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

(11) Publication number: **0 383 574 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **90301577.4**

(51) Int. Cl.5: **F02M 59/46**

(22) Date of filing: **14.02.90**

(30) Priority: **17.02.89 GB 8903682**

(43) Date of publication of application:
22.08.90 Bulletin 90/34

(84) Designated Contracting States:
DE ES FR GB IT

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(54) Delivery valve.

(57) A delivery valve for location in or adjacent the outlet of a fuel injection pump includes a valve body 11 having a bore 12 and a seating 13 defined at one end of the bore. A valve member 17 includes a head 19 shaped for engagement with the seating under the action of a spring and a tubular portion 18 slidable in the bore. A groove 23 is formed in the tubular portion adjacent the head and a by pass port 24 connects the groove with the interior of the tubular portion. Formed in the tubular portion is an opening 25 and extending from the opening towards the head is a flat 26 which is closed off by the walls of the bore as the head following delivery of fuel is moved into engagement with the seating by the spring.

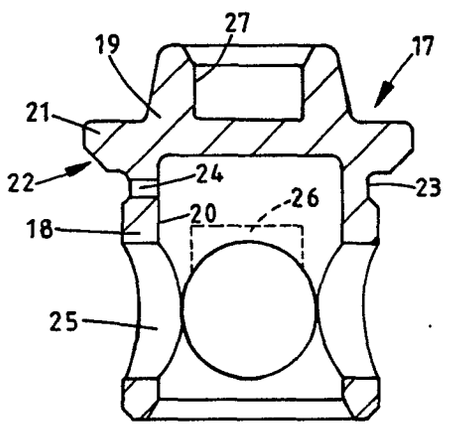

FIG.4.

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DELIVERY VALVE

This invention relates to a delivery valve for use in a fuel system for a compression ignition engine, the valve being located in or adjacent the outlet of a fuel injection pump and connected to an associated fuel injection nozzle of the engine by means of a pipe.

The usual form of delivery valve comprises a valve member having a head shaped for cooperation with a seating defined at one end of a bore defined in a valve body. The head is integrally formed with a fluted portion which is slidably mounted in the bore. The end of the bore remote from the seating is connected to the fuel pump and a spring is provided which acts upon the valve member to bias the head into engagement with the seating. Located between the head and the fluted portion is a so called unloading collar which cooperates with the wall of the bore during closure of the valve member to control the volume of fuel which is returned to the fuel pump from the nozzle and pipe before the head contacts the seating. During delivery of fuel by the fuel pump the unloading collar emerges from the bore to permit fuel flow and during closure of the valve the unloading collar re-enters the bore. Even though the fluted portion of the valve member remains in the bore to guide the movement of the valve member, the cylindrical surface of the unloading collar can become damaged. If the fluted portion of the valve member is extended to improve its ability to guide the movement of the valve member, the bore must also be extended and of course the valve body. Moreover, extending the length of the fluted portion adds to the weight and inertia of the valve member and it is likely that a stronger spring will be necessary to provide the valve with an adequate performance. In addition, in order to allow limited by pass flow it is the practice to provide a flat on the unloading collar and it is not easy to form the flat to the required degree of accuracy.

The object of the present invention is provide a delivery valve in a simple and convenient form.

According to the invention a delivery valve of the kind specified comprises a valve body, a bore defined in the body, a seating defined at one end of the bore, a tubular valve member slidable in the bore, said valve member having an integral head at one end thereof, said head serving to close the centre passage in the tubular portion of the valve member and also being shaped for cooperation with the seating, a groove formed in the outer peripheral surface of the tubular portion adjacent said head, a by pass port extending from said groove into said centre passage, at least one opening extending through the wall of the tubular portion of the valve member at a position spaced from said groove and a flat formed in the outer surface of the tubular part, said flat communicating with said opening and being positioned to be covered by the wall of the bore before the head moves into engagement with the seating during the closing movement of the valve member under the action of a spring.

An example of a valve in accordance with the invention will now be described with reference to the accompanying drawings in which:-

Figure 1 shows the valve in the closed position and it also shows the associated fuel injection pump and injection nozzle,

Figures 2 and 3 show the valve in the partially open and fully open positions and

Figure 4 is a view to an enlarged scale of the valve member.

Referring to Figure 1 of the drawings the delivery valve is generally indicated at 10 and it includes a valve body 11 which defines a bore 12 at one end of which is formed a frusto conical seating 13. The other end of the bore is connected to the outlet of a fuel injection pump diagrammatically illustrated at 14 and fuel flowing from the aforesaid one end of the bore is conveyed by means of a pipe 15 to a fuel injection nozzle 16 of the associated engine. Slidable within the bore 12 is a valve member 17.

With reference to Figure 4 the valve member 17 is of tubular form having a cylindrical portion 18 and an integral head 19 which closes the centre passage 20. The head 19 has a flange 21 the underside of which is shaped as at 22, to cooperate with the seating 13. Adjacent the flange the cylindrical portion 18 is provided with a peripheral groove 23 and extending from the base of the groove 23 into the centre passage 20 is a by- pass port 24. Also formed in the wall of the cylindrical portion are in the particular example, four equiangularly spaced openings 25. Connected to one of the openings 25 is a flat 26 which is shown in dotted outline in Figure 4. The flat is formed on the external surface of the cylindrical portion of the valve member and it extends towards but is spaced from the groove 23. The head 19 is formed with a recess 27 which reduces the mass of the valve member and the head is engaged by one end of a coiled compression spring 28 which acts to urge the delivery valve member to the closed position as shown in Figure 1.

In operation, and assuming that the delivery valve is closed as shown in Figure 1, when fuel is delivered by the fuel injection pump the fuel under pressure will act on the valve member to move the

valve member against the action of the spring 28. Figure 2 shows partial lift of the valve member and it will be seen that the flange 21 of the valve member has been lifted from the seating so that a limited flow of fuel can take place through the port 24 to the pipe 15. With continued movement of the valve member the flat 26 will be exposed beyond the end of the bore 12 and normal fuel flow can take place to the associated engine by way of the pipe line 15 and the injection nozzle 16. Figure 3 shows the fully open position of the valve member and it will be observed that the groove 26 is exposed beyond the end of the bore 12. The valve member may move against the action of the spring by an amount sufficient to slightly expose portions of the openings 25 beyond the end of the bore but even if this is not the case, the openings would still be provided in order to minimise the weight of the valve member. When the flow of fuel from the injection pump ceases, the valve member will be returned by the action of the spring 28 and the fuel pressure in the pipe 15. As soon as the flat 26 during the return motion of the valve member is covered by the wall of the bore, the additional movement of the valve member until the flange engages the seating, is termed the unloading movement of the valve member during which a predetermined volume of fuel is returned towards the injection pump from the pipe. The actual volume of fuel will of course depend upon the displacement of the valve member after the flat has been covered and adjustment can be effected by altering the axial length of the flat 26.

During the movement of the valve member only a small portion of the cylindrical surface of the valve member moves beyond the end of the bore but in any case, the aforesaid cylindrical surface is continuous with the remaining cylindrical surface of the valve member and therefore adequate guiding of the movement of the valve member is obtained and the risk of damage such as occurs with the conventional form of delivery valve, is minimised. The size of the by-pass port 24 is more readily controlled since it is only necessary to select the appropriate size of drill to form the port. Furthermore, the flat 26 can be formed at any desired position to determine the volume of fuel unloaded by the valve during its closing movement, from the pipe 15.

The openings 25 may form a flow path for fuel and also act in the same manner as the flutes of a conventional delivery valve, to minimise possible blockage of the valve by dirt in the fuel.

Claims

1. A delivery valve for use in a fuel system of a compression ignition engine the valve (10) being located in or adjacent the outlet of a fuel injection pump (14) and connected to a fuel injection nozzle (16) by way of a pipe (15) the valve comprising a valve body (11), a bore (12) defined in the body and a seating (13) defined at one end of the bore, a valve member (17) having a cylindrical portion (18) slidable in the bore (12) and a head (19) shaped for co-operation with the seating (13), a spring (28) biasing the head (19) into contact with the seating (13), the end of the bore remote from the seating being connected to the injection pump, characterised in that the cylindrical portion (18) of the valve member is of tubular form and is closed off by the head (19) and by a groove (23) formed in the outer peripheral surface of the cylindrical portion (18) adjacent the head (19), an opening (25) formed in the wall of the cylindrical portion (18), a bypass port (24) extending from the groove (23) into the interior of the tubular portion and a flat (26) on the exterior of the tubular portion, the flat communicating with said opening (25) and being positioned to be covered by the wall of the bore (12) before the head (19) moves into engagement with the seating (13).

2. A valve according to Claim 1 characterised in that said cylindrical portion (18) is provided with a plurality of openings (25).

3. A valve according to Claim 1 characterised in that said head (19) is provided with a flange (21) which serves as an abutment for the spring (28) and also is shaped for co-operation with the seating (13).

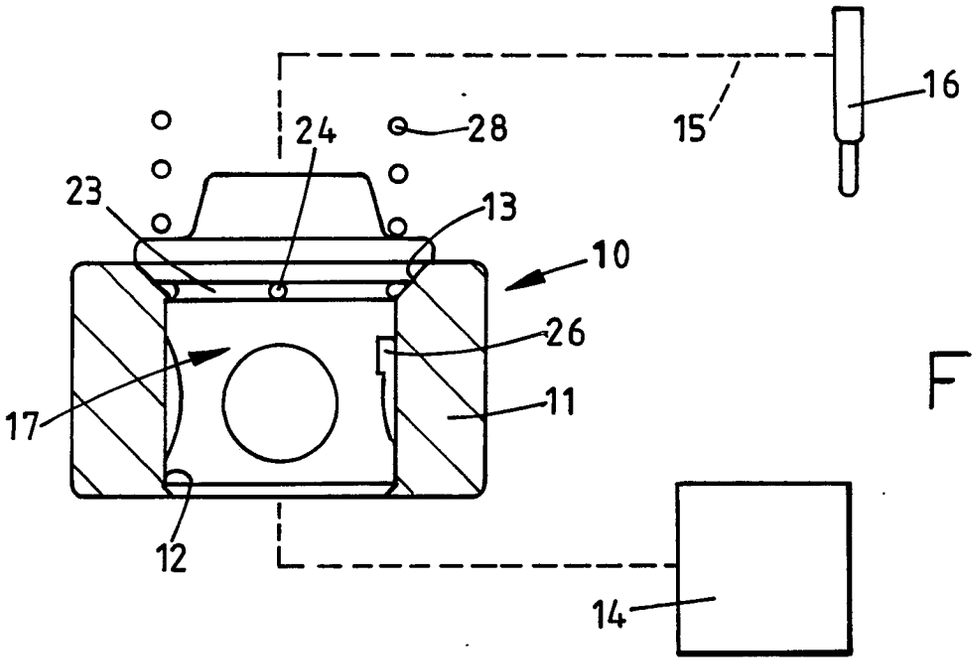

FIG.1.

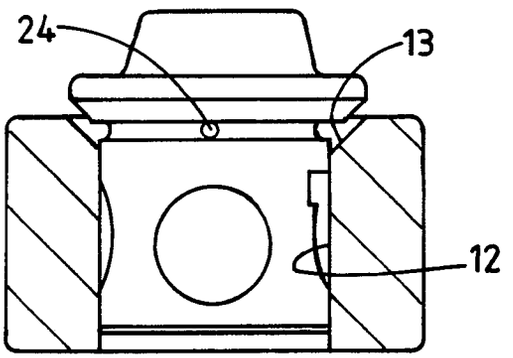

FIG.2.

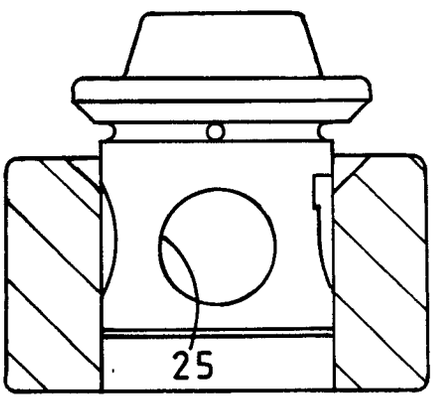

FIG.3.

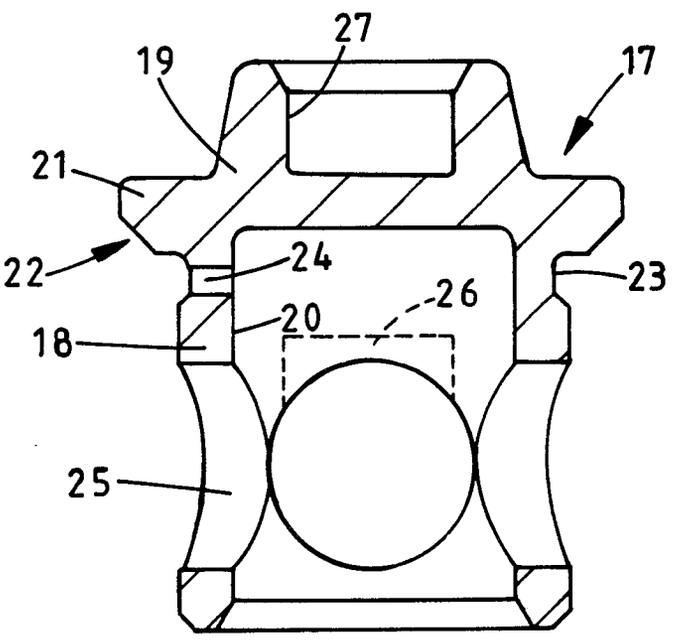

FIG.4.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 30 1577

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.5)
X	GB-A-732695 (C.A.V LTD) * page 1, line 50 - page 2, line 50; figures 1-3 * ---	1-3	F02M59/46
A	GB-A-2026601 (STANADYNE INC.) * page 3, lines 117 - 126; figure 5 * ---	1, 2	
A	US-A-2804825 (MANSFIELD) * column 3, lines 13 - 68; figures 1, 4 * -----	1, 2	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F02M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23 MAY 1990	SIDERIS M.

CATEGORY OF CITED DOCUMENTS

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