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(71) Applicant: **Magneti Marelli S.p.A.**
20011 Corbetta (MI) (IT)

(72) Inventors:
- **Mancini, Luca**
  40054, Budrio (IT)
- **De Vita, Daniele**
  40024, Castel San Pietro Terme (IT)
- **Mattioli, Massimo**
  40013, Castelmaggiore (IT)

(74) Representative: **Jorio, Paolo et al**
STUDIO TORTA
Via Viotti 9
10121 Torino (IT)

(54) **Direct-injection system fuel pump with an improved maximum-pressure valve**

(57) A direct-injection system fuel pump (4) having : at least one pumping chamber (14); a piston (15) mounted to slide inside the pumping chamber (14) to cyclically alter the volume of the pumping chamber (14); an intake channel (17) connected to the pumping chamber (14) and regulated by an intake valve (18); a delivery channel (22) connected to the pumping chamber (14) and regulated by a one-way delivery valve (23) that only permits fuel flow from the pumping chamber (14); and a drain channel (32) regulated by a one-way, maximum-pressure valve (33), which opens when the fuel pressure in the drain channel (32) exceeds a threshold value, and which has a shutter (34) movable along the drain channel (32), a valve seat (35) engaged in fluidtight manner by the shutter (34), and a spring (36) calibrated to push the shutter (34) into a position engaging the valve seat (35) in fluidtight manner.

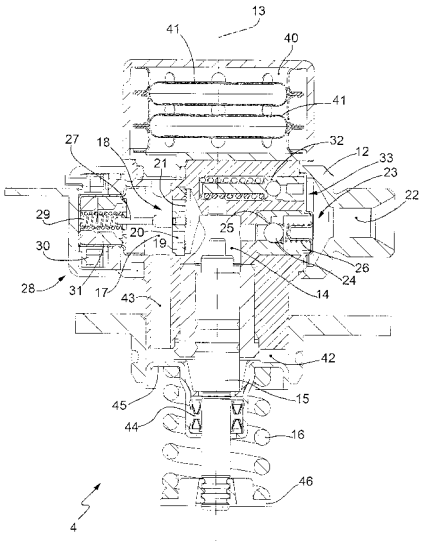


FIG.2

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EUROPEAN SEARCH REPORT

Application Number
EP 10 15 8190

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 10 2007 000293 A1 (DENSO CORP [JP]) 29 November 2007 (2007-11-29) * paragraph [0028] - paragraph [0044]; figure 2a *	1-7 8	INV. F02M59/46 F04B49/035 F04B49/24 F04B53/04
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A	EP 1 365 142 B1 (HITACHI LTD [JP]; HITACHI CAR ENG CO LTD [JP]) 18 July 2007 (2007-07-18) * the whole document *	1-8	
			TECHNICAL FIELDS SEARCHED (IPC) F02M F04B

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
The Hague	27 August 2010	Louchet, Nicolas

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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Application Number
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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:

1-8

☐ 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).

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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: 1-8

A fuel pump with a one-way maximum pressure valve comprises a calibrated plate sized to achieve an effect on the opening of the valve.

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2. claims: 9-11

A fuel pump with:
- a one-way maximum pressure valve comprises a calibrated plate sized to achieve an effect on the opening of the valve
- an inlet valve comprising a disc with a series of through holes and a deformable lamina.

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3. claims: 12-15

A fuel pump with:
- a one-way maximum pressure valve comprises a gauged cap
- a collecting chamber
- a connection duct

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 15 8190

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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27-08-2010

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