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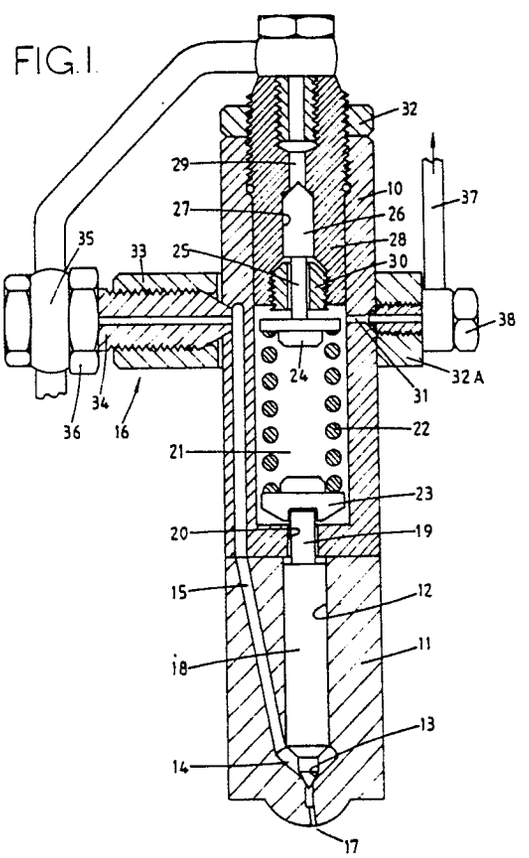
(54) Fuel injection nozzle.

(57) A fuel injection nozzle for supplying fuel to an internal combustion engine includes a valve member (18) slidable in a bore (12) and loaded by a spring (22) to the closed position. The valve member (18) is lifted from a seating (13) by fuel under pressure supplied through an inlet (16). A piston (26) is also subjected to this pressure and controls the position of an abutment (24) for the spring (22). The piston (26) and a stop (30) to limit the movement of the piston (26) is housed in an insert (28) adjustably mounted in a body part (10) of the nozzle. The stop (30) is also adjustable relative to the insert (28).

FIG.1



EP 0 274 260 A1

"FUEL INJECTION NOZZLE"

This invention relates to a fuel injection nozzle for supplying fuel to an internal combustion engine the nozzle being of the kind comprising a nozzle body, a bore formed in the body, a seating defined at one end of the bore, a valve member slidable in the bore and shaped at one end for co-operation with the seating, passage means through which fuel under pressure from an inlet can be applied against a step defined on the valve member to lift the valve member from the seating thereby to allow fuel flow through an outlet, resilient means located in a chamber in the body, one end of said resilient means being operatively connected to the other end of the valve member, the opposite end of the resilient means being operatively connected to a piston which is subject to said fuel pressure and which when the fuel pressure attains a predetermined value, moves through a predetermined distance from an initial position to increase the force exerted by the resilient means on the valve member.

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 said piston is located in a further bore formed in an insert which is adjustably mounted in the body whereby the initial position of the piston can be adjusted, said insert carrying an adjustable stop to enable adjustment of said predetermined distance to be effected.

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

Figure 1 is a sectional side elevation of the nozzle, and

Figure 2 is a section side elevation showing a modification to part of the nozzle of Figure 1.

Referring to the drawing the nozzle comprises a two part body 10, 11 the two parts being held in assembled relationship by means of a cap nut not shown. Within the part 11 of the body is formed a bore 12 and at the end of the bore remote from the body part 10 there is formed a seating 13. This end of the bore is also enlarged to form an enlargement 14 to which fuel under pressure can be supplied in use by way of a passage 15 which extends within the two parts of the body from a fuel inlet 16. An outlet orifice 17 extends from within the seating to the exterior of the part 11 of the body and slidable within the bore 12 is a valve member 18. The portion of the valve member which passes through the enlargement 14 is of reduced diameter and is also shaped at its end for co-operation with the seating. The other end of the valve member is provided with a projection 19 of smaller diameter than the main portion of the valve member, the projection extending through an aperture 20 into a chamber 21 which is formed in the part 10 of the body. The aperture 20 is of a larger diameter than the projection 19 but is smaller in diameter than the bore 12 so that a step is defined at the end of the bore 12, the step acting to limit the movement of the valve member away from the seating.

Located in the chamber 21 is a coiled compression spring 22 one end of which engages an abutment 23 which is mounted on the projection 19.

The other end of the spring 22 is mounted on a further abutment 24 which is carried on the reduced end portion 25 of a piston 26 slidably mounted in a bore 27 formed in an insert 28 which is mounted in axially adjustable relationship by means of screw threads, in the part 10 of the body. Extending from the bore 27 is a passage 29 which is connected to the fuel inlet 16. It will be noted that the passage 29 is of smaller diameter than the bore 27 and that the piston 26 has a tapered end so that initially only a small area of the piston 26 is exposed to the fuel pressure at the inlet, the area increasing as soon as movement of the piston occurs.

The extent of movement of the piston 26 under the action of fuel pressure is limited by means of an adjustable stop in the form of a bush 30 which is mounted in screw thread engagement on the insert 28 and which has a central aperture through which the end portion 25 of the piston passes with clearance.

The chamber 21 is vented to a low pressure through an outlet 31 and in use, when fuel under pressure is supplied to the inlet, the fuel pressure acts upon the step defined on the valve member 18 and will lift the valve member away from the seating in opposition to the force exerted by the spring 22, to allow fuel flow through the outlet orifice 17. When the fuel pressure increases above a predetermined value, the force produced by the fuel pressure acting on the piston 26 will cause movement of the piston, downwardly as shown in the drawing, into contact with the stop member 30 and in so doing the force exerted by the spring 22 on the valve member will be increased tending to cause closure of the valve member 18. The movement of the piston 26 does absorb a volume of fuel delivered by the associated fuel injection pump to the fuel inlet 16 and the effect therefore is to provide for pilot injection of fuel in advance of the main quantity of fuel.

The initial position of the piston 26 is deter-

mined by adjustment of the insert 28 within the part 10 of the body and once the correct position has been determined, a lock nut 32 is tightened to secure the insert against movement. The extent of movement of the piston is determined by adjustment of the stop member 30. The stop member 30 can be replaced as shown in Figure 2, by a shim 30A the width of which can be selected, the shim being held in position by a circlip 30B within the insert 28.

It will be appreciated that assembly of the spring abutment 23, the spring 22 and the spring abutment 24 can be carried out with the insert 28 removed from the body. This enables the part 10 of the body to be shaped so as to define the stop for the valve member 18 and it avoids the necessity of providing a stop plate between the two parts of the body as is the case with more conventional constructions where access to the end of the chamber 21 remote from the valve member is not provided.

The arrangement of the fuel inlet 16 is described in our co-pending British application 8725049 but essentially it comprises a clamp member 32A which extends around part 10 of the body and which is formed with a boss 33 which is provied with a thread through bore. A clamping element in the form of a banjo bolt 34 is engaged with the boss and the inner end of the bolt is shaped to engage within a recess formed in the part 10 of the body and from the base of which extends the passage 15. The banjo bolt when tightened draws the clamp member 32A into firm engagement with the opposite side of the body and of course a seal is established between the end of the banjo bolt and the recess. The banjo bolt in the particular example carries a double banjo union 35 and a nut 36 is provided to tighten the union against the head of the banjo bolt. One of the pipes connects to a further banjo coupling which supplies fuel to the passage 29. The outlet 31 from the chamber 21 is connected in a similar fashion to a drain conduit 37, a further banjo bolt 38 being provided which is in screw thread engagement with the clamp member 32A and which carries an elastomeric sealing member for engagement with the recess in the wall of the part 11 of the body and from which the passage 31 extends to the chamber 21.

Claims

1. A fuel injection nozzle for supplying fuel to an internal combustion engine the nozzle being of the kind comprising a nozzle body 10, 11, a bore 12 formed in the body, a seating 13 defined at one end of the bore, a valve member 18 slidable in the bore and shaped at one end for co-operation with the seating, passage means 15 through which fuel under pressure from an inlet 16 can be applied against a step defined on the valve member to lift the vave member from the seating thereby to allow fuel flow through an outlet 17, resilient means 22 located in a chamber 21 in the body, one end of said resilient means being operatively connected to the other end of the valve member, the opposite end of the resilient means being operatively connected to a piston 26 which is subject to said fuel pressure and which when the fuel pressure attains a predetermined value, move through a predetermined distance from an initial position to increase the force exerted by the resilient means on the valve member, characterised in that said piston 26 is located in a further bore 27 formed in an insert 28 which is adjustably mounted in the body 10, 11 whereby the initial position of the piston can be adjusted, said insert carrying an adjustable stop 30 to enable adjustment of said predetermined distance to be effected.

2. A nozzle according to Claim 1 characterized in that adjustable stop 30 comprises a bush which is mounted in screw thread engagement with the insert 28, said bush having a central aperture through which extends a reduced end portion 25 of the piston.

3. A nozzle according to Claim 1 characterised in that said adjustable stop 30 is in the form of a shim secured within said insert.

4. A nozzle according to Claim 1 characterised in that said insert 28 defines a passage 29 extending from the bore 27, a portion of said passage being threaded to receive a banjo coupling connected to said inlet 16.

FIG.1.

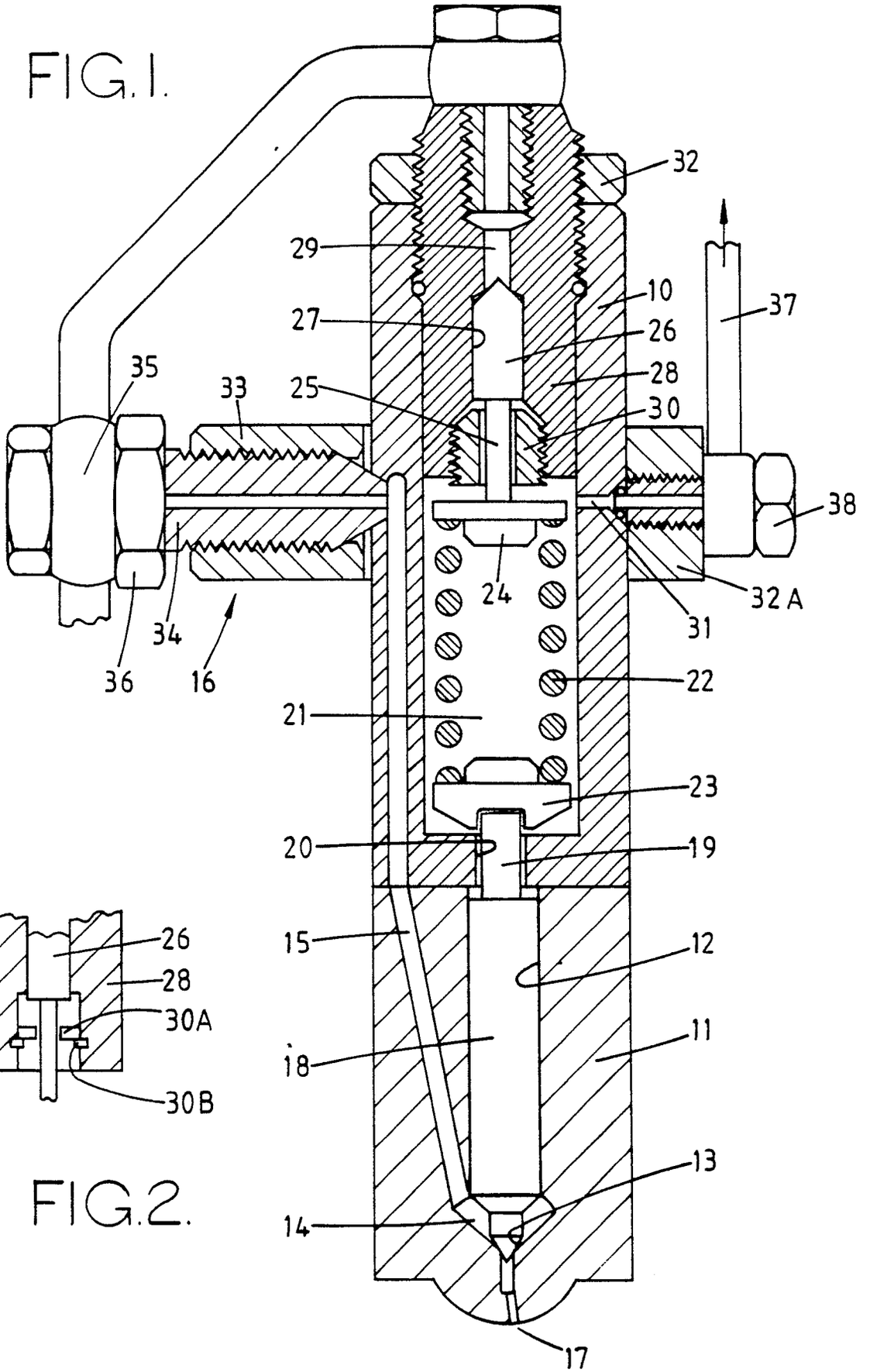

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FIG.2.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 87 31 1233

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	GB-A- 448 752 (RICARDO) * Page 3, lines 22-106; figures 1,2 *	1	F 02 M 61/20
A		4	
Y	FR-A-1 531 448 (LE MOTEUR MODERNE) * Page 1, paragraph 12 - page 2, paragraph 4; figure *	1	
Y	PATENT ABSTRACTS OF JAPAN, vol. 9, no. 92 (M-373)[1815], 20th April 1985; & JP-A-59 218 359 (MITSUBISHI JUKOGYO K.K.) 08-12-1984	1	
A	DE-A-3 409 924 (AVL) * Page 9, lines 8-35; figures 1,2 *	1	
A	GB-A- 787 635 (TEXACO) * Page 4, line 121 - page 5, line 7; figures *	1	

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	15-02-1988	HAKHVERDI M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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