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(54) **FUEL INJECTION SYSTEM, FUEL PUMP AND PLUNGER**

(57) The present invention pertains to a fuel injection system (10) for use in an internal combustion engine comprising an injection nozzle (18) and a fuel pump (14) adapted for pressurizing fuel and for variably adjusting a feed rate of the pressurized fuel to be discharged to the injection nozzle (18) via a discharge valve of the fuel pump (14). The discharge valve is configured to open at a predetermined opening pressure so as to discharge the pressurized fuel from the fuel pump (14). In a non-injection mode of the fuel injection system (10), the fuel pump (14) is configured to pressurize fuel flowing through the fuel pump (14) to a pressure level higher than the opening pressure of the discharge valve.

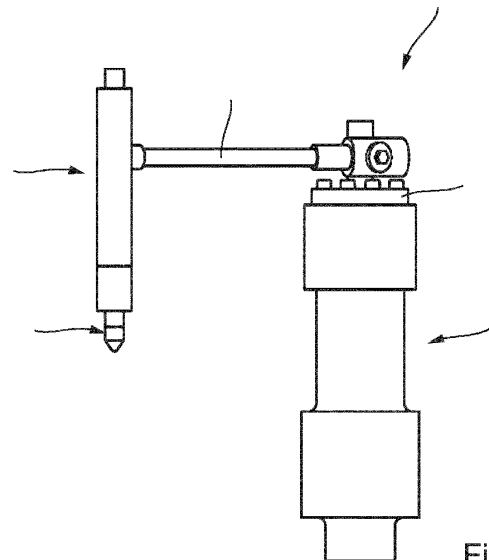


Fig. 1

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EUROPEAN SEARCH REPORT

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EP 19 17 7995

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	EP 2 669 504 A1 (CATERPILLAR MOTOREN GMBH & CO [DE]) 4 December 2013 (2013-12-04) * figures 1-7 *	6,7	
X	WO 2008/065248 A1 (WAERTSILAE FINLAND OY [FI]; KOIVUNEN MATTI [FI]; HAEGGLUND THOMAS [FI]) 5 June 2008 (2008-06-05) * page 5, line 15 - page 8, line 8; figures 1,2 *	8-14	
X	US 6 082 335 A (KAMPICHLER GUENTER [DE] ET AL) 4 July 2000 (2000-07-04) * column 1, line 5 - line 15; figures 1-5 *	1,4, 6-10,12	TECHNICAL FIELDS SEARCHED (IPC) F02M
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 21 January 2020	Examiner Morales Gonzalez, M
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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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-14

Fuel injection system and fuel pump adapted to pressurizing fuel and for variably adjusting feed rate of the pressurized fuel to be discharged.

2. claim: 15

A plunger, for variably adjusting a feed rate of the fuel pump having a feed rate control structure.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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5 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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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82