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(11) Publication number:

0 460 325 A1

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: 90313449.2

(51) Int. Cl.⁵: **F02M 61/18**

(22) Date of filing: 11.12.90

(30) Priority: 08.06.90 GB 9012842

(43) Date of publication of application:
11.12.91 Bulletin 91/50

(84) Designated Contracting States:
DE FR GB IT

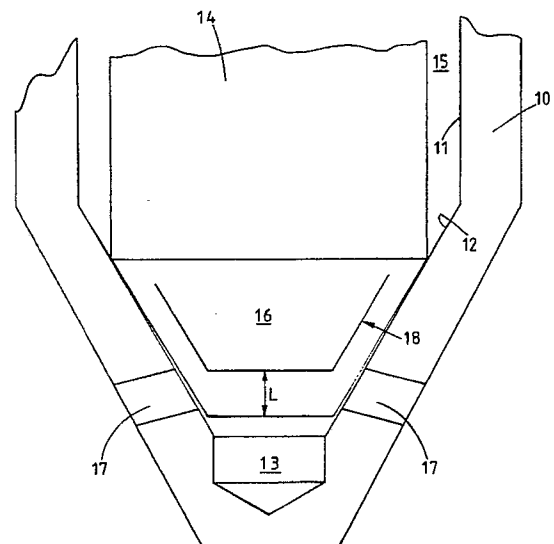
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(54) **Fuel injection nozzles.**

(57) A fuel injection nozzle having a body 10 in which is formed a blind bore 11 having a seating 12 at its inner end. The seating is of frusto-conical form and outlet orifices 17 are provided having their inner ends terminating in the seating surface. A valve member 14 is slidable in the bore and has a frusto-conical end portion 16 which in the closed position of the valve member cooperates with the seating to prevent fuel flow through the orifices and also just covers the orifices. The lift of the valve member is substantially equal to the diameter of the inner ends of the orifices so that in the open position of the valve member the inner ends of the orifices are substantially unobstructed by the valve member.



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This invention relates to fuel injection nozzles for supplying fuel to internal combustion engines, the nozzles being of the kind comprising a nozzle body in which is defined a blind bore, a frusto-conical seating at the blind end of the bore, a plurality of outlet orifices extending to the exterior of the nozzle body, said orifices having their inner ends terminating in the frusto-conical surface of the seating, and a valve member slidable in the bore and shaped to conical form at its inner end to co-operate with the seating to prevent flow of fuel through the orifices from a fuel inlet in the nozzle body, the inner end of the valve member when in engagement with the seating covering the inner ends of the orifices.

Such nozzles are known in the art as VCO nozzles (valve covers orifice) and have certain advantages over other forms of inwardly opening nozzles for example those of the type where the orifices extend from a so-called "sac" volume located downstream of the seating. In the latter form of nozzle dribble of fuel can take place through the orifices from the fuel which remains in the "sac" volume after the valve member has closed. With a VCO type of nozzle the orifices in the closed position of the valve member are effectively closed. However, known forms of VCO type nozzle appear to suffer from unequal fuel flows through the different orifices particularly where the orifices extend at different angles relative to the nozzle axis. This is thought to be due to dissimilar entry conditions at the inner ends of the orifices. A nozzle having a "sac" volume from which the orifices extend is less prone to unequal fuel flows through the orifices.

The object of the invention is to provide a fuel injection nozzle of the kind specified in an improved form.

According to the invention in a fuel injection nozzle of the kind specified the inner end of the valve member is of frusto-conical form and in the closed position just covers the inner ends of the orifices, the lift of the valve member being substantially equal to the diameter of the orifices so that in the fully open position of the valve member the inner ends of the orifices are substantially unobstructed by the valve member.

An example of a fuel injection nozzle in accordance with the invention will be described with reference to the accompanying drawing which shows to enlarged scale, and in sectional side elevation, the nozzle tip.

Referring to the drawing the nozzle comprises a nozzle body 10 in which is defined a blind bore 11 at the blind end of which there is formed a frusto-conical seating 12. The seating extends into a cylindrical recess 13 which is formed during drilling of the bore 11 and the seating 12. Slidable in the bore is a valve member 14 having its inner

end portion of a diameter smaller than that of the bore 11 so as to define an annular space 15 which is connected to a fuel inlet not shown. The valve member has a frusto-conical end portion 16 the cone angle of which is slightly greater than that of the seating 12. The valve member is biased into engagement with the seating by means of a coiled compression spring (not shown) and the valve member defines an area exposed to the pressure within the space 15 so that when fuel under pressure is admitted to the space the fuel pressure generates a force acting on the valve member to lift the valve member away from the seating against the action of the spring.

A plurality of outlet orifices 17 is provided, the orifices having their inner ends lying on the frusto-conical surface of the seating 12. In the closed position of the valve member the inner end portion of the valve member just covers the inner ends of the orifices 17 and effectively in the closed position of the valve member the orifices are closed off from the space 13. The lift of the valve member which is designated in the drawing by the letter L is arranged to be substantially equal to the diameter of the orifices so that in its fully raised position which is indicated at 18, the flat inner end of the valve member provides substantially no obstruction to the flow of fuel into the inner ends of the orifices 17.

If the orifices 17 are inclined at the same angle, the entry conditions for the fuel flowing into the inner ends of the orifices will be substantially the same and furthermore, will not be altered to any substantial extent, by any eccentricity of the seating 12 or the frusto-conical end surface of the valve member. If the orifices are inclined at different angles then the entry conditions will not be quite the same for each orifice and some variation in the fuel flow through the orifices can be expected. Nevertheless, with the construction as described, there will be substantial equality of fuel flow through the orifices 17 particularly where the orifices are at the same inclination, as compared with conventional forms of VCO nozzle where in the fully open position of the valve member the inner ends of the orifices are partially obstructed by the valve member. The reason for this appears to be that the volume of the chamber defined below the valve member when the latter is fully open, serves to reduce the velocity of fuel as compared with the fuel velocity in the clearance between the seating and the valve member. As a result there is a reduced pressure loss as the fuel flows into the orifices leading to a more uniform flow of fuel through the orifices even when the angles thereof differ.

Claims

1. A fuel injection nozzle comprising a nozzle body (10) in which is defined a blind bore (11), a frusto-conical seating (12) at the blind end of the bore, a plurality of outlet orifices (17) extending to the exterior of the body, said orifices having their inner ends terminating in the frusto-conical surface of the seating (12) and a valve member (14) slidable in the bore and shaped at its inner end (16) to conical form to cooperate with the seating (12) to prevent flow of fuel through the orifices (17) from a fuel inlet in the nozzle body, the inner end (16) of the valve member when in engagement with the seating covering the inner ends of the orifices, characterised in that the inner end (16) of the valve member is of frusto-conical form and in the closed position of the valve member just covers the inner ends of the orifices (17), the lift of the valve member being substantially equal to the diameter of the orifices (17) so that in the fully open position of the valve member the inner ends of the orifices are substantially unobstructed by the valve member.

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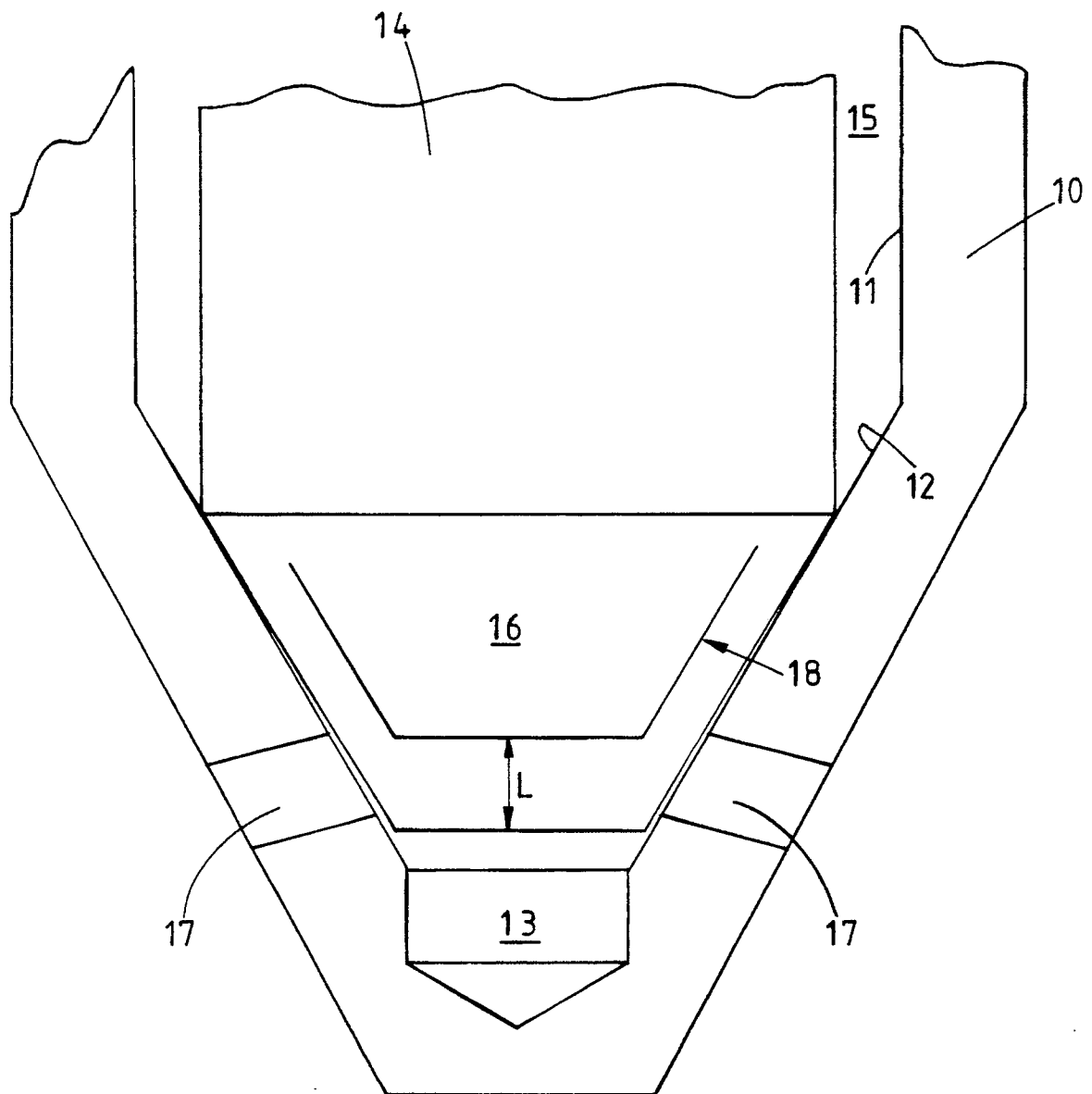
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EUROPEAN SEARCH REPORT

Application Number

EP 90 31 3449

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	PATENT ABSTRACTS OF JAPAN vol. 13, no. 300 (M-848)(3648) 11 July 1989, & JP-A-01 092569 (DIESEL KIKI) 11 April 1989, * the whole document * - - -	1	F 02 M 61/18
A	AUTOMOTIVE ENGINEERING. vol. 87, no. 11, November 1979, WARRENDALE US pages 59 - 62; "Diesel injector sprays fuel in sweep pattern" * page 60, left-hand column, paragraph 3; figure 2 * - - - - -	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F 02 M
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of search 11 July 91	Examiner SIDERIS M.
CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document 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 ----- &: member of the same patent family, corresponding document			