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(54) Fuel injection nozzles.

(57) A fuel injection nozzle includes a nozzle body containing a fuel pressure actuated valve member, the nozzle body being secured to a holder having a fuel inlet. An injection control device including a body (22) is secured to the inlet of the holder and a port (33) opens onto the periphery of the body (22). Fuel can escape through the port (33) during the delivery of fuel by a pump which supplies fuel to the nozzle. A sleeve (38) is loosely mounted about the body (22) and carries an outlet (39) through which fuel from the port (33) can flow. Sealing rings (40) are disposed on opposite sides of the port (33) between the body and the sleeve.

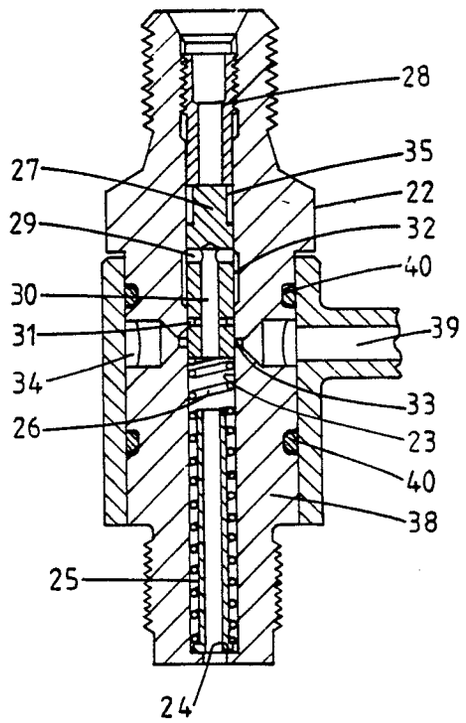

FIG.2.

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"FUEL INJECTION NOZZLES"

This invention relates to a fuel injection nozzle for supplying fuel to a compression ignition engine, and comprising a nozzle holder to which is secured a nozzle body, a fuel pressure actuated valve member slidably mounted in a bore in the nozzle body, resilient means biasing the valve member into contact with a seating to prevent fuel flow from a fuel inlet to a nozzle outlet in the nozzle body, the valve member being lifted from the seating by fuel under pressure supplied in use by a fuel pump having its outlet connected to the fuel inlet, and valve means operable to interrupt the supply of fuel through the nozzle outlet during delivery of fuel by the pump.

It is well known to interrupt the supply of fuel through the nozzle outlet, the purpose of such interruption being to reduce the rate of rise of the pressure in the combustion space of the engine and thereby to minimise the generation of noise.

British Patent Specification 2147359A discloses a nozzle in which the valve means is located in the holder. The material forming the holder is usually an alloy chosen for cheapness and lightness but where the valve means is incorporated into the holder the choice of material is more critical and a more expensive material has to be employed. In addition, the holder has to be very carefully machined so that the holder becomes a non-standard item. An alternative approach is shown in British Specification 1084067 in which in the practical construction shown in Figure 9, the valve means is formed as a separate unit which is attached to the fuel inlet in the nozzle holder. In this case therefore the nozzle holder can be formed from the cheaper material and the holder can be a standard item.

In the example shown in Figure 9 the interruption of fuel flow through the nozzle outlet is achieved by diverting the fuel supplied by the pump to a space which provides temporary storage for a volume of fuel whereas in the nozzle shown in Specification 2147359A the diverted fuel is allowed to flow to a drain. The construction of the valve means in order to define the aforesaid space means that the body of the valve means must be formed as a number of parts which have to be secured together.

The object of the invention is to provide a fuel nozzle of the kind specified in a simple and convenient form.

According to the invention in a nozzle of the kind specified said valve means comprises an elongated body having a bore formed therein, the body at its opposite ends being adapted to be secured to the nozzle holder and to a pipeline connected to the outlet of the fuel pump, the bore extending to the ends of the body, a valve member slidable in the bore, resilient means biasing the valve member towards the one end of the bore which in use is connected to the fuel pump, a port opening into the bore and extending to the exterior of the body, said port during the movement of the valve member away from from said one end of the bore during delivery of fuel by the fuel pump, being temporarily connected to the other end of the bore, a sleeve loosely mounted about the body, said sleeve defining an outlet for connection to a drain, and sealing means located between the sleeve and the body on opposite sides of said port.

An example of a fuel injection nozzle in accordance with the invention will be described with reference to the accompanying drawings in which:-

Figure 1 shows in sectional side elevation, a fuel injection nozzle to which the invention may be applied,

Figure 2 shows a modification of part of the nozzle seen in Figure 1 and incorporating the invention, and

Figure 3 shows a further modification to part of the nozzle seen in Figure 1.

Referring firstly to Figure 1 of the drawings the fuel injection nozzle comprises a cylindrical nozzle holder 10 to one end of which is secured a nozzle body 11 by means of a cap nut 12. Interposed between the nozzle body 11 and the holder 10 is a distance piece 13. In known manner the nozzle body accommodates a fuel pressure actuated valve member which is urged into contact with a seating by means of a coiled compression spring 14 which is located within a chamber formed in the holder, the valve member having an extension 15 which carries a spring abutment engaged by one end of the spring 14.

Fuel is supplied to the nozzle body by way of a passage 16 in the distance piece which registers with a passage 17 in the holder, the latter terminating in a transversely disposed threaded recess 18 in which is located an inlet union 19, the union 19 in use being connected to the end of a pipe line which leads to the outlet of a fuel injection pump.

The chamber in which the spring 14 is located is vented to a low pressure through a drain outlet 20 formed in the end of the holder remote from the nozzle body. In use, when fuel under pressure is supplied by the pump, the pressure acts upon the valve member to lift the valve member against the action of the spring 14, away from a seating to permit fuel flow through an outlet which in the example, comprises a plurality of outlet orifices formed in a protuberance 21 formed at the end of

the nozzle body.

The nozzle as described above will provide a rate of injection determined substantially by the characteristics of the fuel injection pump which supplies fuel to the nozzle and in order to provide the aforesaid pilot injection, the union 19 is replaced by an attachment shown to enlarged scale in Figure 2. The attachment comprises a body 22 which is threaded at its opposite ends, the lower end in the drawing, being secured within the recess 18. Extending within the body 22 is a bore 23 which at its lower end, defines a step 24 against which is located the flanged end of a tubular spring support 25 between the outer surface of which and the wall of the bore is located a coiled compression spring 26. Slidable within the bore is a valve member 27 which at its lower end is engaged by the spring 26 which biases the valve member into contact with a tubular and adjustable stop 28 located in a threaded portion of the bore 23.

Formed in the valve member is a transverse drilling 29 which communicates with an axially extending drilling 30 the latter extending to the end of the valve member which is engaged by the spring. In addition, the valve member is provided nearer to the aforesaid end with a circumferential control groove 31 also communicating with the drilling 30.

A groove 32 is formed in the wall of the bore and also formed in the wall of the bore are, in the particular example, two ports 33 which open into a circumferential groove 34 formed in the periphery of the body. The ports are positioned so that in the rest position of the valve member as illustrated, the ports are situated between the groove 31 and the end of the valve member which is engaged by the spring.

Also formed on the valve member at the end thereof which engages the stop 28 are a pair of flats 35. The inner ends of the flats terminate short of the drilling 29 and in operation, when fuel is supplied by the injection pump the valve member is moved against the action of the spring 26. Such movement pressurizes the fuel at the end of the valve member engaged by the spring and this pressurized fuel acts to lift the valve member of the nozzle from its seating thereby to allow fuel flow to the associated engine. This flow of fuel continues until the groove 31 moves into register with the ports 33. As soon as this occurs the pressure of fuel applied to the valve member of the injection nozzle falls owing to fuel flow through the ports 33 and the flow of fuel to the engine is interrupted. With continued movement of the valve member the groove 31 moves out of register with the ports 33 but the flats 35 move into register with the groove 32 so that fuel can now flow by way of the flats 35, the groove 32 and the drillings 29 and 30 to the associated engine. The effect therefore is that a pilot volume of fuel as determined by the displacement of the valve member from the rest position to the position at which the groove 31 is brought into register with the ports 33, is delivered to the engine followed by a reduction in the fuel pressure and thereby closure of the valve member of the nozzle, followed by the main quantity of fuel delivered by the fuel pump. The amount of fuel forming the pilot quantity is determined by adjustment of the stop 28 and clearly the further the valve member has to move before the groove 31 is brought into register with the ports 33, the greater the pilot volume of fuel.

When the delivery of fuel by the injection pump ceases, the valve member 27 must move back to its rest position and this movement is facilitated by the provision of a one way or non-return valve which for convenience, and as shown in Figure 3, is located in the distance piece 13. The one way valve is indicated at 36 and it connects the passage 16 to the chamber which contains the spring 14. The valve includes a spring loaded ball 37 which is biased into contact with a seating and when the supply of fuel by the injection pump ceases, the ball 37 lifts from its seating to permit fuel flow into the passage 16 from the spring chamber which is kept full of fuel at a low pressure. The valve member 27 can therefore return under the action of the spring 26 into contact with the stop 28.

In the example described the valve member 27 has a pair of flats 35. If desired the flatted portion of the valve member can be omitted and the stop 28 made longer. The flatted portion of the valve member does minimise the risk of the valve member jamming against the upper edge of the groove 32.

Although it is convenient to locate the valve 36 in the distance piece 13 it may be provided at other locations in the nozzle holder. Moreover, other forms of valve can be provided for example, a plate valve.

As shown in Figure 2 the groove 34 is closed by a sleeve 38 which defines an outlet 39. The sleeve 38 is loosely located about the body 22 between a step on the body and part of the holder and a pair of seal members 40 are located in respective grooves in the body 22 on opposite sides of the groove 34. The outlet 39 is connected to a low pressure source of fuel. Conveniently the outlet 39 is connected to the outlet 20 by means of a short length of pipe. The sleeve since it is loosely located about the body can be moved angularly to the desired position once the body 22 has been tightened relative to the holder.

Claims

1. A fuel injection nozzle for supplying fuel to a compression ignition engine and comprising a nozzle holder 10 to which is secured a nozzle body 11, a fuel pressure actuated valve member slidable in a bore in the nozzle body, resilient means 14 biasing the valve member into contact with a seating to prevent fuel flow from a fuel inlet 18 to a nozzle outlet, the valve member being lifted from the seating by fuel under pressure supplied in use by a fuel pump, valve means including a body 22 the opposite ends of which are adapted for connection to the inlet 18 and a pipeline connected to the fuel pump, a bore 23 extending within the body and open to the ends of the body, a valve member 27 slidable in the bore 24 and resilient means 26 biasing the valve member away from the one end of the bore connected to the pipeline, a port 33 opening into the bore, said port being uncovered to the other end of the bore after a predetermined movement of the valve member against the action of the spring, characterised in that said port 33 extends to the exterior of the body, a sleeve 38 loosely surrounding the body, the sleeve defining an outlet 39 and seal means 40 disposed between the sleeve and the body on opposite sides of said port 33.

2. A nozzle according to Claim 1 characterised in that the sleeve 38 is located axially on the body by a step on the body and by part of the holder.

3. A nozzle according to Claim 1 characterised by a groove 34 formed in the periphery of the body, said port 33 opening to said groove.

4. A nozzle according to Claim 1 including a distance piece 13 positioned between the holder 10 and the nozzle body 12, the distance piece defining a passage 16 which conveys fuel from the fuel inlet 18 to the bore in the nozzle body, characterised by a non-return valve 36 located in the distance piece.

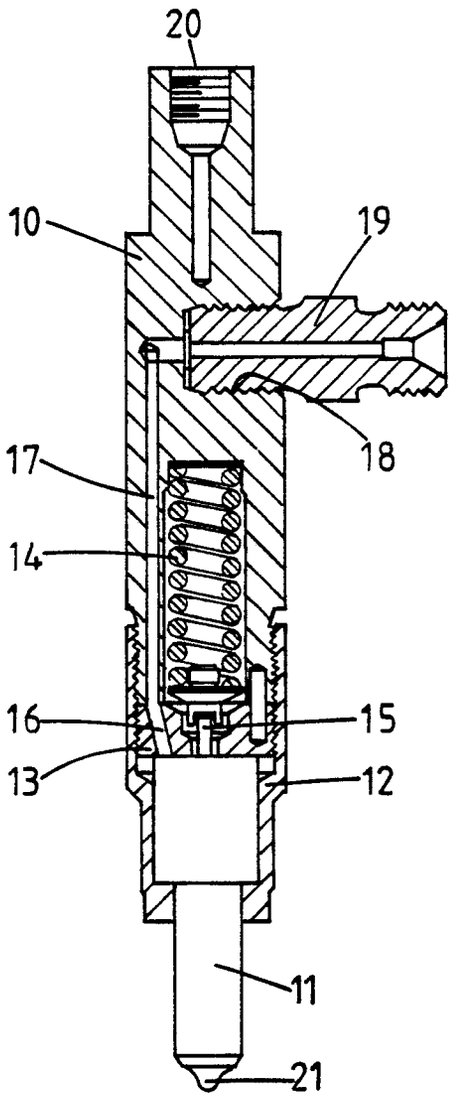

FIG.1.

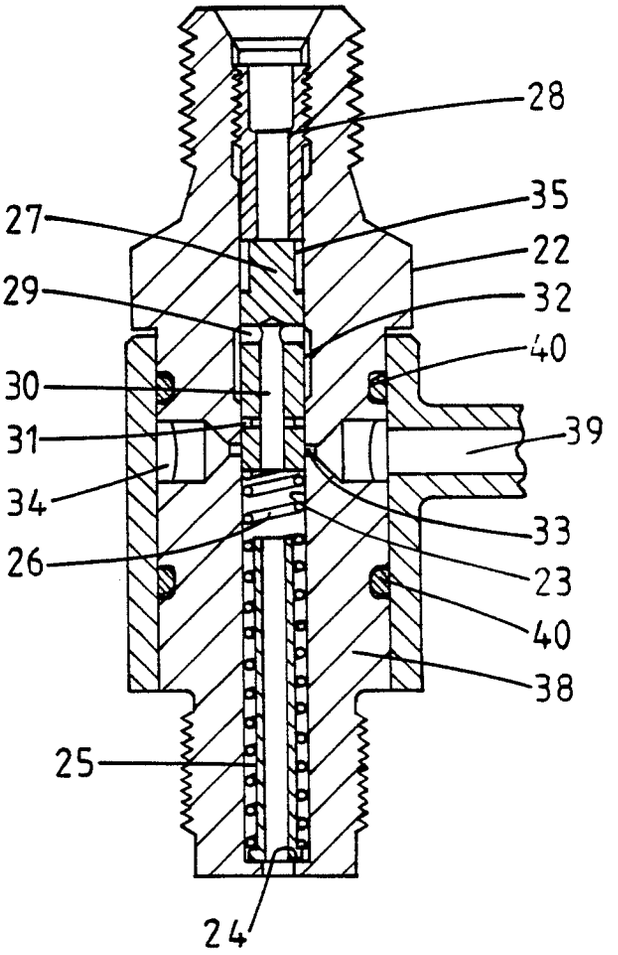

FIG.2.

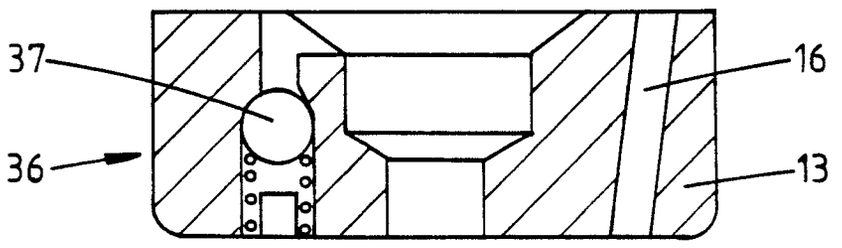

FIG.3.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 30 1387

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	DE-C- 814 684 (KLÖCKNER-HUMBOLDT-DEUTZ) * Whole document *	1,3	F 02 M 45/08 F 02 M 61/16
Y	US-A-3 627 208 (W.M. SCOTT) * Column 3, lines 36-73; figure 2 *	1,3	
A	DE-C- 913 717 (KLÖCKNER-HUMBOLDT-DEUTZ) * Whole document *	1	
A,D	GB-A-1 084 067 (DAIMLER-BENZ) * Page 3, line 108 - page 4, line 87; figure 9 *	1	
A,D	GB-A-2 147 359 (LUCAS) * Page 2, lines 7-94; figure *	1,4	
A	GB-A-2 138 501 (LUCAS) * Page 1, lines 108-126; figure 2 *	2	
A	DE-B-1 252 001 (BOSCH) * Figure *	4	TECHNICAL FIELDS SEARCHED (Int. Cl.4) F 02 M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	06-06-1988	FRIDEN C.M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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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

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