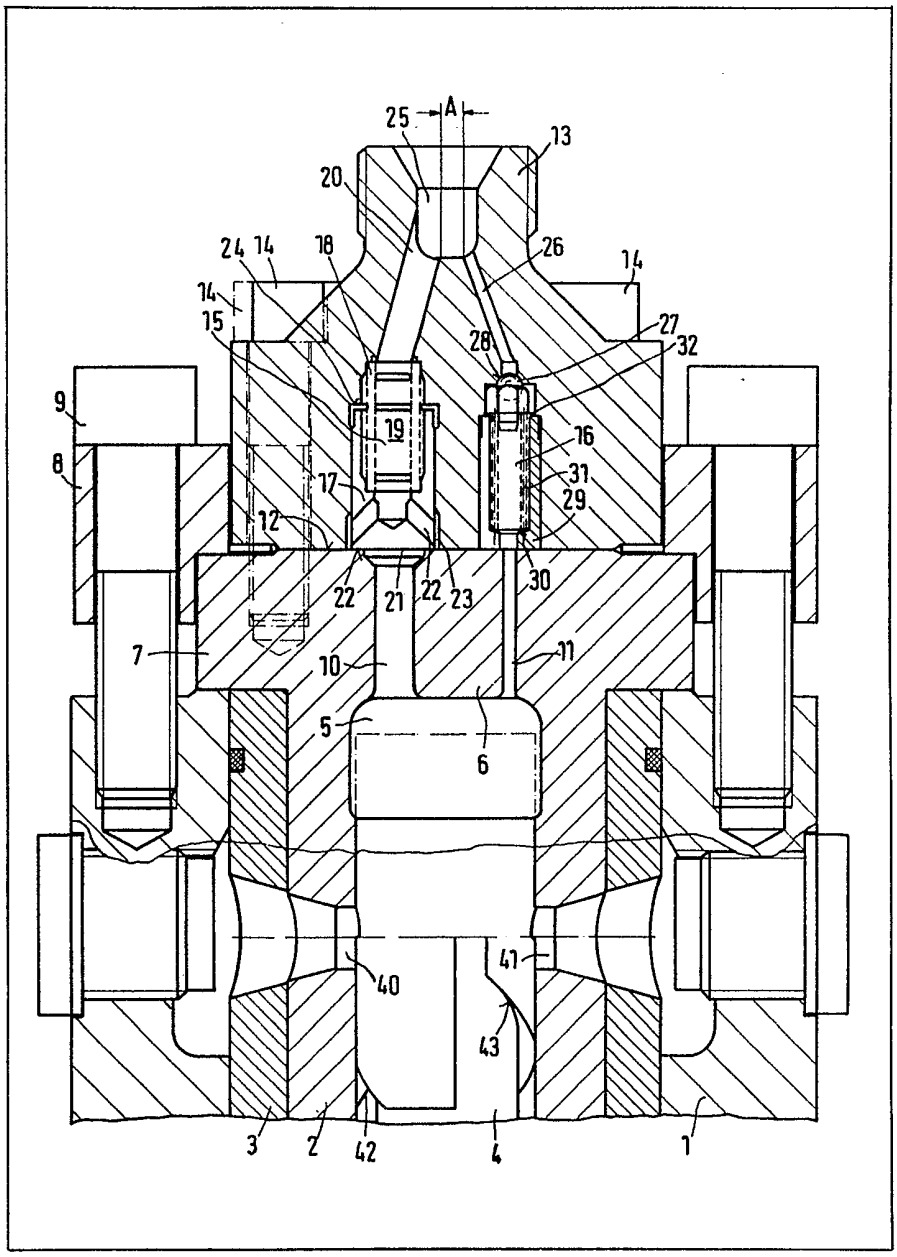
(12) UK Patent Application (19) GB (11) 2 107 801 A

(21) Application No **8230199**
(22) Date of filing **21 Oct 1982**
(30) Priority data
(31) **3141654**
(32) **21 Oct 1981**
(33) **Fed. Rep. of Germany (DE)**
(43) Application published
5 May 1983
(51) **INT CL³**
F02M 59/46
(52) Domestic classification
F1W 100 203 300 EEC
U1S 1883 1992 F1W
(56) Documents cited
GB 1539911
GB 1474216
GB 1297033
GB 0779137
GB 0660562
GB 0587904
(58) Field of search
F1W
(71) Applicants
L'Orange GmbH
(FR Germany),
Porschestrasse 30,
D—7000 Stuttgart 40,
Federal Republic of
Germany
(72) Inventor
Wilfried Hofken
(74) Agent
M. C. Dennis,
ITT UK Patent
Department, Maidstone
Road, Foots Cray, Sidcup
DA14 5HT

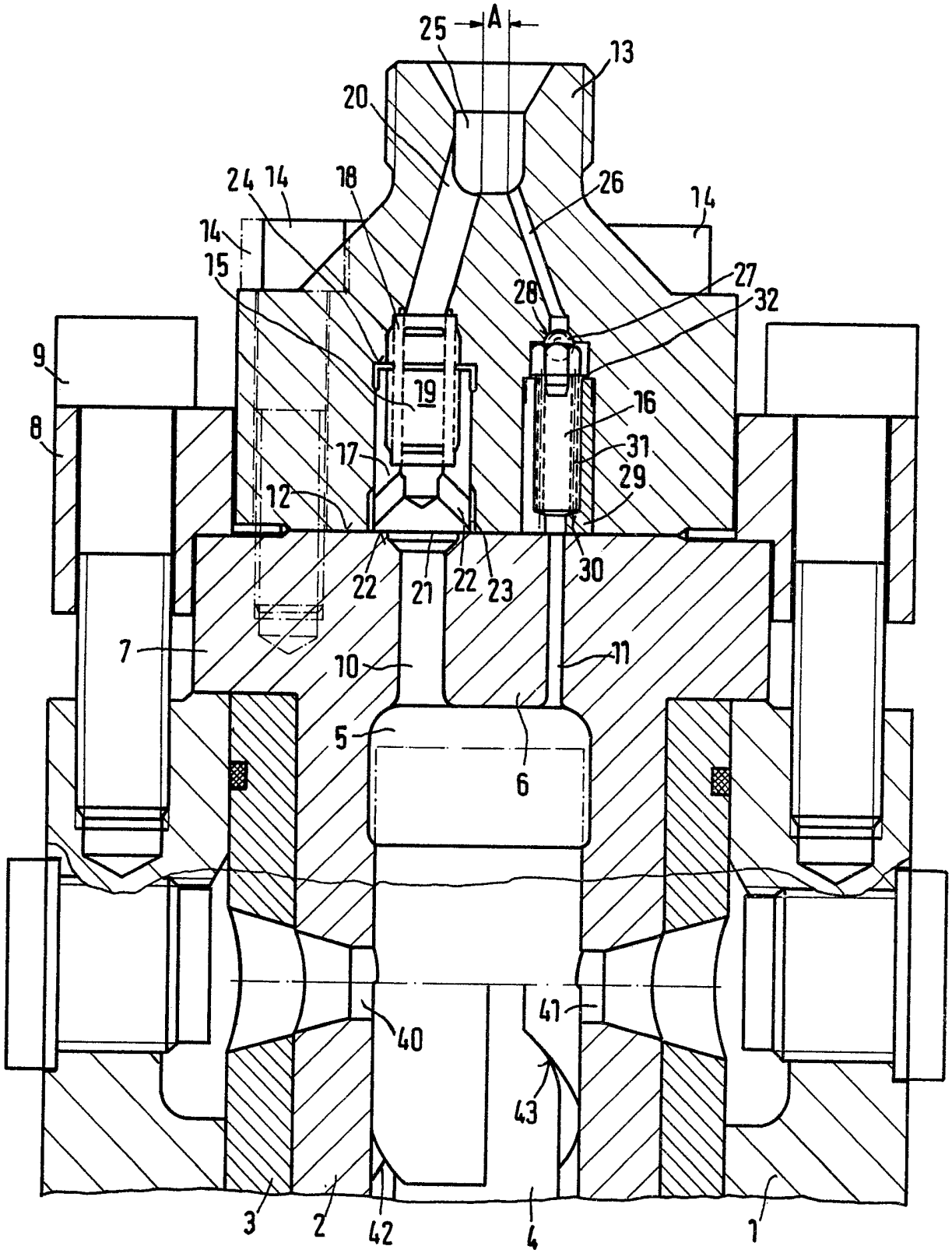
(54) **Fuel injection pump, especially for a diesel-powered internal-combustion engine**

(57) In a fuel injection pump a thrust-carrying piece 13 is directly braced against a planar and microfinished front face 12 of a piston guiding body 2, whereby a valve closing body guided in the thrust-carrying piece 13 with its planar sealing surface 21 in the rest position is directly seated on the front face of the piston guiding body 2.

In case of repairs thus the high-pressure sealing surfaces between the thrust-carrying piece 13 and the piston guiding body 2 and the valve face can time-savingly be re-worked in a single working step.



GB 2 107 801 A


A
25
13
20
24
14
18
26
14
14
15
27
28
32
9
19
16
8
17
31
29
12
22
21
22
23
30
7
10
11
5
6
41
40
43
3
2
42
4
1

SPECIFICATION

Fuel injection pump, especially for a diesel-powered internal-combustion engine

This invention relates to a fuel injection pump, especially to a diesel-powered internal combustion engine.

Recently considerable efforts have been made to reduce the consumption of diesel fuel becoming more and more expensive; this applies particularly to diesel engines with a high output. One possibility for arriving at this end is to intensify the inner mixture formation by an improved atomisation of fuel. For this purpose the pressures in the fuel injection systems have to be increased considerably. Consequently the parts acted upon by the high pressure and subject to compressive stress have to be designed so as to endure the continuously pulsing pressures and deformations and not to admit the smallest leakages. One therefore endeavours to reduce to a minimum the number of critical high-pressure sealing surfaces in a fuel injection system. The conditions on the fuel injection pump are in this respect a particular problem, because one or two delivery valves are necessary between pump chamber and inlet duct, in order to achieve an accurate injection.

From the German petty patent 1,892,860 a fuel injection pump has become known in which the piston guiding body has a partition limiting the pump chamber in the direction of delivery. To this partition follows a projecting collar having an external thread. Partition and collar are penetrated by a bore leading to the free front face. The front face of the collar is planar and machined by grinding, preferably by lapping. A thrust-carrying piece is directly seated on this planar and microfinished front face of the piston guiding body and screwed with the latter. Thus the front face of the piston guiding body serves directly as a sealing face between the piston guiding body and the thrust-carrying piece without additional sealing rings being necessary.

In this known version a valve piston of a valve closing body is guided in the bore leading from the pump chamber to the thrust-carrying piece. The diameter of this bore is therefore relatively large and corresponds to almost the inside diameter of the piston guiding body and, respectively, to the diameter of the pump piston guided in the piston guiding body. Thereby the stability of the wall portion limiting the pump chamber is affected. In addition in this known version the closing body is developed as a valve cone and the bore in the piston guiding body has a correspondingly formed valve face. The production of such a conic valve face which has to be matching to the shape of the valve cone is however relatively expensive. Moreover it is disadvantageous that, when repairs have to be made, in addition to the free front face of the piston guiding body serving as a sealing face the valve face has also to be reworked, which makes the repair more expensive.

This invention is therefore based on the problem of improving a fuel injection pump of the kind mentioned initially so as to be able to apply pressures of more than 2000 bar during continuous operation with little engineering efforts without having to fear leakages.

This problem is solved by the characterising features of claim 1.

The invention is thereby based on the consideration that the stability of the partition limiting the pump chamber in the direction of delivery can be improved considerably, when the valve closing body is guided in the thrust-carrying piece. In that case the diameter of the bore in the piston guiding body can namely be reduced considerably. Moreover the design is substantially simplified in that the planar and microfinished front face of the piston guiding body is directly used as a valve face for the valve closing body, which has a planar sealing face. This embodiment has the advantage that in the case of overhauling the pump guiding body by a mere working of the front face also the valve face is worked.

In such an embodiment the considerably elastic deformations of the piston guiding body at high pressures are endured without danger, because the lateral portions limiting the pump chamber are stably interconnected by the front-sided wall. For a further improvement of the stability according to an advantageous development of the invention a bush can be shrunk onto the piston guiding body, whereby the dimensions of this bush are computed so as to compensate or counterbalance the stresses produced by the high inside pressure in the pump chamber by means of the stresses it creates in the radial direction.

The sealing face between the front face of the piston guiding body and in comparison with the known version, the thrust-carrying piece is improved in that it is directly screwed onto the piston guiding body via several threaded screws. By this measure a higher surface pressure is achieved than in the known version.

The invention and further advantageous embodiments are described below by way of an embodiment shown in the accompanying drawing. The drawing shows a partial section through a fuel injection pump true to scale in essential parts.

In a pump housing 1 a piston guiding body 2 is seated on which a bush 3 is shrunk in order to increase the stability. A piston 4 is displaceably mounted inside the piston guiding body. In the delivery direction the pump chamber 5 is separated by a partition 6 which turns into a flange 7 on which rests a tension ring 8. The piston guiding body 2 and the bush 3 are braced onto the housing 1 via this tension ring 8 and screws 9.

The partition 6 limiting the pump chamber in the delivery direction is penetrated by two bores 10 and 11 which open into the free front face 12. The bore 10 serves to conduct the fuel supplied by the lift of the piston 4, whereas the bore 11 serves as a fuel return bore. The two bores 10 and 11 are eccentrically arranged to the piston guiding axis and both have a diameter which is much smaller than the inside diameter of the piston guiding

body 2. Thus the pump chamber 5 is stably closed also at pressures higher than 2000 bar.

The front face 12 of the partition 6 and, respectively, of the piston guiding body 2, which front face is opposite the pump chamber, is formed as a planar, microfinished sealing surface. A thrust-carrying piece 13 is directly seated on this front face 12 and braced with the piston guiding body by means of several threaded screws. Thus a sufficient sealing is ensured between the piston guiding body and the thrust-carrying piece.

There are two valves 15 and 16 in the thrust-carrying piece 13. The closing body 17 of the valve 15 is substantially formed as a cylinder with a pocket hole 19 receiving a pressure spring 18 and is guided in a portion of the outlet duct 20 having an increased diameter. The front face 21 of this cylindric closing body 17 is formed as a planar sealing surface, which in the rest position is seated directly on the planar front face 12 of the piston guiding body 2. Thus in the area 22 this front face 12 serves as a flat seat sealing surface. When this front face 12 is worked thus the valve sealing surface is also worked.

Via a slanting inlet duct 22 opening into the jacket surface the pocket hole bore 19 in the closing body 17 is connected with an annular duct 23 encircling the closing body 17, through which annular duct the fuel streams into the outlet duct 20, when the valve is open. When the valve 15 is opened the closing body 17 moves in the same direction as the delivering piston, whereby the valve lift is limited when the closing body 17 hits an edge 24 of the thrust-carrying piece. The fuel delivered is pressed into a bore 25 of the thrust-carrying piece and further into an injection pipe not shown in detail.

From the thrust piece bore 25 an inlet duct 26 leads to the valve 16. This inlet duct 26 in the thrust-carrying piece 13 joins to the bore 11 in the wall 6 of the piston guiding body 2. This second valve 16 opens into the opposite direction to the direction of fuel supply and thus enables a backflow of the fuel into the pump chamber. The valve 16 has a ball 27 or a cone as sealing means, which co-operates with an appropriately shaped valve face 28. From the side of the piston guiding body a stop bush 29 is inserted in the inlet duct 26 on the pierced bottom 30 of which a valve pressure spring 31 is supported. The stop bush 29 is pressed by this valve pressure spring 31 on the front face 12 of the piston guiding body 2. The opposite free rim 32 limits the lift of the valve closing body.

As is shown clearly in the drawing the inlet duct 26 and the outlet duct 20 open into the thrust piece bore 25 at a spacing A. The thickness A of the wall portion between the two ducts 20 and 26 may not be substantially smaller, because otherwise inadmissible peak stresses would be created in the material. Thus this advantageous development has also the purpose of creating a fuel injection pump which endures high and changing pressures without any danger also in continuous operation.

Only on grounds of completeness it is to be mentioned that the piston guiding body 2 has two control bores 40 and 41 through which the fuel can flow into the pump chamber 5. The piston 4 has two opposite control edges 42 and 43, which co-operate with these control bores 40 and 41.

By the present invention a fuel injection pump has been developed which has only one high-pressure sealing face at the front face of the piston guiding body 2 and thus endures high stresses.

The design is simplified in comparison with known versions in that this high-pressure sealing face simultaneously serves as a valve face. This enables a time-saving re-working on occasion of the necessary inspections of the fuel injection pump.

CLAIMS

1. A fuel injection pump for a diesel-powered internal-combustion engine, comprising a piston guiding body seated in a pump housing, which piston guiding body has a partition separating the pump chamber in the direction of delivery, which partition is penetrated by at least one bore leading to the free front face, and comprising a thrust-carrying piece which is directly put on the planar, microfinished front face of the piston guiding body and screwed with the latter and which thrust-carrying piece has an outlet duct following the bore, and comprising a delivery valve having a closing body, which in the rest position seals the bore in the piston guiding body, wherein the closing body is guided in the thrust-carrying piece and has a planar sealing surface which in the rest position is directly seated on the planar front face of the piston guiding body.

2. A fuel injection pump according to claim 1, wherein a bush is shrunk onto the piston guiding body, the dimensions of which bush are computed so as to compensate or counterbalance the stresses produced by the high inside pressure in the pump chamber by means of the stresses it creates in the radial direction.

3. A fuel injection pump according to claim 1, wherein the thrust-carrying piece is directly braced with the piston guiding body by means of several threaded screws.

4. A fuel injection pump according to claim 1, wherein the closing body of the valve is substantially formed as a cylinder provided with a pocket-hole bore receiving a pressure spring and is guided in an outlet duct portion having an enlarged diameter and wherein, via an inlet bore opening into the jacket surface in a slanting direction the pocket-hole bore is connected with an annular duct encircling the closing body.

5. A fuel injection pump according to any one of the preceding claims, wherein the partition of the piston guiding body is penetrated by a second bore to which is adjacent an inlet duct in the thrust-carrying piece, and in the inlet duct there is arranged a valve opening in a direction opposite to the delivery direction, wherein from the side of the piston guiding body a stop bush is inserted in the

inlet duct, the free rim of this stop bush limits the lift of the valve closing body and the pierced bottom of this stop bush is pressed against the front face of the piston guiding body by a valve pressure spring.

6. A fuel injection pump according to claim 5, wherein the thrust-carrying piece the outlet duct and the inlet duct open into a thrust-piece bore at a spacing from each other.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1983. Published by the Patent Office 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.