(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 184 568 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
12.06.2002 Bulletin 2002/24

(43) Date of publication A2:
06.03.2002 Bulletin 2002/10

(21) Application number: **01307398.6**

(22) Date of filing: **31.08.2001**

(51) Int Cl.[7]: **F04B 1/04**, F04B 23/06, F04B 5/00, F02M 63/02, F02M 39/00, F04B 1/053

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **31.08.2000 GB 0021295**

(71) Applicant: **Delphi Technologies, Inc.**
Troy, MI 48007 (US)

(72) Inventors:
- **Collingborn, Peter Alban George**
  Gillingham, Kent ME8 8RX (GB)
- **Thornthwaite, Ian Roy**
  Gillingham, Kent ME7 3PJ (GB)

(74) Representative: **Pople, Joanne Selina**
Marks & Clerk,
Alpha Tower,
Suffolk Street,
Queensway
Birmingham B1 1TT (GB)

(54) Fuel pump

(57) A fuel pump comprising a plurality of radially spaced pumping arrangements (10a, 10b, 10c), each of which includes a pumping plunger (20a, 20b, 20c) which is reciprocable within a plunger bore (19a, 19b, 19c) formed in a pump housing (18) under the influence of a respective driven tappet member (24a, 24b, 24c) which acts to transmit a force to the pumping plunger (20a, 20b, 20c) during a forward stroke thereof. The plunger bore (19a, 19b, 19c) defines a pumping chamber (22a, 22b, 22c) within which pressurisation of fuel to a relatively high level occurs upon reciprocal movement of the pumping plunger within the plunger bore. An end region of the tappet member (24a, 24b, 24c) is provided with a further bore (70a, 70b, 70c), a surface associated with the end region of the tappet member (24a, 24b, 24c) defining, in part, an annular auxiliary pumping chamber (40a, 40b, 40c) for fuel, the further bore (70a, 70b, 70c) defining a working chamber (51a, 51b, 51c) arranged to receive fuel to generate a force on the tappet member (24a, 24b, 24c) which acts in a return direction so as to increase the volume of the pumping chamber (22a, 22b, 22c) during a return stroke of the pumping plunger. The fuel pump further comprises a transfer pressure flow path (43) providing communication between the auxiliary pumping chamber (40a, 40b, 40c) of a first pumping arrangement (10a) and the pumping chamber (22b, 22c) of at least one of the other pumping arrangements (10a, 10b) such that fuel displaced from the auxiliary pumping chamber (40a, 40b, 40c), in use, can be supplied through the transfer pressure flow path (43) to said at least one of the other pumping chambers (22b, 22c). The auxiliary pumping chambers (40a, 40b, 40c) and the transfer pressure flow path (43) are constructed and adapted to ensure fuel flows through the transfer pressure flow path (43) at a substantially constant flow rate for a given speed of rotation of the pump.

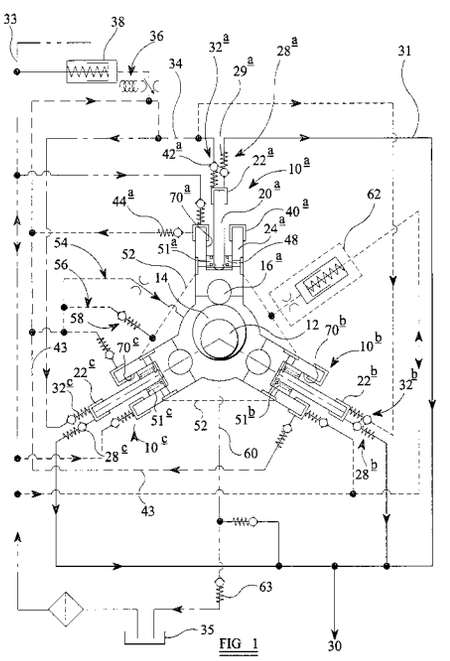

FIG 1

EP 1 184 568 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 30 7398

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 0 972 936 A (LUCAS IND PLC) 19 January 2000 (2000-01-19) * abstract * * column 3, line 24 - column 6, line 54 * * figures 1-3 *	1,4,5, 10,13	F04B1/04 F04B23/06 F04B5/00 F02M63/02 F02M39/00 F04B1/053
A	US 2 702 008 A (STOCKARD JOHN M) 15 February 1955 (1955-02-15) * column 1, line 39 - column 3, line 25 * * figures *	1,2,7-10	
A	GB 837 087 A (PIERRE ETIENNE BESSIERE) 9 June 1960 (1960-06-09) * page 1, line 56 - page 2, line 90 * * figures *	1-3,6-10	
A	GB 1 062 575 A (CAV LTD) 22 March 1967 (1967-03-22) * page 1, line 71 - page 2, line 84 * * figure 1 *	1-3,6-10	
A	GB 533 961 A (ARTHUR JOHN ROWLEDGE) 25 February 1941 (1941-02-25) * page 2, line 29 - page 3, line 43 * * figure 1 *	1,3-5,10	TECHNICAL FIELDS SEARCHED (Int.Cl.7) F04B F02M
A	DE 196 12 413 A (REXROTH MANNESMANN GMBH) 2 October 1997 (1997-10-02) * column 4, line 17 - line 63 * * figure 1 *	1,6	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23 April 2002	Kolby, L

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 01 30 7398

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.

23-04-2002

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0972936 A	19-01-2000	EP 0972936 A2	19-01-2000
		JP 2000038971 A	08-02-2000
US 2702008 A	15-02-1955	NONE	
GB 837087 A	09-06-1960	NONE	
GB 1062575 A	22-03-1967	DE 1278791 B	26-09-1968
		FR 1424893 A	14-01-1966
		US 3309996 A	21-03-1967
GB 533961 A	25-02-1941	NONE	
DE 19612413 A	02-10-1997	DE 19612413 A1	02-10-1997

EPO FORM P0459

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