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(54) Fuel injection nozzles.

(57) A two stage lift injection nozzle includes a nozzle holder (10) to which is secured a nozzle body (15) which accommodates a fuel pressure actuated valve member (18). The valve member is biased into engagement with a seating (23) by a first spring (27) and after a predetermined movement of the valve member away from the seating it engages a spring abutment (34) of a second spring (32). The movement of the valve member away from the seating against the action of both springs is limited by the engagement of the abutment (34) with stop surfaces (39) defined by recesses (36) in the wall of a chamber (12) in the holder and in which the springs are located.

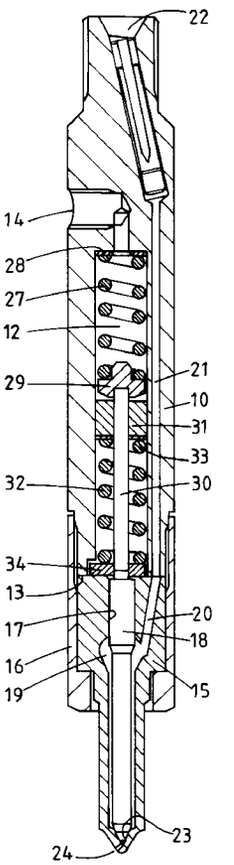

FIG.1.

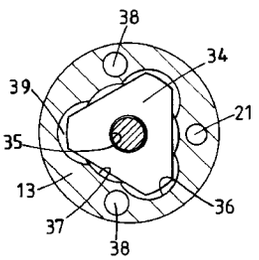

FIG.3.

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This invention relates to fuel injection nozzles for supplying fuel to internal combustion engines and of the kind comprising a nozzle holder to which is secured a nozzle body, the nozzle body defining a bore in which a valve member is slidable, a seating formed in the bore, the valve member being shaped for co-operation with the seating and being movable by fuel under pressure away from the seating to allow fuel flow from a fuel inlet to an outlet, a fuel supply passage formed in the holder and through which fuel flows from the fuel inlet under the control of the valve member, a chamber defined in the holder, a first spring in said chamber and acting on the valve member to bias the valve member into engagement with the seating, a second spring in said chamber, a spring abutment for said second spring, means movable with the valve member and engageable with said spring abutment after a predetermined movement of the valve member away from the seating so that the further movement of the valve member takes place against the action of both springs, and means for limiting the further movement of the valve member away from the seating.

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

According to the invention in a fuel injection nozzle of the kind specified the means for limiting the further movement of the valve member comprises a stop surface defined by a recess formed in the wall of said chamber, said stop surface being engageable by said spring abutment.

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

Figure 1 is a sectional side elevation of the nozzle,

Figure 2 is a view to an enlarged scale of part of the nozzle seen in Figure 1, and

Figure 3 is a section on the line 3-3 of Figure 2.

Referring to the drawings the fuel injection nozzle comprises an elongated nozzle holder 10 of cylindrical form and within which is formed a chamber 12 which opens onto an end surface 13. The opposite end of the chamber communicates with a fuel outlet 14.

Located against the end surface 13 is the larger end of a stepped nozzle body 15, the body being secured to the holder by means of a cap nut 16. Formed in the nozzle body is a bore 17 in which is slidable a valve member 18. Intermediate the ends of the bore is an enlargement 19 which is connected by means of a passage 20 in the nozzle body and a registering passage 21 formed in the holder, with a fuel inlet 22 which in use is connected to the outlet of a high pressure fuel injection pump.

The valve member is shaped at its end remote from the holder to engage with a seating 23 and downstream of the seating is formed an outlet orifice 24. The portion of the valve member which lies intermediate the enlargement or recess 19 is of smaller diameter than the bore so as to provide an annular clearance along which fuel can flow from the recess 19 when the valve member is lifted from its seating. Moreover, at its end adjacent the holder the valve member is provided with an extension 25 which is of reduced diameter as compared with the adjacent portion of the valve member so as to form an annular step 26. In the closed position of the valve member the step 26 lies below the adjacent end surface of the nozzle body by a predetermined distance which is labelled in Figure 2 of the drawings, h1.

The fuel injection nozzle also includes a pair of coiled compression springs. The first spring 27 is housed in the end of the chamber 12 remote from the nozzle body and at one end it engages with the end wall of the chamber with a shim 28 being interposed therebetween. At its other end the spring engages an abutment 29 which is mounted upon one end of a push rod 30 which engages with the extension 25 of the valve member. The push rod 30 extends through and is guided by the wall of an aperture in a fixed abutment 31 against which is engaged one end of the second spring 32. As with the spring 27 a shim 33 is interposed between the spring and the abutment. The abutment 31 is retained in position by deforming the wall of the holder, and a passage is provided to enable leakage fuel to flow to the outlet 14. At its opposite end the spring engages a further abutment 34 which as more clearly seen in Figure 3, comprises a plate which is of generally triangular form but having its corners rounded. The plate 34 is provided with a central aperture 35 which is located about the extension 25 so that the plate is laterally located by the extension. Moreover, the push rod 30 extends into the aperture so that it is located by the plate.

The rounded corners of the plate 34 extend within part cylindrical recesses 36 respectively which are formed in the wall 37 of the chamber 12. The recesses define stop surfaces 39 respectively for engagement by the adjacent surfaces of the corner portions of the plate 34 and as will be observed from Figure 2, a predetermined distance labelled h2 exists between the end surface of the plate and the stop surfaces 39.

In operation, when fuel under pressure is supplied to the inlet 22 a force is generated upon the valve member which acts to move the valve member against the action of the spring 27. When the force generated is sufficient the valve member is lifted from the seating to allow fuel flow through the orifice 24. The initial lift of the valve member is determined by the engagement of the step 26 with the plate 34 and the fuel flow through the orifice 24 is at a restricted rate. As the pressure of fuel which is supplied to the inlet 22 increases, the force acting on the valve member will eventually become sufficient to overcome the

force exerted by both springs and the valve member will lift to permit substantially unrestricted flow of fuel through the orifice 24. The full extent of the lift is determined by the engagement of the adjacent surfaces of the rounded corner portions of the plate 34 with the stop surfaces 39 and the total lift of the valve member amounts to the sum of the distances hl and h2. When the pressure of fuel supplied to the inlet decreases, the valve member will return to the closed position.

The position of the passage 21 is carefully chosen to resist the forces which are developed on the wall of the passage when fuel under pressure is supplied to the inlet 22 and as will be seen from Figure 3 the angular spacing of the passage 21 is such that it lies intermediate a pair of adjacent recesses 36. The end surface 13 of the holder also defines a pair of recesses 38 which accommodate location pegs respectively which are provided on the end surface of the nozzle body.

By the arrangement described the maximum lift stop is defined by the surfaces 39 of the nozzle holder thereby eliminating the rod like stop member found in prior constructions. The provisions of three stop surfaces 39 and the use of the generally triangular spring abutment allows sufficient wall thickness in the nozzle holder for the passage 21.

Claims

1. A fuel injection nozzle for supplying fuel to an internal combustion engine comprising a nozzle holder (10) to which is secured a nozzle body (15), the nozzle body defining a bore (17) in which a valve member (18) is slidable, a seating (23) formed in the bore, the valve member being shaped for cooperation with the seating and being movable by fuel under pressure away from the seating to allow fuel flow from a fuel inlet (22) to an outlet (24), a fuel supply passage (21) formed in the holder and through which fuel flows from the fuel inlet (22) under the control of the valve member, a chamber (12) defined in the holder, a first spring (27) in said chamber, the first spring acting on the valve member (18) to bias the valve member into engagement with the seating (23), a second spring (32) in said chamber, a spring abutment (34) for said second spring, means (26) movable with the valve member and engageable with said spring abutment (34) after a predetermined movement of the valve member (18) away from the seating so that the further movement of the valve member away from the seating takes place against the action of both springs, characterised by a stop surface (39) defined by a recess (36) in the wall of the chamber, said stop surface being engageable by said spring abutment (34) to limit the further movement of the valve member away from the seating.

2. A nozzle according to Claim 1, characterised by three angularly spaced recesses (36) in the wall of said chamber and in that the spring abutment (34) is of generally triangular shape.

3. A nozzle according to Claim 2, in which said fuel supply passage (21) is positioned intermediate a pair of said recesses (36).

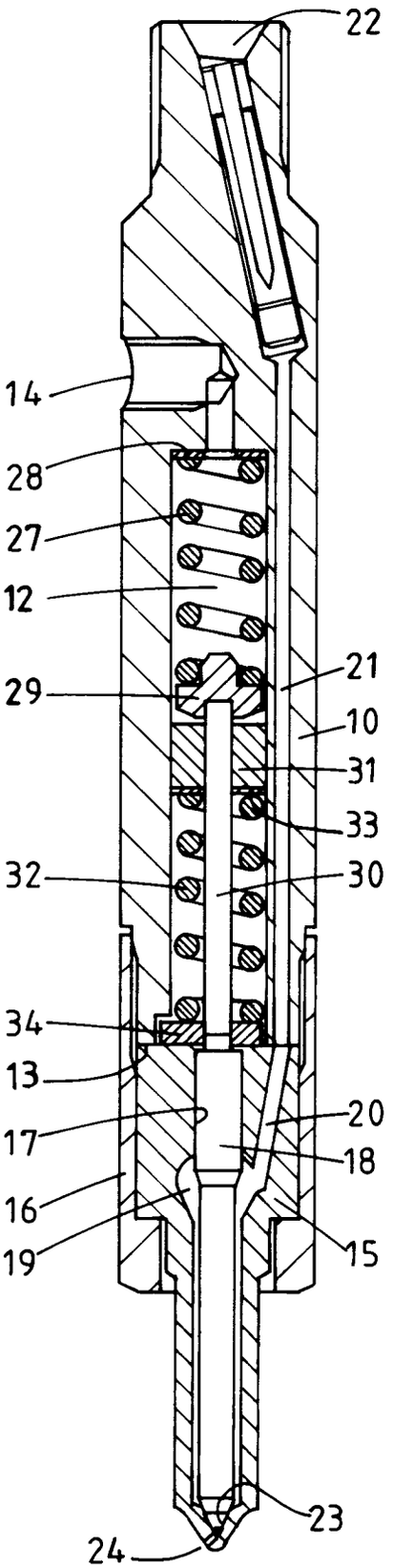

FIG.1.

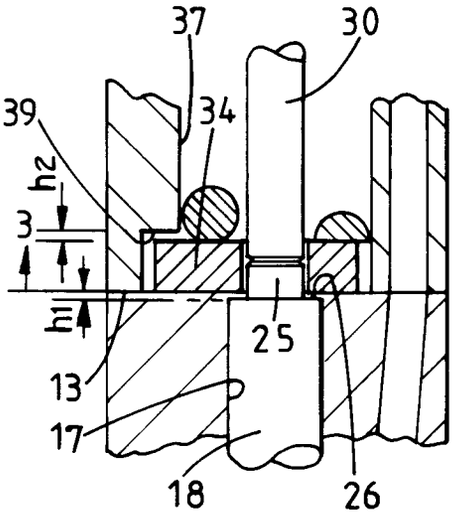

FIG.2.

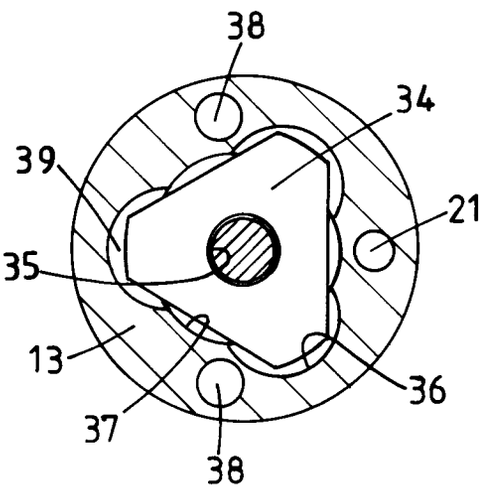

FIG.3.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number EP 93 30 3598

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 Y	DE-A-4 036 580 (SKL) * column 3, line 56 - column 5, line 27; figure 1 *	1 2,3	F02M45/08 F02M61/20
Y	EP-A-0 360 170 (DIESEL KIKI) * column 13, line 41 - line 44 * * column 25, line 36 - column 28, line 24; figures 8,9 *	2,3	
A	GB-A-835 712 (E. SATZGER) * the whole document *	1	

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	01 SEPTEMBER 1993	HAKHVERDI M.

CATEGORY OF CITED DOCUMENTS

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