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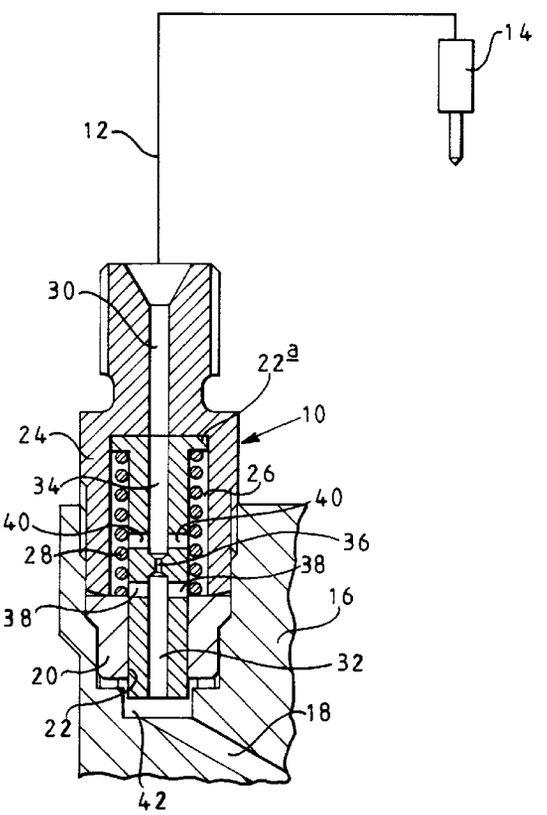
(54) Valve

(57) A valve (10) for use in controlling the fuel pressure within an injector supply line (12) comprises a tubular guide member (20) having a central bore provided therein. A valve member (22) is slidable within the central bore. A holder (24) secures the guide member (20) within the outlet port provided in a fuel pump housing (16). The holder (24) includes a bore of relatively large diameter which together with the guide member (20) and valve member (22) defines a spring chamber (26). The valve member (22) defines a first flow passage (32,38) and a second flow passage (34,40). The valve member (22) is slidable between a first position in which the first and second flow passages (32,38;34,40) both communicate directly with the spring chamber (26) and a second position in which the direct communication between the first flow passage (32,38) and the spring chamber (26) is broken. The valve member (22) is resiliently biased by a spring (28) towards the first position.



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Description

This invention relates to a valve, and in particular to a valve suitable for use in the fuel system of an internal combustion engine.

It is known to provide valves in the outlets of a high pressure fuel pump in order to maintain a relatively high pressure in fuel lines connecting the pump to the fuel injectors of the engine, the relatively high pressure being below that required to open the injector. The provision of such a valve is advantageous as less effort is required to return the line to injection pressure when a subsequent injection is required. It is also known to provide a valve arrangement whereby fuel is able to flow at a restricted rate from the fuel line towards the pump in order to absorb or reduce the effect of pressure waves within the fuel line. It is an object of the invention to provide a valve of this type which is of simple construction.

According to the present invention there is provided a valve comprising a valve member slidable within a bore, the valve member and bore defining a chamber, first and second flow passages provided in the valve member, wherein the valve member is slidable between a first position in which the first and second flow passages both communicate directly with the chamber and a second position in which the direct communication between the first flow passage and the chamber is broken, and resilient means biasing the valve member towards the first position.

The first and second passages are conveniently interconnected by a restricted passage.

The invention will further be described, by way of example with reference to the accompanying drawing which is a sectional view of a valve in accordance with an embodiment of the invention.

The accompanying drawing illustrates a so-called snubber valve 10 for use in maintaining the fuel pressure within a fuel supply line 12 for supplying fuel to a fuel pressure actuated injector 14 and for damping pressure waves within the supply line 12. The snubber valve 10 is mounted in an outlet port provided in a fuel pump housing 16 having a delivery passage 18 through which fuel is supplied at high pressure, in use, when fuel injection is to occur, the passage 18 being connected to a low pressure volume when fuel injection is to be terminated, and subsequently fuel at an intermediate pressure known as transfer pressure is applied thereto.

The snubber valve 10 comprises a tubular guide member 20 having a central bore provided therein within which a valve member 22 is slidable. A holder 24 is in screw-threaded engagement with the housing 16, the holder 24 securing the guide member 20 within the outlet port. The holder 24 includes a bore of relatively large diameter which together with the guide member 20 and valve member 22 defines a spring chamber 26. A spring 28 is located within the spring chamber 26, the spring 28 being engaged between a surface of the guide member 20 and an outwardly extending flange 22a provided on the valve member 22. The spring 28 biases the valve member 22 towards the position shown in which the outwardly extending flange 22a abuts an end of the spring chamber 26.

The holder 24 further includes an axially extending bore 30 which opens into the spring chamber 26, the bore 30 extending through a part of the holder 24 which forms a connector to which an end of the supply line 12 is secured, in use.

The valve member 22 includes a first axially extending blind bore 32 which is provided in the end of the valve member 22 which extends through the guide member 20, and a second axially extending blind bore 34 which is located in the part of the valve member 22 including the outwardly extending flange 22a. A restricted passage 36 interconnects the blind ends of the blind bores 32, 34. The first blind bore 32 communicates with a pair of first radially extending passages 38 which are located such that when the valve member 22 occupies the position illustrated in the accompanying drawing, the first radially extending passages 38 communicate with the spring chamber 26, the first blind bore 32 and first passages 38 defining a first flow passage. A second pair of radially extending passages 40 communicate with the second blind bore 34, the second passages 40 also communicating with the spring chamber 26. A second blind bore 34 and second passages 40 together define a second flow passage.

The outlet port of the pump housing 16 is shaped so as to include a recess 42 which is arranged to receive an end of the valve member 22, the recess 42 being arranged to permit movement of the valve member 22 away from the position shown in the accompanying drawing to a position in which the first radially extending passages 38 are obscured by the guide member 20 and no longer communicate directly with the spring chamber 26. It will be appreciated that in this position, communication between the first and second blind bores 32, 34 is only by way of the restricted passage 36. In this position, the end of the valve member 22 abuts the housing 16, thus further movement of the valve member 22 in this direction is prevented.

In use, in the position illustrated in the accompanying drawing, if fuel at high pressure is applied to the delivery passage 18, the fuel is able to flow through the first blind bore 32 and first radially extending passages 38 to the spring chamber 26. From the spring chamber 26, the fuel is able to flow through the second radially extending passages 40 to the second blind bore 34 and from there through the bore 30 to the supply line 12 and the injector 14. The presence of the spring 28 ensures that the valve member 22 is maintained in the position shown. The injector 14 is of the pressure actuated type, thus the application of high pressure fuel thereto causes the valve member of the injector 14 to be lifted from its seating and hence in injection commencing.

In order to terminate injection, the delivery passage 18 is connected to a suitable low pressure drain, thus

the fuel pressure within the recess 42 is reduced. The pressure within the spring chamber 26 also falls. The high pressure within the supply line 12 and bore 30 applies a force to the valve member 22 which is sufficiently high to overcome the effect of the spring 28, and the valve member 22 moves downwards in the orientation illustrated in the accompanying drawing until the end of the valve member 22 abuts the housing 16. The downward movement of the valve member 22 results in the first radially extending passages 38 initially becoming partially obscured, and eventually totally obscured by the guide member 20 thus breaking the direct communication between the first flow passage and the spring chamber 26. It will be appreciated that once the first radially extending passages 38 are obscured by the guide member 20, further flow of fuel through the valve member 22 is only possible by way of the restricted passage 36, thus the flow of fuel through the valve member 22 is at a very restricted rate. The downward movement of the valve member 22 further increases the volume of the part of the spring chamber exposed to the fuel pressure within the supply line 12, thus the fuel pressure within the supply line falls.

It will be appreciated that the pressure which must be applied to the valve member 22 in order to move the valve member 22 to the position in which the first radially extending passages 38 are obscured is dependent upon the effective area of the valve member 22 exposed to the pressure within the supply line 12 and also upon the rate of the spring 28. These parameters are selected in order to result in the pressure within the supply line 12 falling to a sufficiently low level that the injector 14 is closed, but sufficiently high that relatively little effort is needed to raise the fuel pressure within the supply line 12 to injection pressure.

In use, upon closure of the injector 14 at the termination of injection, a pressure wave may be generated in the supply line 12 which is transmitted towards the snubber valve 10. It is desirable to damp such pressure waves, and this is achieved, in part, by the provision of the restricted passage 36 which enables a restricted flow of fuel through the valve even when the first radially extending passages 38 are obscured by the guide member 20. The amplitude of a reflection of the pressure wave is therefore reduced.

Between injections, the delivery passage 18 is supplied with fuel at transfer pressure which is substantially equal to the pressure maintained within the supply line 12. As the pressure differential across the snubber valve 10 is substantially removed, the valve member 22 moves under the action of the spring 28 to the position illustrated. Thus prior to the subsequent injection, the substantially unrestricted fuel passage through the spring chamber 26 is restored.

It will be appreciated that the snubber valve 10 is of relative simple construction, the valve being composed of only four parts. Further, as the snubber valve does not include a valve seat as such, manufacture of the valve is relatively simple.

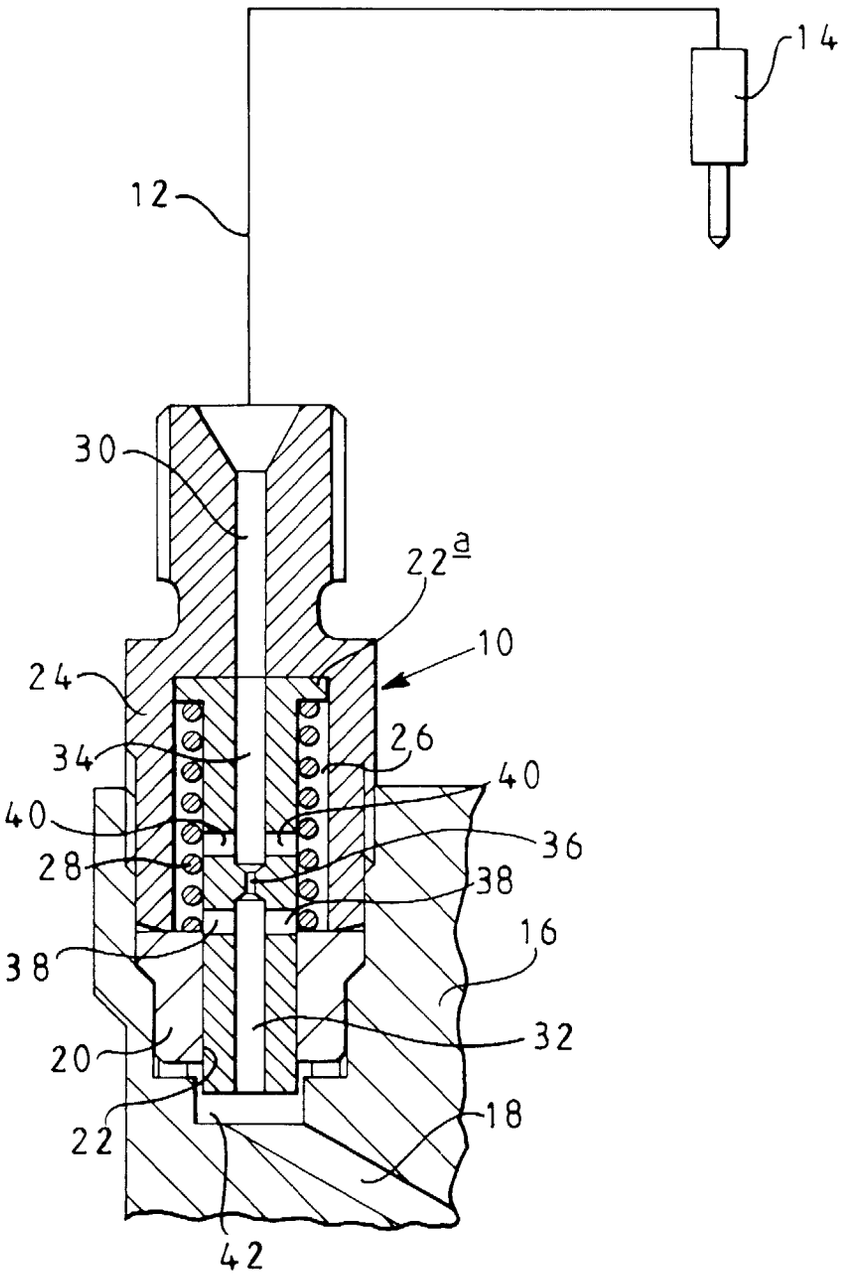
Claims

1. A valve comprising a valve member (22) slidable within a bore, the valve member (22) and bore defining a chamber (26), first and second flow passages (32, 34, 38, 40) provided in the valve member (22), wherein the valve member (22) is slidable between a first position in which the first and second flow passages (32, 34, 38, 40) both communicate directly with the chamber (26) and a second position in which the direct communication between the first flow passage (32, 38) and the chamber (26) is broken, and resilient means (28) biasing the valve member (22) towards the first position.

2. A valve as claimed in Claim 1, wherein the first and second flow passages (32, 34, 38, 40) are interconnected by a restricted flow passage (36).

3. A valve as claimed in Claim 1 or Claim 2, wherein the resilient means (28) comprises a spring (28) located within the chamber (26).

4. A valve as claimed in any one of the preceding claims, further comprising a guide member (20) and a holder (24), the guide member (20) guiding sliding movement of the valve member (22), the chamber (26) being defined between the valve member (22), the guide member (20) and the holder (34), wherein when the valve member (22) occupies its second position, the first flow passage (32, 38) is closed by the guide member (20).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EUROPEAN SEARCH REPORT

Application Number
EP 98 30 0164

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.6)
X	FR 2 300 905 A (VYSOKE UCENI TECH BRNE) 10 September 1976 * page 3, line 19 - page 6, line 12; figure 1 *	1,4	F02M59/46
A	PATENT ABSTRACTS OF JAPAN vol. 010, no. 122 (M-476), 7 May 1986 & JP 60 249664 A (KUBOTA TEKKO KK), 10 December 1985, * abstract *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F02M
F16K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	4 May 1998	Hakhverdi, M

CATEGORY OF CITED DOCUMENTS

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