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

(11) Publication number: **0 304 741 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **88113139.5**

(22) Date of filing: **12.08.88**

(51) Int. Cl.4: **F02M 59/08 , F02M 59/10 , F02M 59/38**

(30) Priority: **25.08.87 IT 6773287**

(43) Date of publication of application:
01.03.89 Bulletin 89/09

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

(71) Applicant: **WEBER S.r.l.**
Corso Marconi, 20
I-10125 Torino(IT)

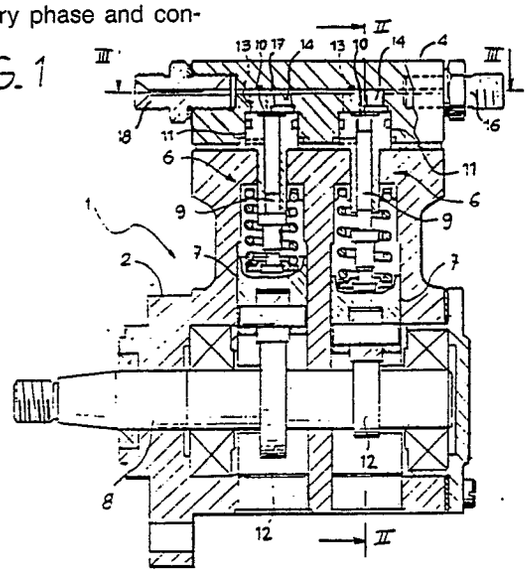
(72) Inventor: **Filippi, Renato**
Via Parisetto, 31
I-10048 Vinovo Torino(IT)
Inventor: **Turchi, Sergio**
Via Bussoleno, 16
I-10040 Rivalta Torino(IT)
Inventor: **Sfarzetta, Mario**
Traversa Madonna delle grazie, 13
I-70027 Palo del Colle Bari(IT)

(74) Representative: **Buzzi, Franco et al**
c/o Jacobacci-Casetta & Perani S.p.A. Via Alfieri, 17
I-10121 Torino(IT)

(54) In-line pump for fuel injection systems with controlled injectors for i.c. engines.

(57) An in-line pump for fuel injection systems with controlled injectors for i.c. engines includes two piston-and-cylinder pumping units (9, 10) driven by a shaft with eccentrics (12) having double-lobed profile with null acceleration in the delivery phase and constant speed.

FIG. 1



EP 0 304 741 A1

In-line pump for fuel injection systems with controlled injectors for i.c. engines

The present invention relates in general to injection pumps for fuel injection systems for i.c. engines for motor vehicles, particularly diesel engines.

More particularly, the invention relates to an in-line injection pump for injection systems with controlled injectors, of the type comprising a body containing one or more in-line cylinder-and-piston pumping units driven by a shaft with eccentrics connected through respective intake and delivery valves to inlet and outlet means for the fuel.

The object of the present invention is to provide a pump of the type specified above, having a simpler and cheaper construction than conventional pumps of this type, with a modular structure adapted to pump high-pressure fuel at a constant rate of flow without the need of an external accumulator.

According to the invention this object is achieved by virtue of the fact that the pump includes two pumping units and the cams of the drive shaft have a double-lobed profile with constant accelerations, and in particular null in the delivery phase.

The invention will now be described in detail with reference to the appended drawings, provided purely by way of non-limiting example, in which:

Figure 1 is a schematic longitudinal sectional view of an in-line injection pump according to the invention,

Figure 2 is a cross-section taken on the line II- II of Figure 1,

Figure 3 is a horizontal section taken on the line III-III of Figure 1, and

Figure 4 shows several functional graphs of the pump according to the invention.

With reference to Figures 1 to 3, an in-line injection pump for fuel injection systems for diesel engines with electrically controlled injectors (not illustrated) is generally indicated 1.

The pump 1 comprises essentially a base 2 which is normally of aluminium and is provided at one end with a substantially triangular attachment flange 3, and a head 4, normally of steel, which is separate from the base 2 and is fixed to its top by means of screws 5.

Within the base 2 are two in-line pumping units 6, each of which includes, in generally known manner, a tappet 7 driven by a cam-shaft 8 for driving a piston 9. Each piston 9 is reciprocable within a respective cylinder 10 formed in an insert 11 carried by the head 4 and extending into an upper zone of the base 2. Each tappet 7 cooperates operatively with a respective cam 12 of the shaft 8 which, as illustrated in greater detail in Figure 2, has a double-lobed profile.

Each cylinder 10 is associated with an intake valve 13 and a delivery valve 14 of generally known type. The two intake valves 13 are connected to a common passage 15 formed in the head 4 and communicating with an inlet connector 16 fitted to one side thereof, whilst the two delivery valves 14 are connected to a common passage 17 parallel to the passage 15 and com municating with a delivery connector 18 carried by the opposite side of the head 4. Thus, in practice, the high-pressure side of the pump is located entirely within the head 4, with an obvious rationalisation and simplification of the construction of the pump.

Figure 4 illustrates several functional graphs of the pump according to the invention, resulting from the particular profile of the cams 12 which are designed so as to achieve constant accelerations with trapezoidal-asymmetric-type changes in the velocity of the pistons 9. Suitable staggering of the cams 12 gives a low-pressure ripple at the outlet, with minimised dead volumes, since the overlapping of delivery of the pumping units allows accomplishment of constant flow rate over the 360° of rotation of the pump.

The graphs of Figure 4 relate in particular to the pump according to the invention, which is dimensioned as follows:

- total swept volume: 0.4 - 0.6 cm^3 /revolution
- maximum velocity: 2800 revolutions per minute
- base radius of the cams 12: 14.5mm
- roll radius of the tappet 7: 8.5mm
- maximum rise: 6 mm.

The three graphs of Figure 4 show, in dependence on the angular position of the cams 12, the rise, the velocity and the acceleration of the pistons 9, respectively.

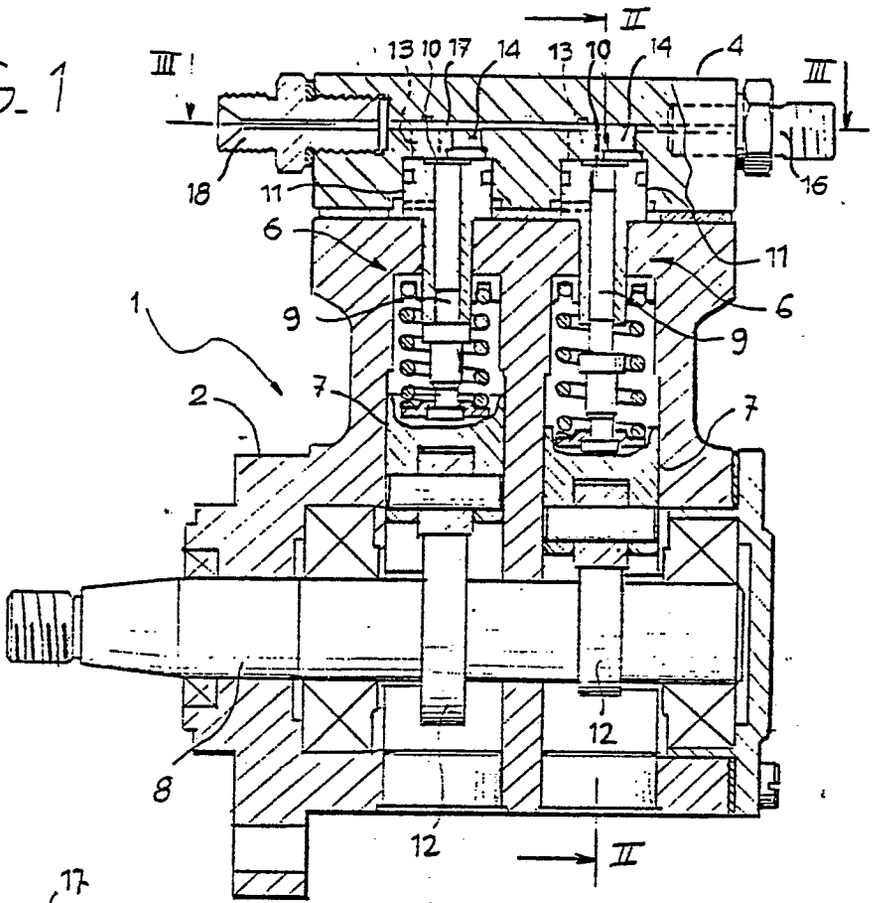
Although the invention has been described with reference to a two-cylinder in-line pump, it is clear that it could also be applied with equal advantage to multi-cylinder pumps.

Claims

An in-line injection pump for fuel injection systems with controlled injectors for i.c. engines, including a body containing one or more in-line cylinder-and-piston pumping units driven by a shaft with eccentrics and connected through respective intake and delivery valves to inlet and outlet means for the fuel, characterised in that it includes two pumping units (9, 10) and in that the cams (12) of the drive shaft (8) have a double-lobed profile with

null accelerations in the delivery phase and constant speed, so as to ensure constant fuel flow rate along the 360° of rotation of the pump.

FIG_1


II
III
13 10 17 14 13 10 14
4
III
18
11
16
6
11
1
9
6
9
2
7
7
8
12
12
II

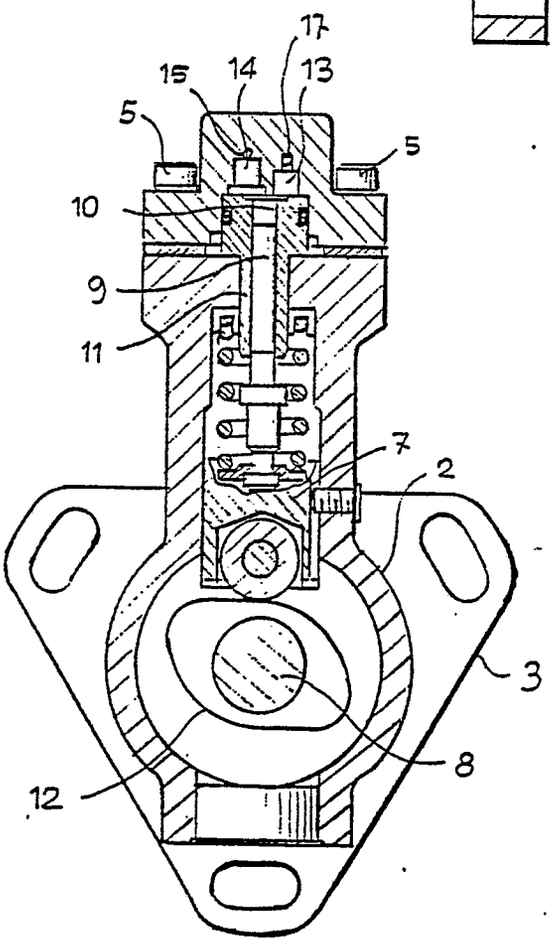

17
15
14
13
5
5
10
9
11
7
2
3
8
12

FIG_2

FIG. 3

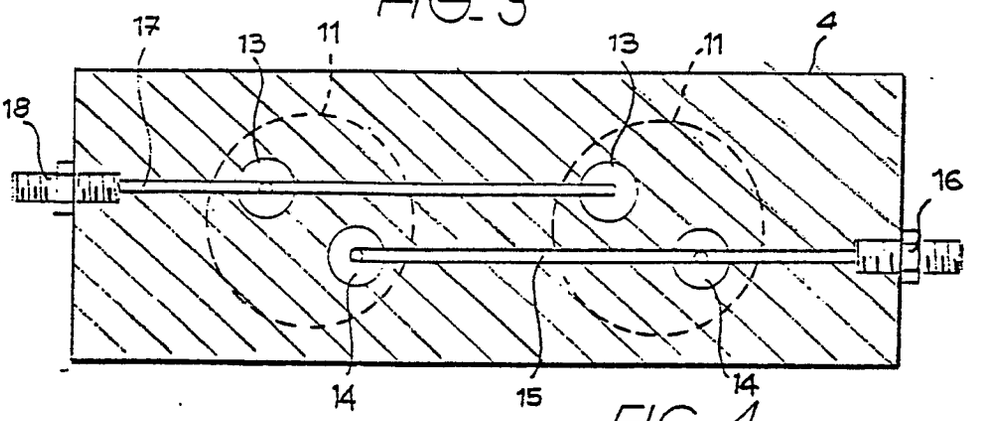
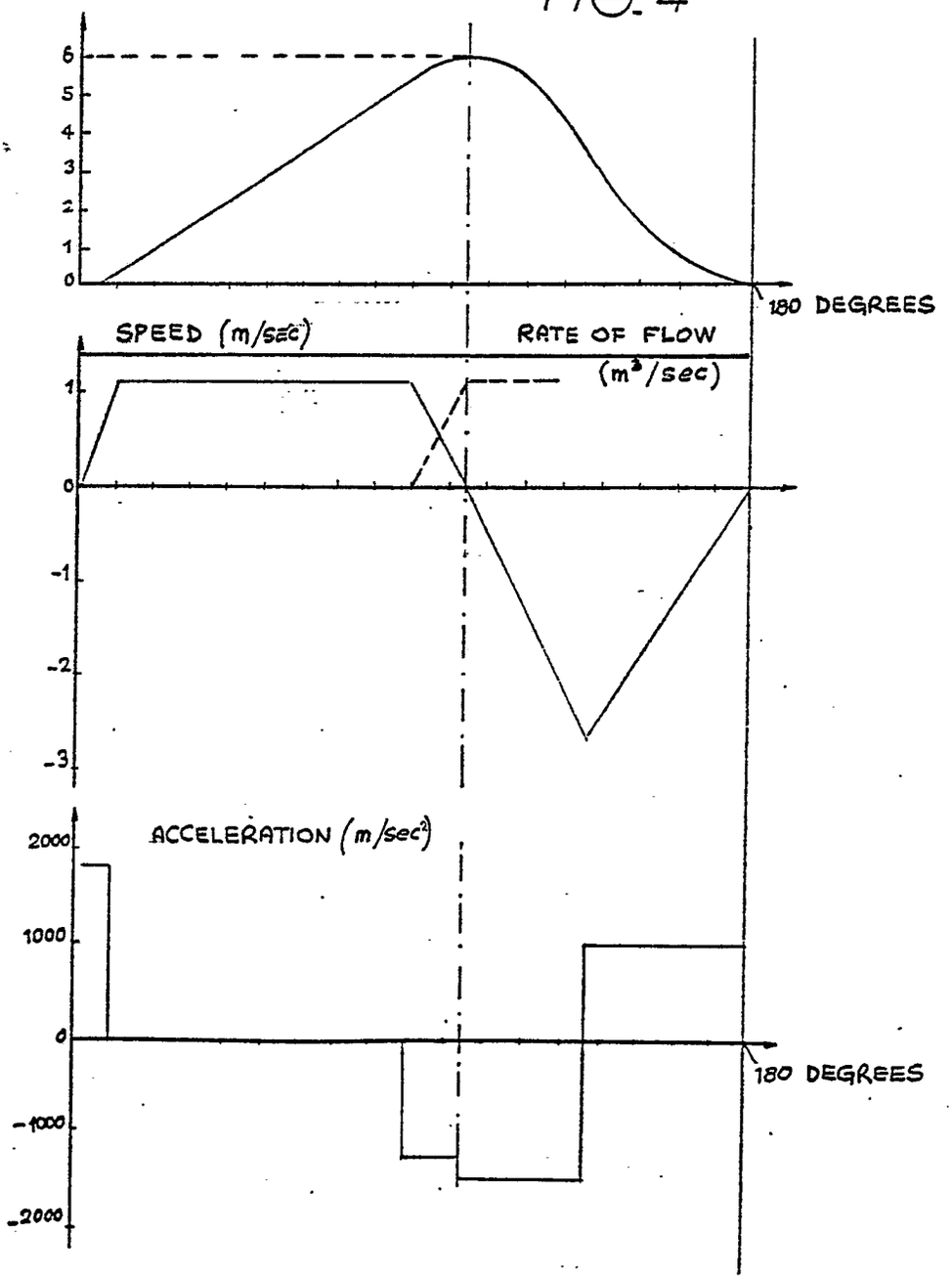

17
13
11
13
11
4
18
16
14
15
14

FIG. 4


6
5
4
3
2
1
0
180 DEGREES
SPEED (m/sec)
RATE OF FLOW
(m³/sec)
1
0
-1
-2
-3
ACCELERATION (m/sec²)
2000
1000
0
-1000
-2000
180 DEGREES

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 11 3139

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.4)
Y	US-A-2 440 194 (JUHASZ) * Column 2, lines 37-48; column 4, lines 14-23; figures 1-4 *	1	F 02 M 59/08 F 02 M 59/10 F 02 M 59/38
Y	V.A. VANSCHEIDT: "Design and strength calculations of marine diesel engines", 1969, pages 365-370, Soudostroenie, Leningrad, SU * Page 368, figure 31a; page 369, lines 9-26 *	1	
A	GB-A- 365 061 (SUPERIOR ENGINE) * Page 1, line 90 - page 3, line 4; figures 1-7 *	1	
A	DE-B-1 297 479 (BRÜCKNER) * Column 2, lines 16-53; figures 1,2 *	1	
A	US-A-2 845 875 (CORBETT)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

F 02 M
F 04 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14-10-1988	HAKHVERDI 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

EPO FORM 1503 03.82 (P0401)