 60). 5
6. System comprising at least one connector (10) according to one of the previous claims and at least one connecting device (14) with a counter connecting part (16). 10

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FIG 1

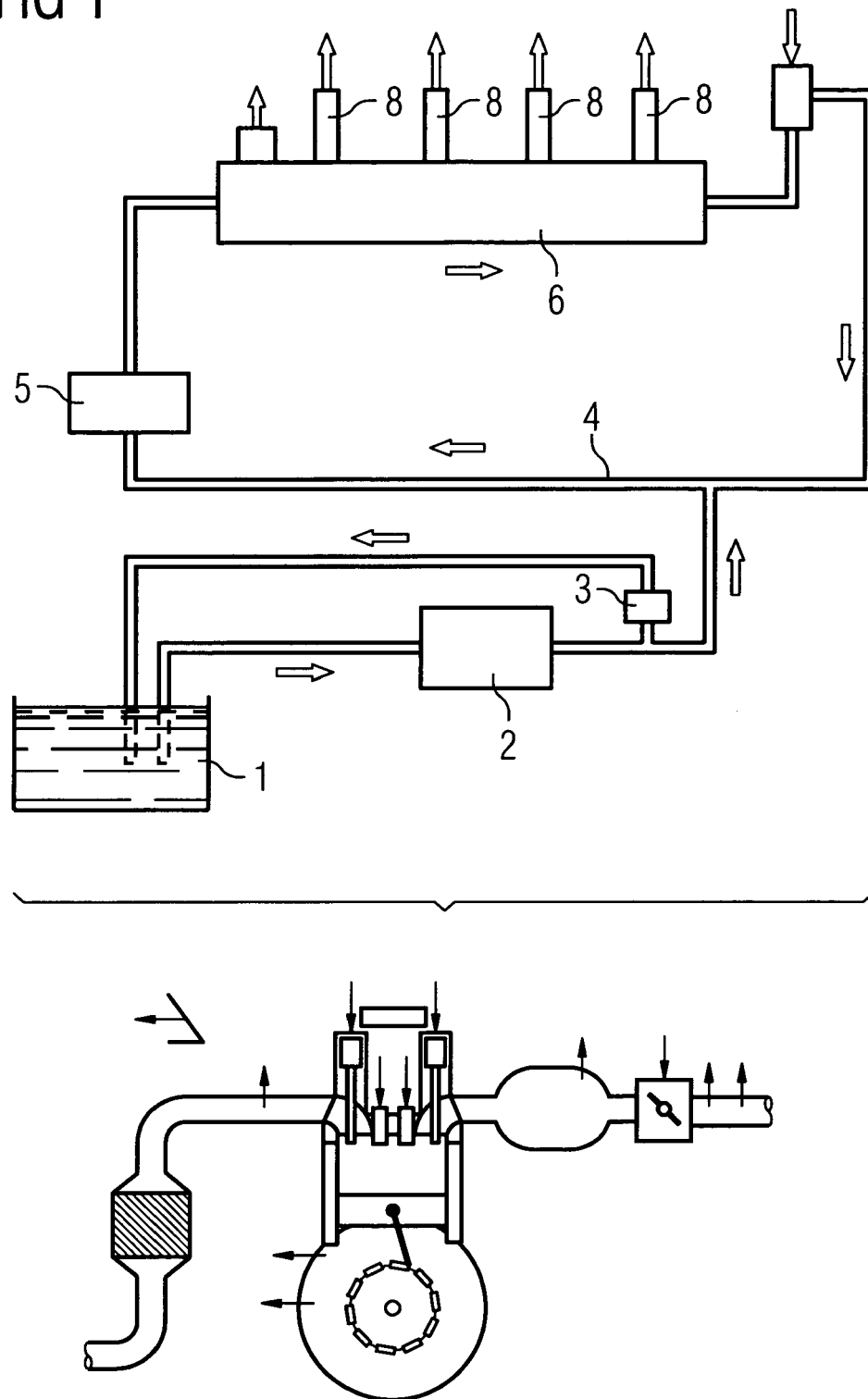


FIG 2

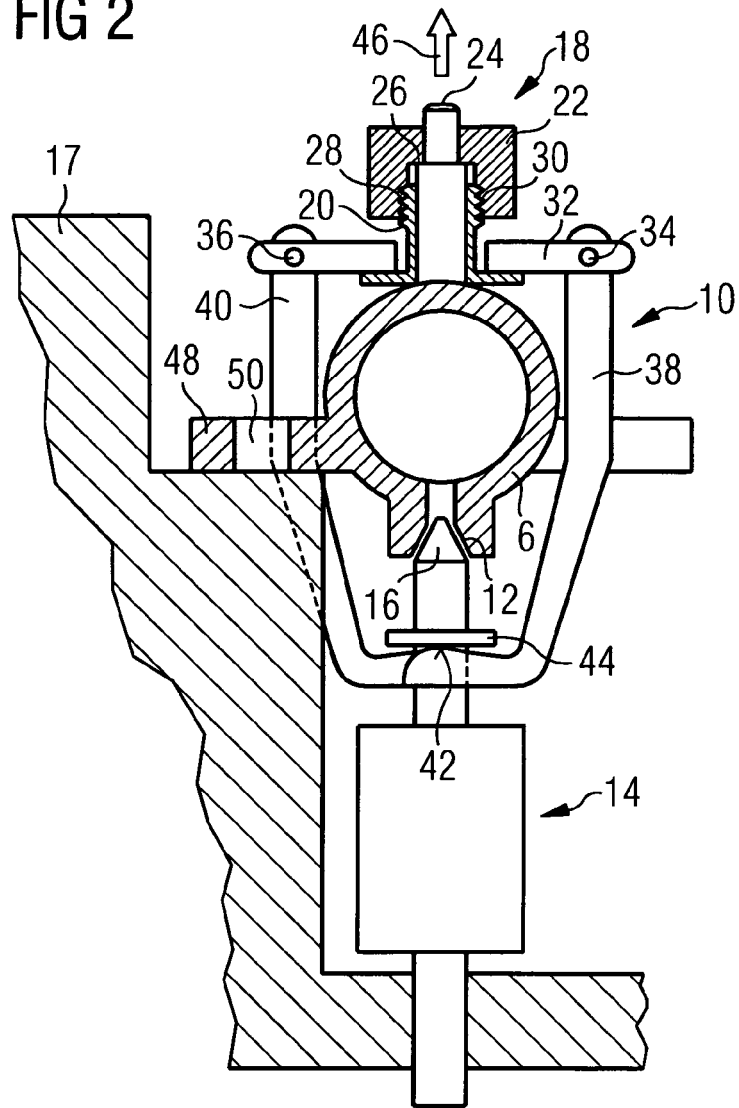
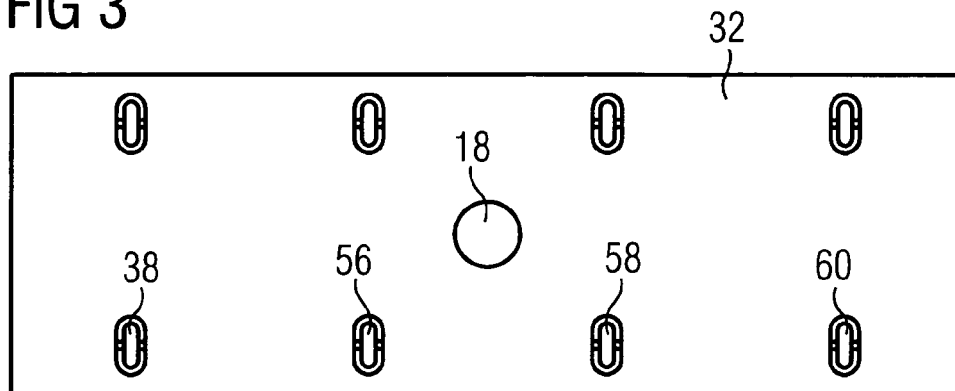


FIG 3





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 05 01 5670

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Place of search Munich		Date of completion of the search 7 October 2005	Examiner Etschmann, G
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 05 01 5670

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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