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(54) **Delivery valve.**

(57) An unloading delivery valve (10) for incorporation in a fuel delivery passage to a compression ignition engine has a valve member (17) slidable in a bore (14) which forms part of the flow path of the delivery passage. The valve member has a head (18) having on its under surface a portion (19) shaped to cooperate with a seating (16) at an end of the bore. The valve head is spring loaded into engagement with the seating (16) and is lifted from the seating when fuel flows to the engine. An unloading collar (21) is mounted on the valve member and cooperates with the wall of the bore to determine the return flow of fuel which flows when the valve head moves into engagement with the seating. A drilling (24) is formed in the collar to modify the return flow and the drilling is positioned so that during flow of fuel to the engine, the fuel which flows through the drilling impinges on the valve head at a position inwardly of the shaped portion (19).

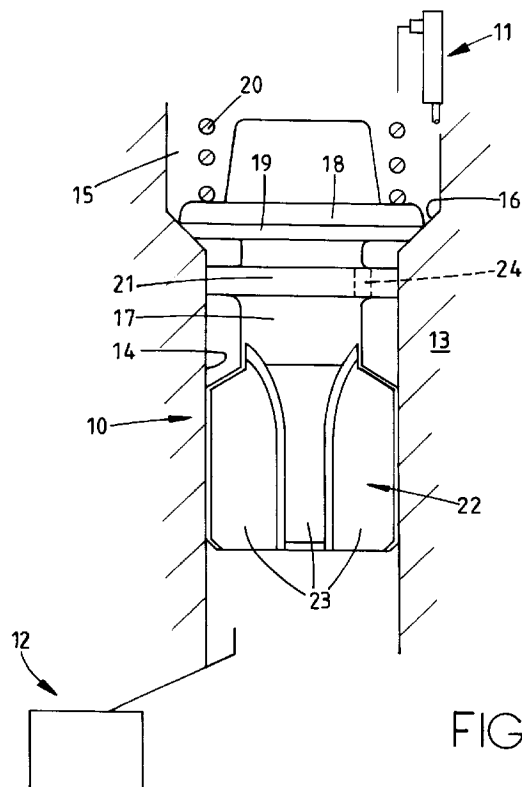


FIG. 1.

This invention relates to unloading delivery valves for incorporation in the high pressure fuel circuit of a fuel pumping apparatus intended to supply fuel to a compression ignition engine, the valve comprising a valve body defining a bore, the bore forming part of the flow path for fuel from the apparatus to the engine and the fuel flowing from the one end of the bore to the other end thereof during delivery of fuel to the associated engine, a seating defined at said other end of the bore, a valve member guided for movement in the bore, said valve member having a head located exterior of the bore and having a portion of its under surface shaped for cooperation with the seating, resilient means biasing the head into engagement with the seating, the head being lifted from the seating during delivery of fuel to the engine and the head being returned into engagement with the seating when the flow of fuel to the engine ceases, and an unloading collar mounted on the valve member, said collar cooperating with the wall of the bore to control the quantity of fuel which flows towards said one end of the bore during the return motion of the head towards the seating.

Such valves are well known in the art and it is known in such valves to provide a small flat on the cylindrical surface of the unloading collar. The flat acts to modify the operating characteristics of the valve particularly at low engine speeds, the effect being to reduce the quantity of fuel which returns to said one end of the bore before the head of the valve member closes onto the seating. During the delivery of fuel to the engine some flow of fuel will take place along the gap between said flat and the wall of the bore and the fuel which flows along the gap will impinge on the head of the valve member and will tend to erode the shaped under surface thereof. This is particularly the case if there are any cavities present in the fuel column. As the shaped under surface erodes it can no longer form a seal with the seating and therefore intermediate successive deliveries of fuel through the valve the pressure upstream of the valve will fall to a greater extent than intended.

The object of the present invention is to provide a valve of the kind specified in an improved form.

According to the invention in a delivery valve of the kind specified there is formed in the collar a drilling the flow of fuel through which acts to modify the quantity of fuel which flows during the return motion of the valve head towards the seating, the flow of fuel which takes place through said drilling during delivery of fuel to the associated engine impinging on the head at a position inwardly of the shaped portion thereof.

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

Figure 1 is a side elevation of the delivery valve together with parts of the fuel system in which it is incorporated, and

Figure 2 is an inverted plan view of the valve shown in Figure 1.

Referring to the drawings the delivery valve is generally indicated at 10 and is interposed between a fuel injection nozzle 11 and an outlet of a fuel pumping apparatus 12. The delivery valve comprises a valve body 13 which may form part of or be secured to the housing of the fuel pumping apparatus. Within the valve body there is formed a bore 14 one end of which is connected to the pumping apparatus and the other end of which leads into a chamber 15 which is connected to the fuel injection nozzle. Surrounding the other end of the bore is a seating 16 and slidable within the bore is a valve member 17 having an integral head 18 having an under surface a portion 19 of which is shaped to cooperate with the seating. The head is biased into engagement with the seating by means of a coiled compression spring 20 which is located in the chamber 15.

The valve member includes a cylindrical portion 21 which is spaced from the head 18, and which is a close sliding fit with the wall of the bore 14. The valve member is guided by a fluted portion 22 which includes a plurality of flutes 23. In operation, when fuel under pressure is supplied by the apparatus 12 to the one end of the bore, the pressure of fuel acts upon the valve member until the force exerted by the spring and any pressure upstream of the closed valve member, is overcome. The valve member lifts from its seating and flow of fuel takes place to the injection nozzle. The pressure of fuel supplied to the injection nozzle eventually attains the nozzle opening pressure and fuel flow can take place to the associated engine. During the delivery of fuel the collar will move towards the other end of the bore and emerge from the bore. The maximum extent of movement of the valve member is determined by the abutment of the valve member with a stop (not shown).

When the flow of fuel from the pumping apparatus ceases the pressure at the one end of the valve member is reduced and the valve member is returned by the action of its spring. During the return motion the collar re-enters the bore and the continued movement of the valve member until the head engages the seating, ensures that a predetermined volume of fuel is returned to the fuel pumping apparatus from upstream of the delivery valve.

It is known to modify the operating characteristics of the valve so that for example less fuel is returned to the pumping apparatus at low engine speeds. In order to achieve this there is provided in accordance with the invention, in the collar 21 a drilling 24 and as will be more clearly seen from Figure 2, the drilling is spaced inwardly from the cylindrical surface of the collar. At low engine speeds therefore some flow of fuel takes place through the drilling 24 before the valve member returns into engagement with its seating so that a reduced quantity of fuel is

unloaded from upstream of the valve. During delivery of fuel to the injection nozzle some flow of fuel takes place through the drilling but since the drilling is spaced inwardly from the cylindrical surface of the collar the fuel flow is directed at the valve head 18 inwardly of the portion 19 so that any erosion of the valve head which may occur takes place away from the shaped portion 19 of the valve head so that the valve member even after extended use, continues to form an efficient seal with the seating. 5 10

The size of the drilling is chosen to achieve the desired operating characteristic.

Claims 15

1. An unloading delivery valve for incorporation in the high pressure fuel circuit of a fuel pumping apparatus intended to supply fuel to a compression ignition engine, the valve (10) comprising a valve body (13) defining a bore (14), the bore forming part of the flow path for fuel from the apparatus to the engine and the fuel flowing from the one end of the bore to the other end thereof during delivery of fuel to the associated engine, a seating (16) defined at said other end of the bore, a valve member (17) guided for movement in the bore, said valve member having a head (18) located exterior of the bore and having a portion (19) of its under surface shaped for cooperation with the seating, resilient means (20) biasing the head into engagement with the seating, the head being lifted from the seating during delivery of fuel to the engine and the head being returned into engagement with the seating when the flow of fuel to the engine ceases and an unloading collar (21) mounted on the valve member, said collar cooperating with the wall of the bore (14) to control the quantity of fuel which flows towards said one end of the bore during the return motion of the head towards the seating characterised by a drilling (24) formed in the collar (21), the flow of fuel through the drilling acting to modify the quantity of fuel which flows during the return motion of the valve head towards the seating, the flow of fuel which takes place through said drilling (24) during delivery of fuel to the associated engine impinging on the head (18) at a position inwardly of the shaped portion (19) thereof. 20 25 30 35 40 45 50

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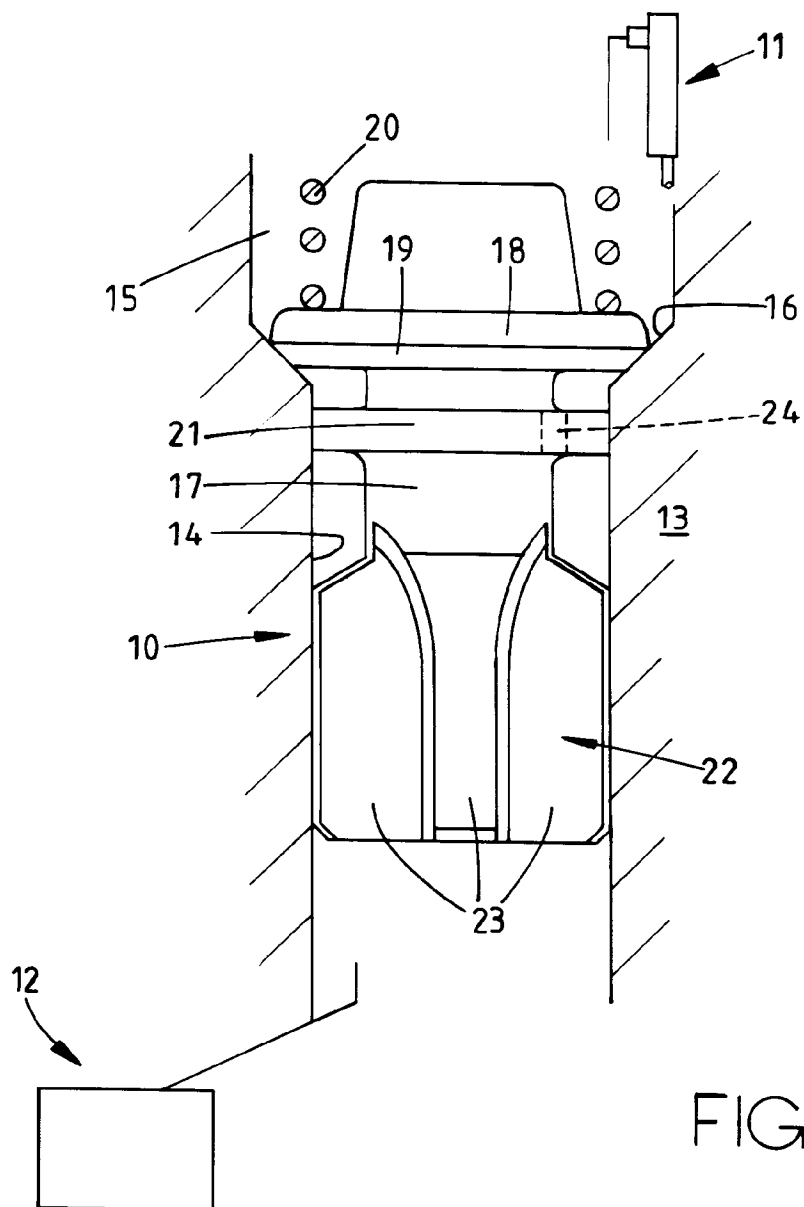


FIG. 1.

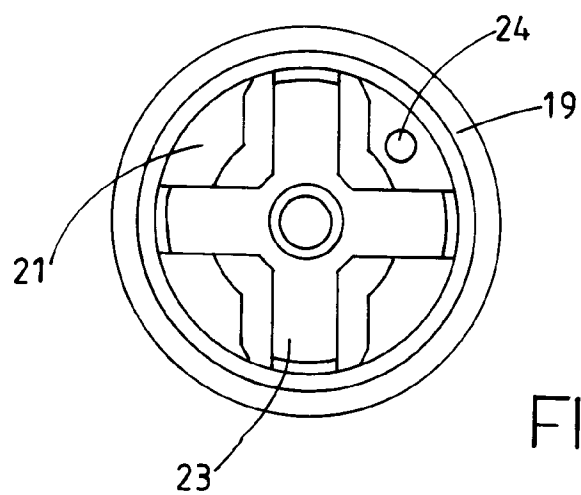


FIG. 2.



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 1600

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)
A	GB-A-2 023 720 (SIGMA DIESEL) *see the whole document * ---	1	F02M59/46
A	FR-A-2 108 749 (BOSCH) * claims; figures * ---	1	
A	US-A-2 706 490 (NORDBERG MANUFACTURING CO) * the whole document * -----	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.5) F02M
Place of search THE HAGUE		Date of completion of the search 16 June 1994	Examiner Klinger, T
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