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(71) Applicant: **Caterpillar Motoren GmbH & Co. KG**
24159 Kiel (DE)

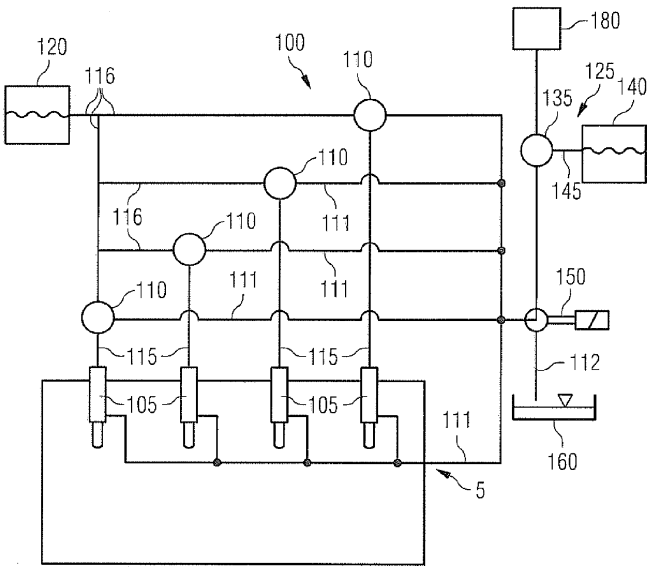
(72) Inventor: **Nagel, Jürgen**
24214 Gettorf (DE)

(74) Representative: **Kramer - Barske - Schmidtchen**
Landsberger Strasse 300
80687 München (DE)

(54) Fuel injection system including a purging system for purging a fuel pump and/or an injection nozzle in operation with pyrolysis fuel oil

(57) The present disclosure refers to a fuel injection system (100) configured to supply fuel as, e.g., Pyrolysis Fuel Oil to injection nozzles (105) of a large internal combustion engine (5). The fuel injection system may comprise a fuel injection pump (110) configured to measure fuel as, e.g., Pyrolysis Fuel Oil into correct amounts for injection, building up a high pressure, and delivering it to at least one injection nozzle (105) of the large internal combustion engine (5) at the proper time. The fuel injection pump (110) may include a pump barrel (10) extending along a longitudinal direction and having a barrel inner wall (12), a plunger (13) configured to reciprocate within the pump barrel (10) and guided by the barrel inner wall (12), and a first groove (38) formed in the barrel inner wall (12) at a first position with respect to the longitudinal direction and always covered by the reciprocating plunger (13). The fuel injection system may further comprise an injection nozzle (105) including an injection barrel (200) and a valve needle (210) configured to reciprocate within the injection barrel and guided by a barrel inner wall (212). A barrel groove (232) may be formed in the barrel inner wall at a position that is always covered by the valve needle (210). A purging system (125) may be provided to supply a purging fluid to the first groove (38) of the fuel pump (110) and the barrel groove (232) of the injection nozzle (105).

FIG 1



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Description

Technical Field

[0001] The present disclosure generally refers to a fuel injection system for supplying fuel, e.g. Pyrolysis Fuel Oil, to injection nozzles of a large internal combustion engine. Furthermore, the present disclosure refers to an injection barrel of an injection nozzle, an injection nozzle, a fuel injection system, a method for purging an injection nozzle and a fuel injection pump configured to supply fuel, e.g. Pyrolysis Fuel Oil, to a large internal combustion engine, and use of Pyrolysis Fuel Oil as a fuel for a fuel injection system of a large internal combustion engine.

Background

[0002] Generally, the term "large internal combustion engine" may refer to internal combustion engines which may be used as main or auxiliary engines of ships/vessels such as cruiser liners, cargo ships, container ships, and tankers, or in power plants for production of heat and/or electricity. In particular, large internal combustion engines may be configured to bum at least one fuel selected from the group consisting of Diesel, Marine Diesel Oil (MDO), Heavy Fuel Oil (HFO) and the new Bio Fuel Pyrolysis Fuel Oil (Pyoil).

[0003] Pyrolysis Fuel Oil (Pyoil) is a critical fluid for injection systems because it is very acidic (ph-value 2-3) and needs to be kept in a given temperature range (60-80°C) in order to have the right viscosity and to be far away from risk of polymerization. If an engine needs to be stopped due to an emergency alarm the remaining Pyoil inside the small clearance of the pump element and nozzle element leads to sticking plungers and / or needles due to polymerization of the Pyoil itself After a certain time there is no movement of the plunger and / or needle possible anymore and the engine cannot be started after solving / repair the reason for the emergency stop.

[0004] Fuel injection pumps for supplying fuel to injection nozzles of large internal combustion engines are basically known. These pumps are configured to measure fuel into correct amounts of oil injection, building up a high pressure, and delivering it to the injection nozzles of the large internal combustion engines at the proper time. Such a fuel injection pump may include a pump barrel, the pump barrel extending along a longitudinal direction and having a barrel wall. A plunger may be configured to reciprocate within the barrel and guided by the barrel wall. A groove may be formed in the barrel wall at a position with respect to the longitudinal direction and covered by the plunger. The injection nozzle may be out of the state of the art, where a spring loaded valve needle is guided inside an injection barrel and what opens the way to the spray holes when a given injection pressure is created by the injection pump.

[0005] The present disclosure is directed, at least in part, to improving or overcoming a problem of one or more aspects of prior art fuel injection systems.

Summary of the Disclosure

[0006] In a first aspect of the present disclosure an injection barrel for guiding a valve needle of an injection nozzle may comprise a barrel inner wall extending along a longitudinal direction and having a needle guiding section, a barrel groove formed in the needle guiding section of the barrel inner wall, and a purging fluid supply passage passing through the injection barrel for supplying a purging fluid to the barrel groove.

[0007] In a second aspect of the present disclosure, an injection nozzle for a fuel injection system for injecting fuel, e.g. Pyrolysis Fuel Oil, into a cylinder of a large internal combustion engine, may include an injection barrel of the first aspect and a valve needle configured to reciprocate within the injection barrel and having a first section guided by the valve needle guiding section of the barrel inner wall, wherein the barrel groove is formed in the barrel inner wall at a position with respect to the longitudinal direction that is always covered by the first section of the valve needle.

[0008] In a third aspect of the present disclosure, a fuel injection system configured to supply fuel, e.g. Pyrolysis Fuel Oil, to injection nozzles of a large internal combustion engine, the fuel injection system may comprise at least one injection nozzle according to the second aspect and a purging system connectable to the purging fluid supply passage.

[0009] In a fourth aspect of the present disclosure, a method for purging an injection nozzle according to the second aspect of a fuel injection system, which injection nozzle is configured to inject fuel, e.g. Pyrolysis Fuel Oil, into a cylinder of a large internal combustion engine within e.g. a ship or generator set, may comprise supplying a purging fluid to the barrel groove of the injection nozzle.

[0010] In a fifth aspect of the present disclosure, Pyrolysis Fuel Oil is used as a fuel for a fuel injection system of a large internal combustion engine; the fuel injection system may comprise at least one injection nozzle configured to receive the fuel under pressure and including an injection barrel, which extends along a longitudinal direction and has a barrel inner wall, and a valve needle configured to reciprocate within the injection barrel and having a first section guided by the barrel inner wall; wherein a barrel groove is formed in the barrel inner wall at a position with respect to the longitudinal direction that is always covered by the first section of the valve needle; and further comprising a purging system being configured to supply a purging fluid to the barrel groove.

[0011] Other features and aspects of this disclosure will be apparent from the following description and the accompanying drawings.

Brief Description of the Drawings

[0012] Fig. 1 shows a schematic block diagram of an

exemplary embodiment of a fuel injection system of the present disclosure;

[0013] Fig. 2 shows a schematic sectional view of a fuel injection pump which may be adapted to be used in a fuel injection system shown in Fig. 1;

[0014] Fig. 3 shows a piston and pump barrel adapted to be used in a fuel injection pump as, e.g., shown in Fig. 2, and

[0015] Fig. 4 shows a schematic sectional view of an injection nozzle.

Detailed Description

[0016] Fig. 1 shows a schematic block diagram of an exemplary embodiment of a fuel injection system 100 configured to supply fuel as, e.g., Pyrolysis Fuel Oil, to injection nozzles 105 of a large internal combustion engine 5. In accordance with this exemplary embodiment of fuel injection system 100 each injection nozzle 105 may be connected to an associated fuel injection pump 110 via a high-pressure fuel line 115. Each fuel injection pump 110 may be connected to a fuel reservoir 120 via fuel supply lines 116. Furthermore, each fuel injection pump 110 and each injection nozzle 105 may be connected to a purging system 125 via purging fluid supply lines 111. Purging system 125 may comprise a common purging fluid pump 135. It is also contemplated that each fuel injection pump 110 and each injection nozzle 105 may be connected to an associated, individual purging fluid pump 135. Purging fluid pump 135 may be connected via a purging fluid supply line 145 to a purging fluid reservoir 140. In addition, purging fluid pump 135 may be connected via a communication line to a control unit 180. The control unit 180 is connected to a 3way-valve 150 and to the purging fluid pump 135. In case of an emergency shut down signal to the engine 5 the purging fluid pump 135 is activated and the 3way-valve 150 connects the purging fluid pump 135 with the fluid supply lines 111 as shown in Fig.1. The purging fluid is getting into the small element clearance of the injection pumps 110 and into the small clearance of the nozzle elements of the injection nozzles 105. When the engine 5 can be started again the stop signal has to be reseted and the control unit 180 shuts the purging fluid pump 135 off and switches the 3way-valve 150 into a second position, so that the purging fluid supply lines 111 are connected to a drain tank 160. In this configuration the lines 111 are used as conventional leakage drain lines of pump elements inside the injection pumps 110 and nozzle elements inside the injection nozzles 105.

[0017] In the following, further details of a fuel injection pump 110 are provided with reference to Fig. 2. Referring to Fig. 2, the pump may comprise a stepped pump barrel 10 which may be located within a housing 11. Formed in the barrel may be a bore in which is formed a reciprocal plunger 13. The plunger may extend from the end of the barrel 10 and may be provided with a pair of lateral pegs 14 which may be located in grooves 15 respectively formed in an extension of a control sleeve 16 which is mounted for angular movement about a cylindrical portion 17 of the barrel 10. The control sleeve 16 may be provided with teeth for engagement by a rack bar 18 in known manner. The plunger may have a foot 19 formed at its free end, the foot being engaged by a spring abutment 20 and this in turn is engaged by one end of a coiled compression spring 21 the opposite end of which may be in engagement with a flanged spring abutment 22 which may additionally serve to retain the sleeve 16 against axial movement.

[0018] The housing 11 may define a cylindrical guide surface 23 for a cup shaped tappet 24 which in use, may be driven inwardly by the action of an engine cam either directly or indirectly through a rocker mechanism. During inward movement of the tappet 24 the base wall thereof may engage with the foot 19 of the plunger 13 to impart inward movement of the plunger 13 against the action of the spring. The spring 21 may return the plunger 13 and also the tappet when so allowed by the cam.

[0019] In known manner there may be provided in the wall of the bore a pair of ports 26 which communicate with a fuel supply gallery 27 defined between the housing and the pump barrel 10. The ports 26 may be arranged to be covered by the plunger 13 after a predetermined inward movement and thereafter fuel will be expelled from the pumping chamber 28 defined in part by the end of the plunger and the wall of the bore to an associated engine. The plunger may also provided with a groove which is in communication with the pumping chamber 28, the groove having a helical control edge 29 which may uncover one of the ports 26 to the groove after a further inward movement of the plunger and when the port may be uncovered to the groove fuel may spill from the pumping chamber and may be returned to the supply gallery 27.The angular setting of the sleeve and plunger may determine the point during the inward movement of the plunger at which spill takes place and therefore the amount of fuel supplied to the associated engine.

[0020] Formed in the wall of the bore at a position intermediate the ports 26 and the end of the barrel 10 from which the plunger extends, may be a (second) circumferential groove 30. This groove 30 may communicate by way of a passage 31 in the barrel 10 with gallery 27. The groove 30 may be connected to the gallery 27 so that substantially all the fuel which may leak from the pumping chamber due to the high pressure therein in use of the pump 110, will be collected in the groove 30 and returned to the fuel supply gallery 27 via passage 31.

[0021] Dependent from the kind of fuel pumped within the fuel injection pump 110 deposits, e.g. in form of deposits or layers may develop at the outer surface of plunger 13 and/or the barrel inner wall 12, e.g. within the area between ports 26 and cylindrical portion 17.

[0022] Another (first) groove 38 may be formed in the wall of the bore at a position below second groove 30, in particular at a position which may be located more far way from edge 29 than mentioned second groove 30.

Groove 38 may be connected to an inlet 33 of purging system 125 via passages 32, 39.

[0023] One of the plurality of purging fluid supply lines 111 may be connected to passage 32. Accordingly, purging fluid reservoir 140 may be connected via supply line 145 and pump 135 to groove 38. Hence, groove 38 may be supplied with purging fluid so that purging fluid may be supplied continuously, frequently or on demand to groove 38. Consequently, the purging fluid may distribute from groove 38 into the minimum gap between the two contacting surfaces of plunger 13 and barrel bore, i.e. barrel inner wall 12, in direction to edge 29 and/or in direction to foot 19. The purging fluid may flush the Pyrolysis Fuel Oil out of the small clearance between plunger and barrel and prevent it from polymerization.

[0024] Referring to Fig. 3 a more schematic view of a similar piston 13 and barrel 10 as, e.g., to be used in a fuel injection pump 110 shown in Fig. 2, is shown.

[0025] In this exemplary embodiment of plunger 13 and pumping barrel 10 for a fuel injection pump 110 the area of barrel inner wall 12 between grooves 30, 38 and/or even a larger area between edge 29 and lower cylindrical portion of plunger 13 may come into contact with purging fluid supplied into groove 38. It may be effective to provide the possibility to supply groove 38 with a purging fluid, e.g. under pressure, for flush away any rests of Pyrolysis Fuel Oil out of the small clearance between plunger 13 and/or barrel inner wall 12.

[0026] Fig. 4 shows a schematic sectional view of a injection nozzle 105. The injection nozzle 105 may comprise an injection barrel 200 with an inner bore 202 formed with a constant diameter along almost its whole length. At its one end, the lower end in Fig. 4, the inner bore 202 is formed with a conical face 204, which forms a transition between the bore 202 and a sac chamber 206. The sac chamber 206 is connected to the outside by at least one nozzle orifice 208.

[0027] A valve needle 210 is accommodated within the bore 202 and is formed with a first section 211 having a diameter corresponding to the diameter of the bore 202, so that the first section 211 of the valve needle 210 is guided by a needle guiding section 212 formed by an upper section of an inner wall 213 of the injection barrel 200 with a guiding clearance between the valve needle 210 and the needle guiding section 212, which may have a width of e.g. 1/1000th of the diameter of the first section 211 of the valve needle 210.

[0028] A second section 214 of the valve needle 210 is formed with a smaller diameter so that an annular chamber 216 is formed between the second section 214 and the inner wall 213 of the injection barrel 200. A free end of the second section 214 may be formed with a conical or convex surface 218, which ends in a protrusion 220 protruding into the sac chamber 206.

[0029] The detailed shape of the lower end of valve needle 210 and the lower end of inner bore 202 may be of any design as known in the prior art as to form a valve.

[0030] An end of the injection barrel 200 opposite to sac chamber 206 is covered by a body member 222 so as to form a space 224, which accommodates a spring 226. The spring 226 urges valve needle 210 into a downward direction, so that convex surface 218 is pressed into sealing abutment against conical face 204. The diameter of space 224 may be smaller than the diameter of the first section 211 of valve needle 210 so that an end surface of body member 222 forms a stop for the opening movement of valve needle 210.

[0031] Annular chamber 216 is connected via a passage 230 to a high-pressure fuel line 115 connected to a corresponding fuel injection pump 110.

[0032] A barrel groove 232 is formed in the inner wall 212 of the injection barrel 200 in a region, which is always covered by the first section 212 of the injection barrel 200. Barrel groove 232 is connected to a purging fluid supply line 111 (Fig. 1) by a passage 234.

[0033] Space 224 may be connected to a fuel supply line 116 (Fig. 1) or the leakage tank 160 by a passage 236.

[0034] The function of the injection nozzle 105 is generally known. When fuel under high pressure is supplied from an injection pump 110 to the annular chamber 216, valve needle 210 is pressed upwardly by the fuel pressure against the force of spring 224. As soon as the upward force generated by the fuel pressure is bigger than the downward force generated by spring 226, valve needle 210 moves in an upward direction (Fig. 4) so that surface 218 moves away from conical face 204, and fuel under pressure flows into sac chamber 206 and is injected into a cylinder of the engine through nozzle orifice(s) 208. As soon as the fuel pressure in annular chamber 216 decreases, valve needle 210 moves back, so that surface 218 comes into sealing engagement with conical face 204.

Industrial Applicability

[0035] Referring to Figs. 1-4 the basic operation of a fuel injection pump shown and how the purging method may be conducted will be explained. During pumping fuel, e.g. Pyrolysis Fuel Oil, may leak in the gap between barrel inner wall 12 and the outer surface of plunger 13 and in the gap between inner wall 212 of injection barrel 200 and valve needle 210. During stand still of the engine due to e.g. an emergency stop the Pyrolysis Fuel Oil may result in formation of solid deposits on plunger 13 and/or barrel inner wall 12 as well as on valve needle 210 and inner wall 212. The reason is that Pyrolysis Fuel Oil may change from liquid to solid due to polymerization at temperatures over 80°C.

[0036] It may be possible to supply purging fluid by means of purging fluid pump 135 via lines 111 to the fuel injection pumps 110 and the injection nozzles 105. That is possible, if control unit 180 controls the one or more pumps 110. During operation of purging fluid pump 135 purging fluid sucked from purging fluid reservoir 140 may be supplied, e.g. at an appropriate, even high pressure,

into first groove 38 via inlet 33, passage 32 and passage 39 as well as into barrel groove 232 via passage 234 and lines 111. Supply of purging fluid, e.g. at high pressure (e.g. 10-70 bar, in particular 40-60 bar, more particularly 50 bar) into groove 38 may be conducted in a frequent manner, continuously, or on demand. As purging fluid, ethanol or other cleaning fluids with or without an appropriate additive, e.g. a cold cleaner, may be used.

[0037] It should be noted that the term "purging" as used herein may be replaced by the term "cleaning". Irrespective of whether term is used herein the present disclosure may serve to prevent Pyoil from polymerization within a pump at the plunger and/or the barrel inner wall, or within an injector at the needle and / or the nozzle body inner wall to reduce or eliminate deposits within the pump at the plunger and/or the barrel inner wall.

[0038] It is preferable that some purging fluid leaks at least from first groove 38 to second groove 30 and / or from barrel groove 232 to space 224 or to annular chamber 216 (when the engine has been stopped by an emergency alarm) so as to transport any rests of Pyoil out of the small guiding gap between plunger 13 and barrel inner wall 12 and / or valve needle 210 and barrel inner wall 212.

[0039] Although the preferred embodiments of this invention have been described herein, improvements and modifications may be incorporated without departing from the scope of the following claims. Examples of such modifications and improvements may be disclosed in the above description and/or in the attached claims.

Claims

1. An injection barrel (200) for guiding a valve needle (210) of an injection nozzle (105), the injection barrel (200) comprising:

   a barrel inner wall (213) extending along a longitudinal direction and having a needle guiding section (212);
   a barrel groove (232) formed in the needle guiding section of the barrel inner wall (213); and
   a purging fluid supply passage (234) passing through the injection barrel (200) for supplying a purging fluid to the barrel groove (232).

2. An injection nozzle (105) for a fuel injection system for injecting fuel, e.g. Pyrolysis Fuel Oil, into a cylinder of a large internal combustion engine, the injection nozzle (105) including:

   an injection barrel (200) of claim 1; and
   a valve needle (210) configured to reciprocate within the injection barrel (200) and having a first section (211) guided by the needle guiding section (212) of the barrel inner wall (213); wherein the barrel groove (232) is formed in the barrel inner wall (213) at a position with respect to the longitudinal direction that is always covered by the first section (211) of the valve needle (210).

3. A fuel injection system (100) configured to supply fuel, e.g. Pyrolysis Fuel Oil, to injection nozzles (105) of a large internal combustion engine (5), the fuel injection system (100) comprising:

   at least one injection nozzle (105) of claim 2; and
   a purging system (125) connectable to the purging fluid supply passage (234).

4. The fuel injection system of claim 3, further comprising:

   a fuel pump (110) configured for measuring fuel, e.g. Pyrolysis Fuel Oil, into correct amounts for injection, building up a high pressure, and delivering the pressurized fuel to at least one injection nozzle (105) at the proper time, wherein the fuel injection pump (110) includes a pump barrel (10) extending along a longitudinal direction and having a barrel inner wall (12), a plunger (13) configured to reciprocate within the pump barrel (10) and guided by the barrel inner wall (12), and a first groove (38) formed in the barrel inner wall (12) at a first position with respect to the longitudinal direction and always covered by the reciprocating plunger (13); and
   a purging system (125) being configured to supply the purging fluid to the first groove (38).

5. The fuel injection system of claim 4, further comprising a second groove (30) formed in the barrel inner wall (12) at a second position in respect to the longitudinal direction, the second position being different to the first position and being connected to a chamber (27) for draining or recirculation fluid.

6. The fuel injection system of claim 4 or 5, wherein the purging system (125) includes a purging fluid reservoir (140) configured to store the purging fluid e.g., ethanol or other cleaning fluids with or without an additive, and
   a purging fluid pump (135) connected to the purging fluid reservoir (140) and being configured to pump the purging fluid to the barrel groove (232) and/or the first groove (38).

7. The fuel injection system of claim 6, further comprising a plurality of injection nozzles (105) and/or a plurality of fuel injection pumps (110),
   wherein the purging system (125) is configured to supply the purging fluid to the barrel grooves (232) and/or the first groove (38).

8. A method for purging an injection nozzle (105) of

claim 2 of a fuel injection system, which injection nozzle (105) is configured to inject fuel, e.g. Pyrolysis Fuel Oil, into a cylinder of a large internal combustion engine (5) within, e.g., a ship or generator set, the method comprising:

supplying a purging fluid to the barrel groove (232) of the injection nozzle (105).

9. The method of claim 8, wherein the injection system further includes a fuel injection pump (110), which is configured to supply fuel, e.g., Pyrolysis Fuel Oil, to the injection nozzle (105) and includes a pump barrel (10), the pump barrel (10) extending along a longitudinal direction and having a barrel inner wall (12), a plunger (13) configured to reciprocate within the pump barrel (10) and guided by the barrel inner wall (12), and a first groove (38) formed in the barrel inner wall (12) at a first position with respect to the longitudinal direction that is always covered by the plunger (13), the method further comprising:

supplying a purging fluid to the first groove (38) of the injection pump (110).

10. The method of claim 8 or 9, wherein the step of supplying the purging fluid includes supplying the purging fluid under pressure; the pressure being in the range of 10 to 80 bar, in particular between 40-60 bar, more particular about 50 bar and/or supplying the purging fluid in a manner selected from the group consisting of continuously, on demand, and frequently.

11. Use of Pyrolysis Fuel Oil as a fuel for a fuel injection system of a large internal combustion engine, the fuel injection system comprising:

at least one injection nozzle (105) configured to receive the fuel under pressure and including an injection barrel (200), which extends along a longitudinal direction and has a barrel inner wall (213), and a valve needle (210) configured to reciprocate within the injection barrel (200) and having a first section (211) guided by the barrel inner wall (213), wherein a barrel groove (232) is formed in the barrel inner wall (212) at a position with respect to the longitudinal direction that is always covered by the first section of the valve needle (210); and
a purging system (215) being configured to supply a purging fluid to the barrel groove (232).

12. Use of Pyrolysis Fuel Oil of claim 11, the fuel injection system further comprising:

a fuel pump (110) configured to measure the fuel into correct amounts for injection, building up a high pressure, and delivering it to at least one injection nozzle (105) at the proper time, the fuel injection pump (110) includes a pump barrel (10) extending along a longitudinal direction and having a barrel inner wall (12), a plunger (13) configured to reciprocate within the pump barrel (10) and guided by the barrel inner wall (12), and a first groove (38) formed in the barrel inner wall (12) at a first position with respect to the longitudinal direction and always covered by the reciprocating plunger (13); and
a purging system (125) connectable to the first groove (38), the purging system (125) being configured to supply a purging fluid to the first groove (38).

FIG 1

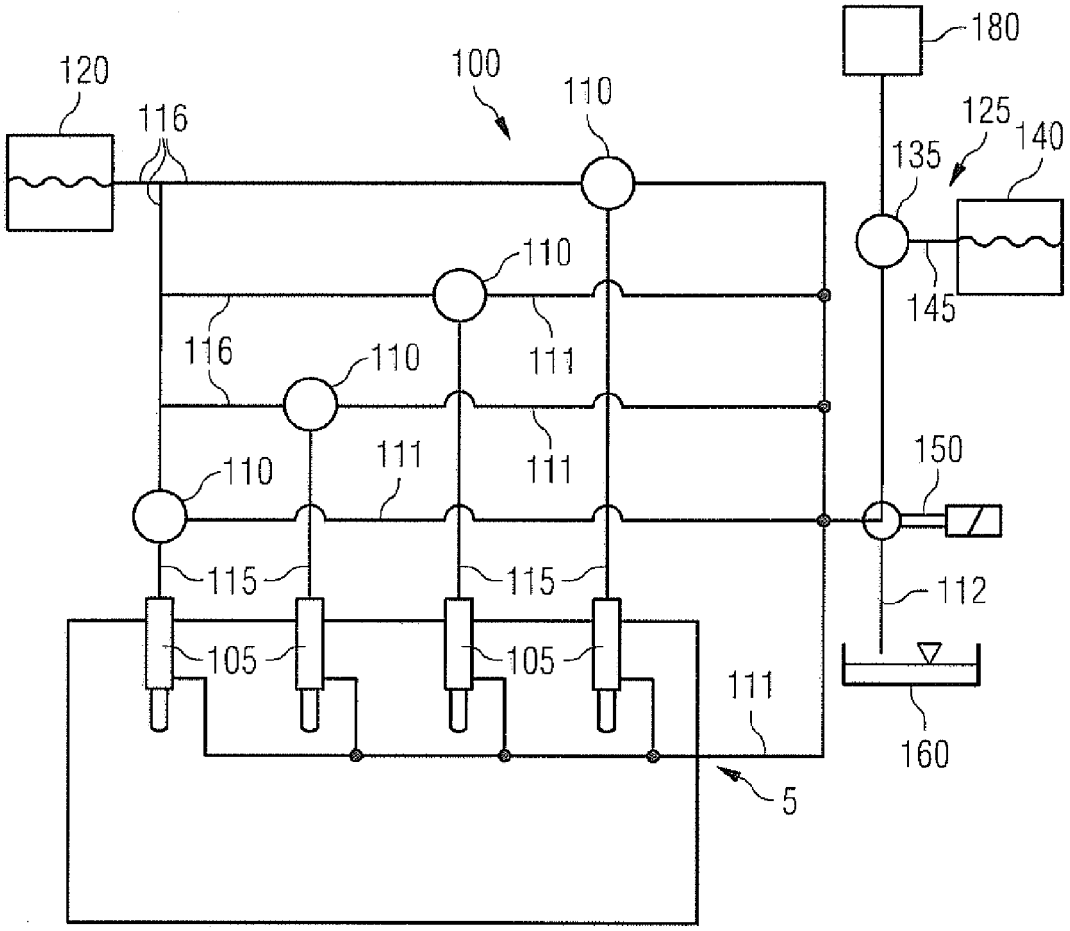
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FIG 2

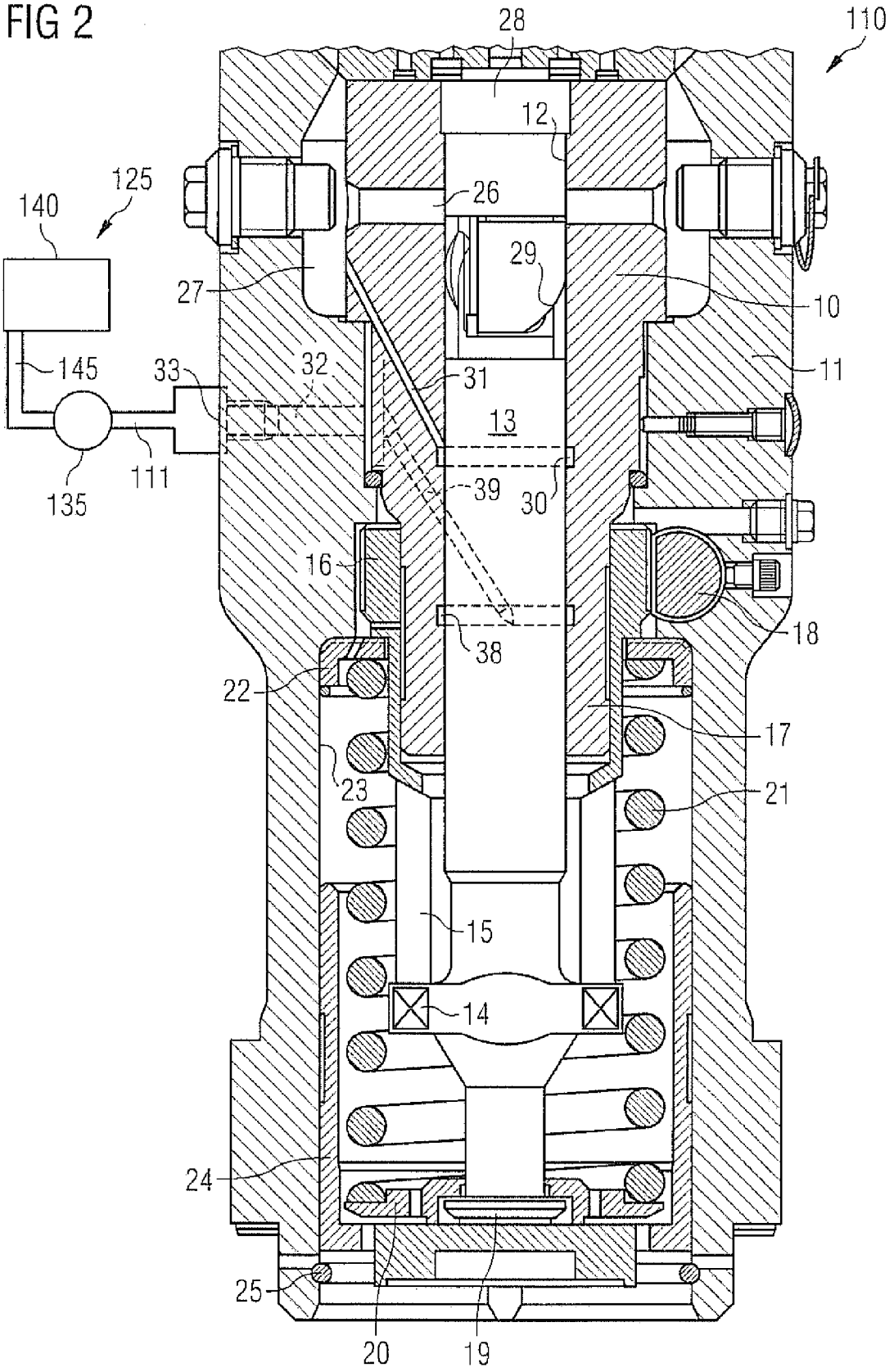
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FIG 3

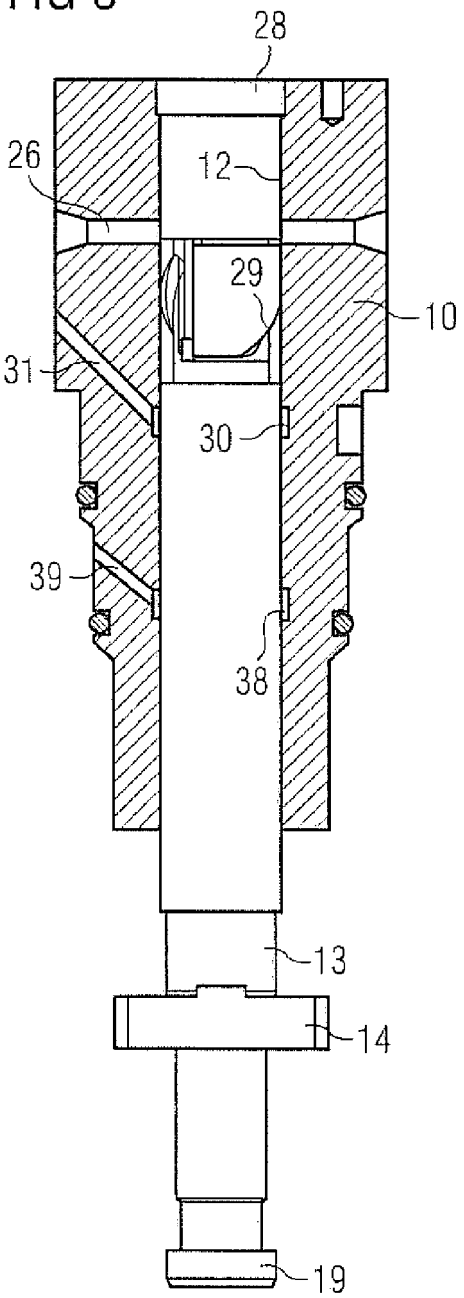
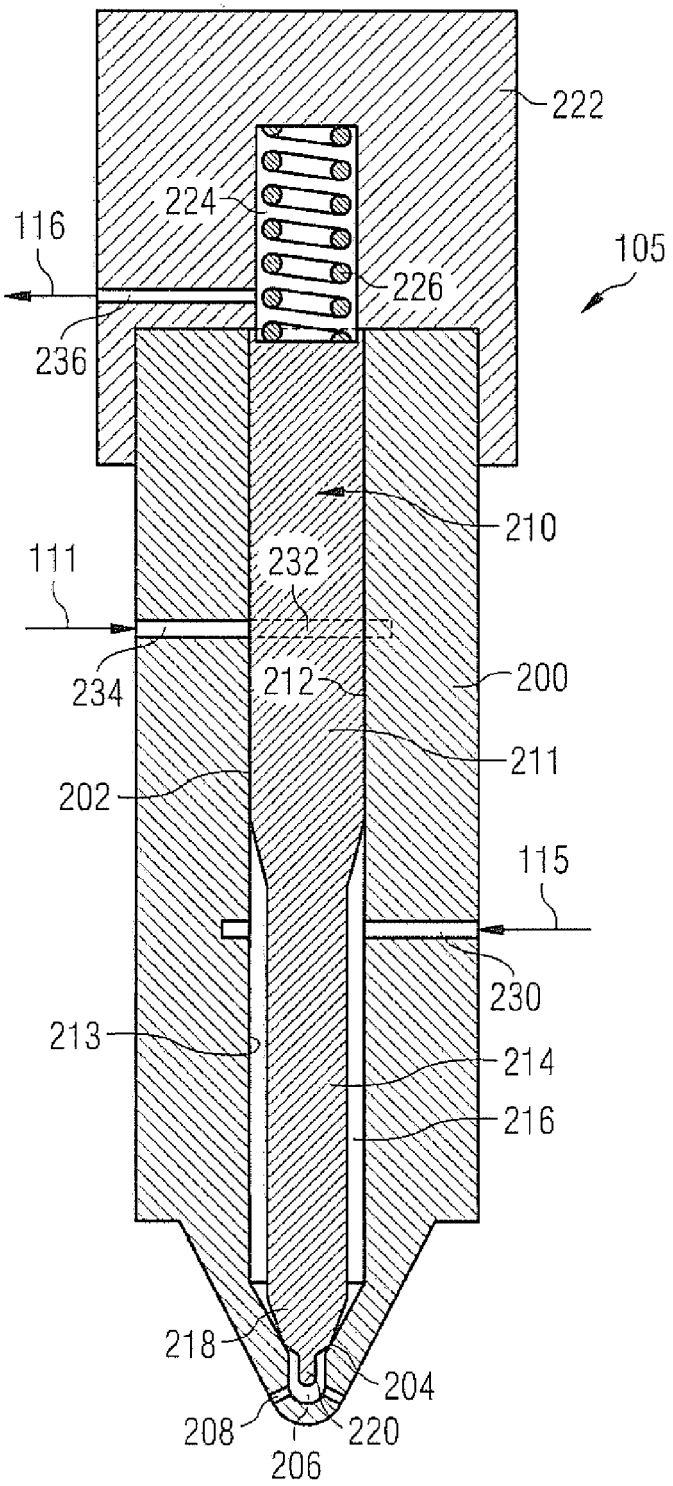


FIG 4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EUROPEAN SEARCH REPORT

Application Number
EP 11 16 1075

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	DE 720 659 C (FRIEDRICH WEINHARDT) 12 May 1942 (1942-05-12) * page 1, line 33 - page 2, line 27 *	1-3,8,10 4-7,9	INV. F02M63/00 F02M61/16
Y	GB 2 260 374 A (LUCAS IND PLC [GB]) 14 April 1993 (1993-04-14) * page 4, paragraph 2 - page 5, paragraph 2; figure 1 *	4-7,9	
X	FR 966 413 A (ERGAR BRANDT ETS; PREC MECANIQUE) 10 October 1950 (1950-10-10) * left hand column, last paragraph; page 2; figure 2 *	1-10	
X	US 4 714 198 A (SAVKAR SUDHIR D [US]) 22 December 1987 (1987-12-22) * column 3, lines 26-30; figure 1 *	1-10	

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	1 June 2011	Etschmann, Georg

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 16 1075

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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01-06-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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GB 2260374 A	14-04-1993	NONE	
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82