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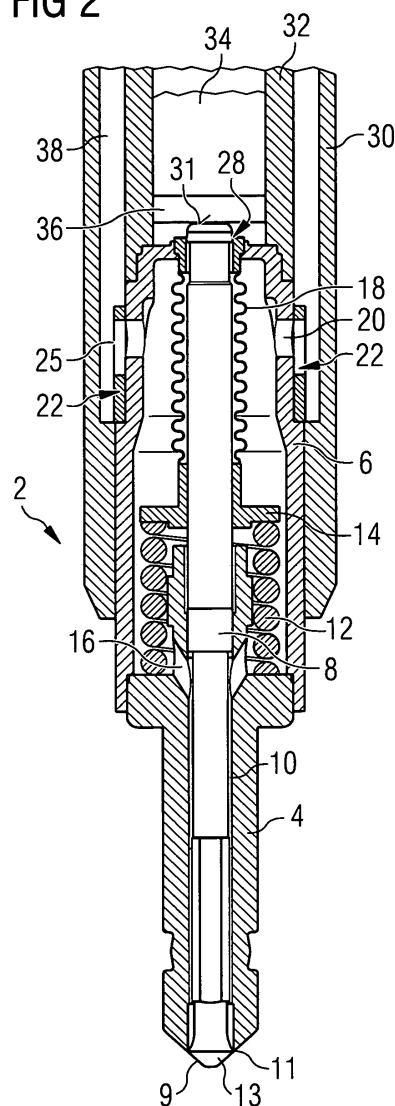
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(54) Injector and valve group for the injector

(57) A injector (1) has a fluid connection (3) for connecting the injector (1) to a fluid supply (5) and a fluid line (38) which guides the fluid from the fluid connection (3) to a fluid recess (20). The injector (1) further comprises a valve group (2) with a valve body. The valve body comprises the fluid recess (20) and a valve body recess which takes in a needle (8) movable in axial direction. The needle (8) prevents in a closed position of the needle (8) a fluid flow through an opening (11) in the valve body and otherwise enabling the fluid flow through the opening (11). A filter assembly is arranged downstream the fluid line (38) and next to the fluid recess (20) and/or downstream the fluid recess (20) and upstream the opening (11) of the valve body enabling filtering of the fluid downstream of the filter assembly.

FIG 2



Description

[0001] The invention relates to an injector and a valve group for the injector with a fluid connection for connecting the injector to a fluid supply, with a fluid line which guides the fluid from the fluid connection to a fluid recess, and with a valve body which comprises the fluid recess and a valve body recess which takes in a needle movable in axial direction.

[0002] The injector is proposed to inject fluid into a combustion chamber of an internal combustion engine. It is very important for a precise injection of fluid into the combustion chamber and to ensure a long lifetime of the injector that the fluid does not comprise any dirt. Said dirt may come into the fluid downstream a tank and upstream the combustion chamber. Said dirt may comprise burrs or chips. These burrs or chips can destroy the sealing area of the injector at an injector tip of the injector.

[0003] The object of the invention is to create an injector and a valve group for the injector, which enables simple an accurate dosing of fluid into a combustion chamber of an internal combustion engine and a long lifetime of the injector and the valve group.

[0004] The object of the invention is achieved by the features of claim 1. Advantageous embodiments of the invention are given in the sub-claims.

[0005] The invention is distinguished by an injector for an internal combustion engine and a valve group for the injector. The injector has a fluid connection for connecting the injector to a fluid supply. Further the injector has a fluid line which guides the fluid from the fluid connection to a fluid recess. The valve group comprises a valve body. The valve body comprises the fluid recess and a valve body recess which takes in a needle movable in axial direction. In a closed position of the needle the needle prevents a fluid flow through an opening in the valve body and otherwise enables the fluid flow through the opening. A filter assembly is arranged downstream of the fluid line and next to the fluid recess and/or downstream the fluid recess and upstream the opening of the valve body enabling filtering of the fluid downstream of the filter assembly.

[0006] The filter assembly is arranged in such a way as to filter the whole fluid which enters the valve group. The filter assembly enables simple a clean fluid at the opening of the valve body. This contributes to a long lifetime of the valve group and an accurate dosing of the fluid to a combustion chamber of an internal combustion engine. In that case the fluid is preferably fuel.

[0007] The injector comprises at least one connection area, in general the injector comprises two connection areas. The first connection area is for electrical connections to control the injection. The second connection area is to connect the injector to the fluid supply which may comprise a pipe which connects the injector for example with a common rail or a tank. The second connection area may comprise an assembly to fix the pipe to the injector. The fixing assembly is arranged at the fluid con-

nection of the injector. The fluid connection may comprise a fluid connection filter in order to filter the fluid which enters the injector. This protects the injector against dirt which is in the fluid and which may get into the fluid between the tank or the common rail and the injector. With said fluid connection filter it is not possible to filter out dirt which enters the fluid in the injector itself. Such dirt may be created by the assembling of the injector and/or the assembling of the valve group to the injector, for example by welding. Downstream the fluid connection filter the fluid goes through the fluid line of the injector. After that the fluid enters the valve group through the fluid recess in the valve body. The valve group of the injector is that part of the injector which takes in the needle and which forms an injector tip which is considered to be faced to the combustion chamber of the internal combustion engine.

[0008] In an advantageous embodiment of the valve group the filter assembly comprises an external filter which is arranged next to the fluid recess at the outside of the valve body. With an external filter the whole valve group is protected against dirt, especially dirt which is produced by assembling the valve group to an injector housing of the injector. The external filter can be easily mounted to the valve body. An adequate external filter enables mounting of the external filter without modification of the valve body.

[0009] In a further advantageous embodiment of the valve group the filter assembly comprises an internal filter which is arranged next to the fluid recess inside the valve body. With an internal filter the whole interior of the valve group is protected against dirt, especially dirt which is produced by assembling the valve group to the injector housing and/or dirt which is in the fluid recess of the valve body.

[0010] In a further advantageous embodiment of the valve group the valve body comprises a valve cap, a cartridge with a cartridge borehole and a cartridge recess which takes in the needle and with the filter assembly comprising a cartridge filter, which is arranged next to the cartridge borehole. This enables filtering of dirt which is produced by assembling the valve group to the injector and/or by assembling the cartridge to the valve cap.

[0011] In a further advantageous embodiment of the valve group the filter assembly comprises a lattice. This enables a simple filtering of the fluid.

[0012] In a further advantageous embodiment of the valve group the lattice comprises a synthetic material. This enables in a simple way a cheap filter assembly.

[0013] In a further advantageous embodiment of the valve group the synthetic material comprises nylon. This enables in a simple way a resistant filter assembly.

[0014] In a further advantageous embodiment of the valve group the lattice comprises stainless steel. This enables easy mounting of the lattice to the filter assembly by welding.

[0015] Exemplary embodiments of the invention are explained in the following with the aid of schematic draw-

ings.

[0016] These are as follows:

Figure 1 an injector,

Figure 2 a cut through a first embodiment of a valve group for the injector,

Figure 3 a cut through a second embodiment of the valve group,

Figure 4 a detailed view of the valve group in accordance with Figure 3,

Figure 5 a cartridge of the valve group.

[0017] Elements of the same design and function that appear in the different illustrations are identified by the same reference character.

[0018] A fluid injector 1 (figure 1) comprises an injector housing 30 and a valve group 2. The valve group 2 comprises a cartridge 4 and a valve cap 6. The injector 1 further comprises a fluid connection 3. The injector 1 may be used to inject fluid to a combustion chamber of an internal combustion engine. The fluid connection 3 may be connected to a high pressure fuel chamber, for example a common rail, of an internal combustion engine, where fuel is stored under high pressure, for example under the pressure of about 200 Bar.

[0019] The injector housing 30 has a tubular shape. The fluid connection 3 is formed at the injector housing 30 on one side of the injector housing 30. The fluid connection 3 may comprise a connection assembly for a fluid supply 5 which may communicate with a fluid pipe. The fluid connection 3 also may comprise a fluid connection filter in order to filter the fluid while entering the injector 1 and so protecting the injector 1 against dirt in the fluid. The dirt may get into the fluid downstream a tank and upstream the injector 1.

[0020] The valve group 2 further comprises a valve body (figure 2). The valve body comprises the cartridge 4 with a cartridge recess 10. Further the valve body comprises the valve cap 6 which is connected to the cartridge 4. The cartridge 4 takes in a needle 8. The needle 8 prevents in a closed position of the needle 8 a fluid flow through a cartridge opening 11 at one axial end of the cartridge recess 10 at a cartridge tip 9. In the closed position of the needle 8 a needle tip 13 is pressed to the cartridge recess 10 from the outside of the cartridge recess 10 covering it sealing up the cartridge recess 10. So the needle 8 prevents the fluid flow through the cartridge recess 10. Beyond the closed position the needle tip 13 is moved away from the cartridge recess 10. In that way the needle 8 and the cartridge tip 9 form the cartridge opening 11. So the cartridge opening 11 forms a cylindrical shaped nozzle.

[0021] A spring 12 is arranged between the cartridge 4 and a spring washer 14. The spring 12 forces the needle

8 in order to press the needle tip 13 to the cartridge recess 10. The needle 8 is movable relative to the spring washer 14. The cartridge 4 comprises at least two boreholes 16 through which the fluid can flow to the cartridge tip 9 and beyond the closed position of the needle 8 into the combustion chamber of the combustion engine.

[0022] The valve cap 6 comprises at that side which is faced away from the cartridge 4 a control recess 17 through which the needle 8 exits the valve cap 6. The fluid is prevented from exiting the valve cap 6 through the control recess 17 by bellows 18. The bellows 18 prevent leaking of the fluid through the control recess 17 of the valve cap 6. The needle 8 comprises at that side of the needle 8 which is faced away from the needle tip 13 an end face 31. The end face 31 protrudes in an actor housing 32. An actor 34 comprises a ground plate 36 and is arranged in the actor housing 32. Via the ground plate 36 the actor 34 affects the needle 8 at the end face 31 of the needle 8.

[0023] The valve cap 6 comprises on its outside an external filter 22 which is arranged next to a fluid recess 20. The fluid can enter the valve group 2 through the fluid recess 20. The external filter 22 comprises a lattice 25 in order to filter all the fluid which enters the valve group 2. The valve group 2 is connected to the fluid connection 3 by a fluid line 38 which is formed in the double tubed free volume between the actor housing 32 and the injector housing 30. The fluid is lead from the fluid connection 3 through the fluid line 38, through the external filter 22 and the fluid recess 20. Further the fluid is lead to the cartridge 4, through the cartridge boreholes 16 and then towards the cartridge tip 9. Alternatively the injector housing 30 may also comprise only one tube and the fluid is then lead around the actor 34 towards valve group 2 and then to the cartridge tip 9.

[0024] The spring washer 14 is coupled to the needle 8 and stays in a fixed position independent from the movement of the needle 8. The spring washer 14 forms a spring rest for the spring 12. A second spring rest is formed preferably at one axial end of the cartridge 4 which is faced away from the cartridge tip 9.

[0025] The axial position of the needle 8, which determines whether the cartridge opening 11 is opened or closed, depends on a force balance. A first force in the closing direction of the needle 8 is affected by the spring 12 and a second force in opened direction of the needle 8 is affected by the actor 34.

[0026] In the explained embodiments the fluid injector is designed to be normally closed, that means that if no control signal is applied to the actor 34 the needle 8 is pushed against the cartridge opening 11 by the spring 12 and that closes the cartridge opening 11. If a suitable control signal is applied to the actor 34, the actor 34 changes its axial length and in that way controls whether the cartridge opening 11 is opened or closed by the needle 8. The fluid injector 1 may, however, also be designed to be normally open or may be of an inward-opening type. Then the cartridge opening 11 may be formed as a small

hole through the cartridge tip 9.

[0027] In an alternative embodiment of the filter assembly an internal filter 24 (figure 3) is arranged at the inside of the valve cap 6. The internal filter 24 alternatively may be arranged together with the external filter 22. The internal filter 24 preferably comprises the lattice 25. Additional to the effects inherent with the external filter 22, the internal filter 24 enables filtering of dirt which occurs in the fluid recess 20. Dirt in the fluid recess 20 may be created by drilling the fluid recess 20.

[0028] Both, the external filter 22 and the internal filter 24 enable mounting and finishing the valve group 2 in a clean room. In this way the valve group 2 is protected against dirt which may be created while assembling the valve group 2 to the injector housing 30, especially by welding.

[0029] A cartridge filter 26 (figure 4) may be arranged additionally or alternatively to the external and/or the internal filter 22, 24. A cartridge filter 26 is preferably arranged at the boreholes 16 of the cartridge. The cartridge filter 26 is preferably arranged at the outside of the cartridge 4. The cartridge filter 26 may also be arranged in the borehole 16 of the cartridge 4 or in the cartridge recess 10. The cartridge filter 26 also comprises the lattice 25 (Figure 5) so the cartridge 4 may be mounted and finished in a clean room and then may be assembled outside the clean room to the rest of the valve group 2. This prevents dirt in the fluid from entering the cartridge recess 10.

[0030] The filter assembly may comprises an other filter which is arranged at another place downstream of the fluid recess 20 in the valve cap 6 and upstream of the cartridge opening 11 as long as it is guaranteed that the whole fluid which reaches the cartridge opening 10 is filtered. Therefore dirt in the fluid, for example burrs or chips, cannot affect the injection of the fluid to the combustion chamber of the internal combustion engine. Also the dirt cannot hinder the needle moving in its closed position because of dirt in between the needle tip 13 and the cartridge tip 9. This guarantees a precise injection of the fluid and a long lifetime of the valve group 2 and so of the whole injector unit 1.

[0031] The lattice 25 may comprise a synthetic material, for example Nylon. This contributes to a cheap production of the filter assembly. Nylon especially is a very robust material and contributes to a long lifetime of the filter assembly. If the lattice 25 comprises a high amount of synthetic material it may be advantageous, if the lattice 25 is not directly fixed to the valve cap 6 and/or the cartridge 4. Preferably the lattice 25 then is arranged closely to the valve cap 6 and/or respectively the cartridge 4 and is fixed to a frame which is fixed to the valve cap 6 and/or respectively to the cartridge 4.

[0032] The lattice 25 also may comprise stainless steel. This contributes to a very long lifetime of the filter assembly. If the lattice 25 comprises a high amount of stainless steel it may be advantageous, if the lattice 25 is directly fixed to the valve cap 6 and/or the cartridge 4.

The lattice 25 may also be arranged closely to the valve cap 6 and/or respectively the cartridge 4 and be fixed to a frame which is fixed to the valve cap 6 and/or respectively the cartridge 4.

Claims

1. Valve group (2) for an injector (1), the injector comprising a fluid connection (3) for connecting the injector (1) to a fluid supply (5) and the injector (1) comprising a fluid line (38) which guides the fluid from the fluid connection (3) to a fluid recess (20), the valve group (2) comprising

- a valve body, which comprises the fluid recess (20) and a valve body recess which takes in a needle (8) movable in axial direction,
- the needle (8) preventing in a closed position of the needle (8) a fluid flow through an opening (11) in the valve body and otherwise enabling the fluid flow through the opening (11),
- a filter assembly which is arranged downstream the fluid line (38) and next to the fluid recess (20) and/or downstream the fluid recess (20) and upstream the opening (11) of the valve body enabling filtering of the fluid downstream of the filter assembly.

2. Valve group (2) in accordance with claim 1 with the filter assembly comprising an external filter (22) which is arranged next to the fluid recess (20) at the outside of the valve body.

3. Valve group (2) in accordance with one of the preceding claims with the filter assembly comprising an internal filter (24) which is arranged next to the fluid recess (20) inside the valve body.

4. Valve group (2) in accordance with one of the preceding claims with the valve body comprising a valve cap (6), a cartridge (4) with a cartridge borehole (16) and a cartridge recess (10) which takes in the needle (8) and with the filter assembly comprising a cartridge filter (26), which is arranged next to the cartridge borehole (16).

5. Valve group (2) in accordance with one of the preceding claims with the filter assembly comprising a lattice (25).

6. Valve group (2) in accordance with claim 5 with the lattice (25) comprising a synthetic material.

7. Valve group (2) in accordance with claim 6 with the synthetic material comprising nylon.

8. Valve group (2) in accordance with one of the claims

5 to 7 with the lattice (25) comprising stainless steel.

9. Injector (1) for an internal combustion engine which comprises the valve group in accordance with one of the claims 1 to 8.

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FIG 1

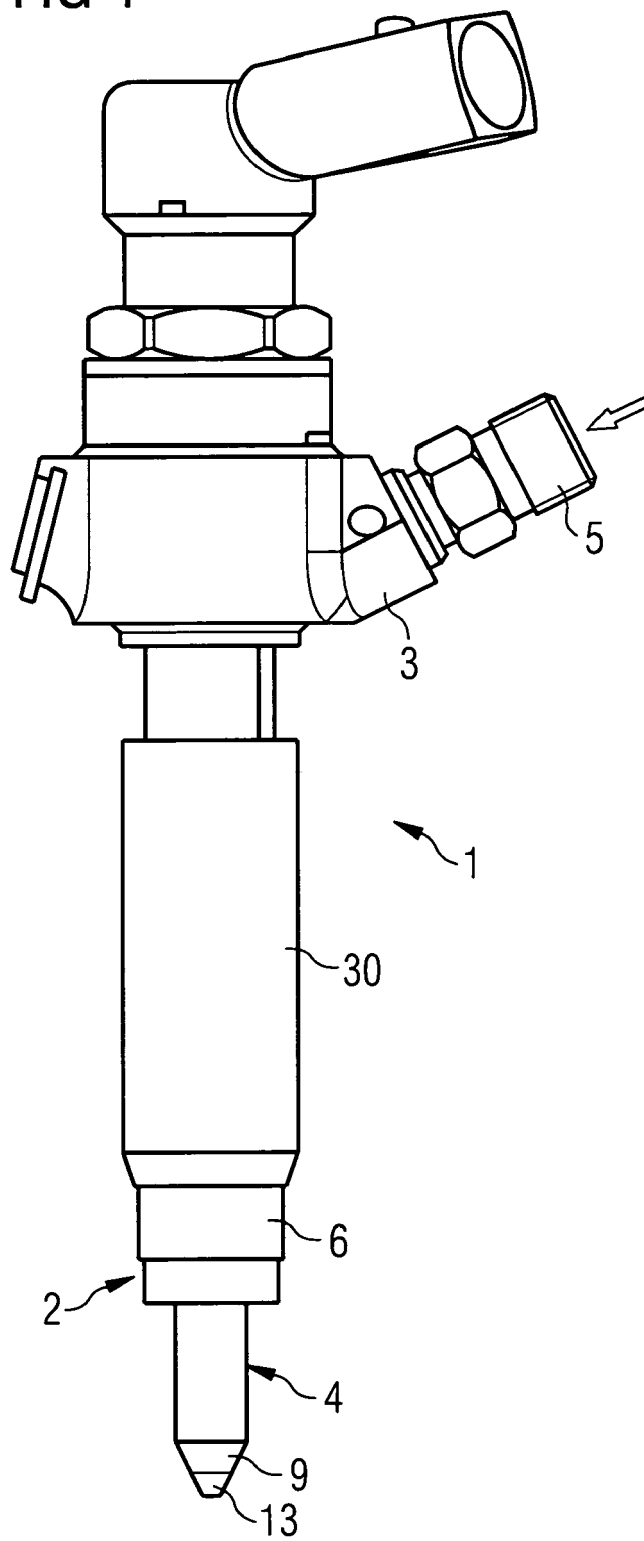


FIG 2

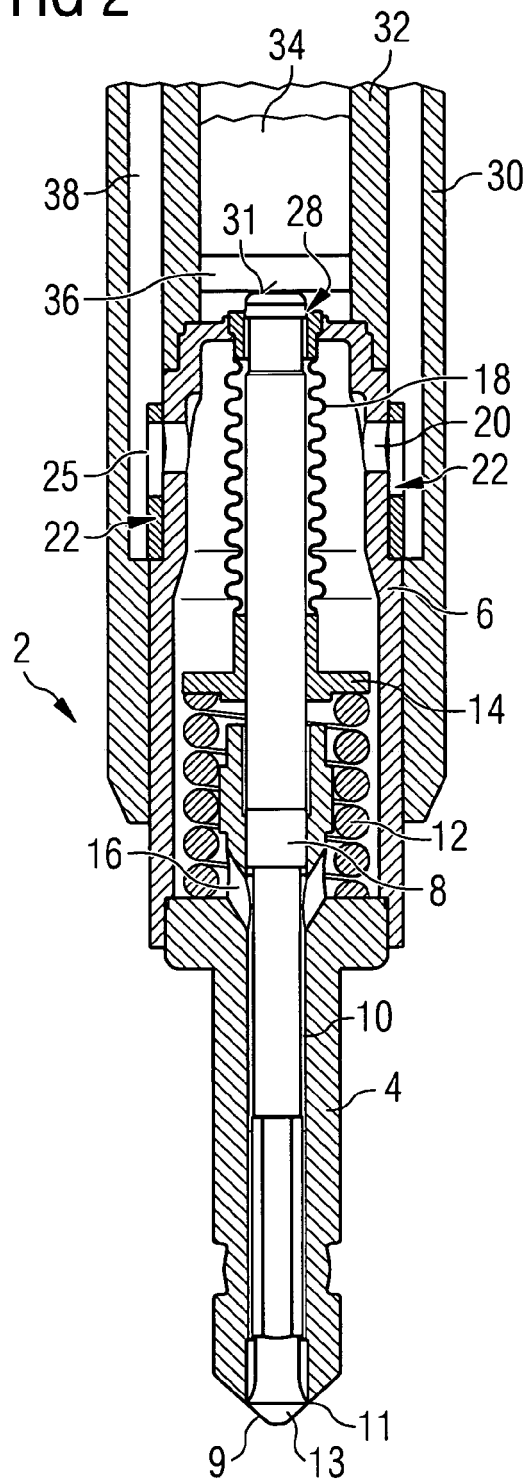


FIG 3

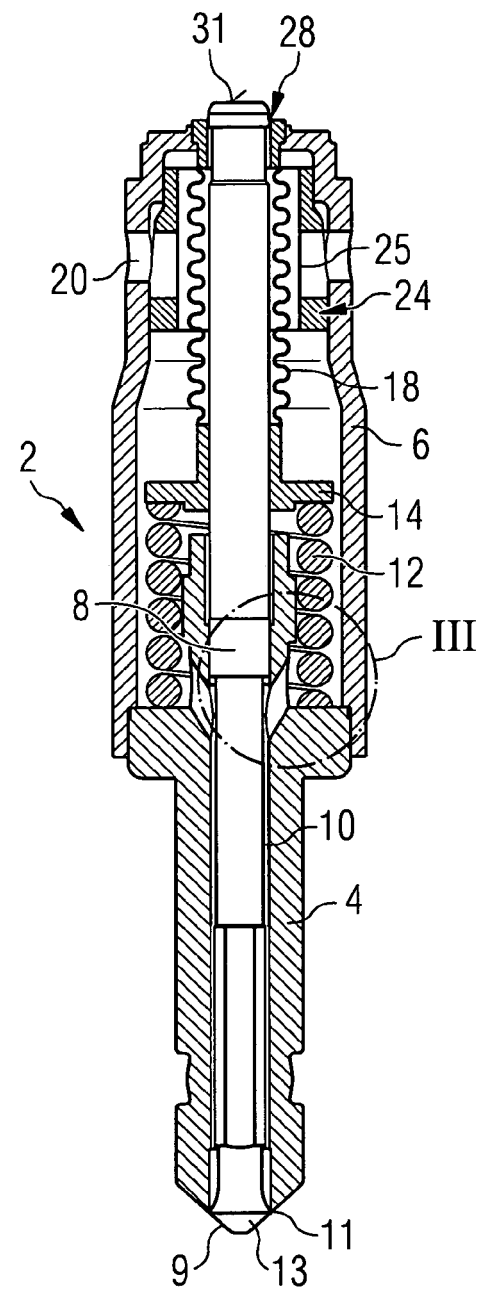


FIG 4

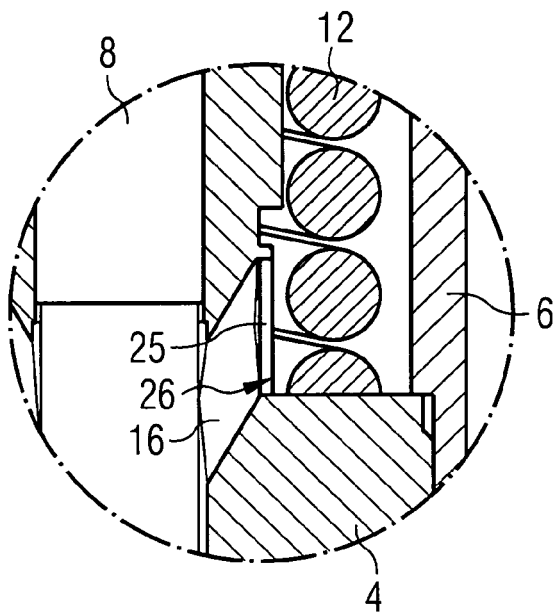
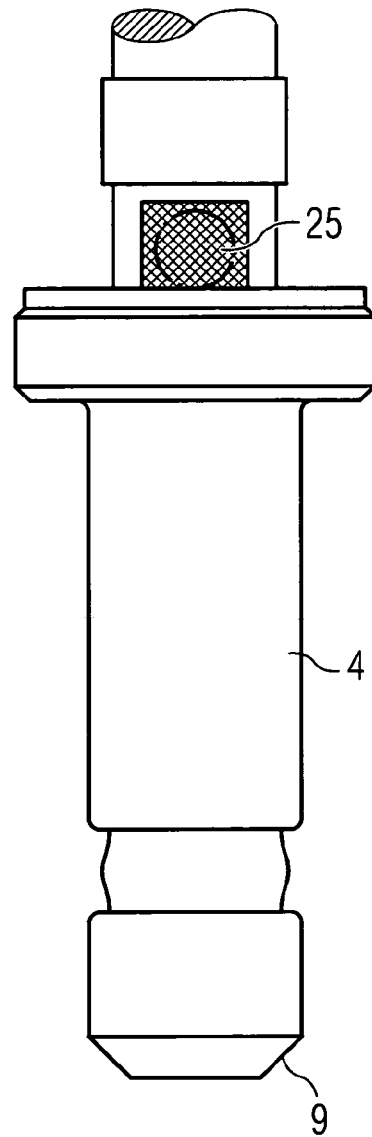


FIG 5





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 01 0066

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Place of search Munich		Date of completion of the search 7 September 2005	Examiner Torle, E
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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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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