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(54) **Injection timing advance arrangement**

(57) An advance arrangement comprises an advance piston (12) which is slidable within a first bore (14), the advance piston (12) cooperating, in use, with a cam arrangement of a fuel pump to adjust the timing of fuel delivery by the pump. A servo-piston (24) is slidable within a further bore (22) provided in the advance piston (12), a light load piston (26) being moveable relative to the advance piston (12) against the action of a light load control spring (28). A servo-control spring (34) is engaged between the light load piston (26) and the servo-piston (24) and a seal arrangement (30, 32) comprising at least one separate seal member, is arranged to form a substantially fluid tight seal between the servo-piston (24) and the light load piston (26). The servo-piston (24) may include a removable region (40), whereby removal of the region (40) permits the advance characteristics of the advance arrangement for light load conditions to be varied.

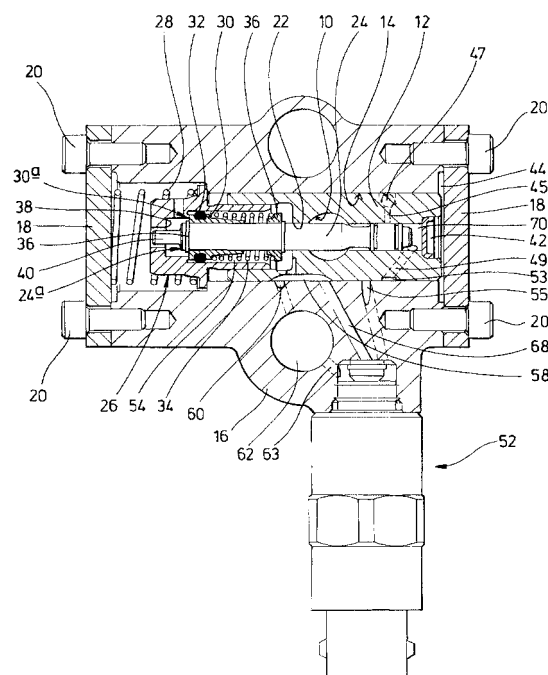


FIG 1



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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
D,A	EP 0 921 300 A (LUCAS IND PLC) 9 June 1999 (1999-06-09) * column 2, line 42 - line 54; figure 2 *	1-4,7	F02D1/18 F02M41/14
A	US 4 748 958 A (ASH EUGENE G ET AL) 7 June 1988 (1988-06-07) * column 4, line 13 - line 63; figures 2,3 *	1-5	
A	DE 27 52 086 A (STANADYNE INC) 23 May 1979 (1979-05-23) * page 9, paragraph 4 - paragraph 5; figure *	7-11	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F02M F02D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 April 2002	Examiner Schmitter, T
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 more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims 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 the first ten claims.

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:



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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: 1-6

Advance arrangement to adjust the timing of fuel delivery by a pump. The advance arrangement comprising an advance piston, a servo piston and a light load piston which are movable relative to each other against the force of biasing springs and depending on the fuel pressure in the control chambers.

A seal member is carried by the servo piston which is arranged to form a substantially fluid tight seal between the servo piston and the light load piston.

2. Claims: 7-11

Advance arrangement to adjust the timing of fuel delivery by a pump. The advance arrangement comprising an advance piston, a servo piston and a light load piston which are movable relative to each other against the force of biasing springs and depending on the fuel pressure in the control chambers.

A region of the servo piston can be removed that permits the length of the servo-piston to be altered and, hence, the maximum extent of movement of the servo-piston within the further bore can be altered.

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

EP 01 30 4818

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-04-2002

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