(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 460 326 A1**

(12) **EUROPEAN PATENT APPLICATION**

(21) Application number: **90313450.0**

(51) Int. Cl.5: **F02M 61/18**, F02M 61/06

(22) Date of filing: **11.12.90**

(30) Priority: **08.06.90 GB 9012844**

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

(84) Designated Contracting States:
DE FR GB IT

(71) Applicant: **LUCAS INDUSTRIES PUBLIC LIMITED COMPANY**
Brueton House, New Road
Solihull, West Midlands B91 3TX(GB)

(72) Inventor: **Gaskell, David John**
Firethorns, Upper Stanstead
Sudbury, Suffolk C010 9AS(GB)

(74) Representative: **Thompson, George Michael et al**
MARKS & CLERK Alpha Tower Suffolk Street Queensway
Birmingham B1 1TT(GB)

(54) Fuel injection nozzles.

(57) A fuel injection nozzle includes a body 10 defining a blind bore 11 at the inner end of which is formed a frusto conical seating 12. Outlet orifices 17 extend to the exterior of the body from the seating. A valve member 14 is slidable in the bore and has a seat engaging portion 18 which engages with the seating and also just covers the inner ends of the orifices in the closed position of the valve member. The valve member has a projection 19 in which is formed a circumferential groove 18. The lift of the valve member is substantially equal to the diameter of the inner ends of the orifices 17 and the width of the groove 18 being substantially equal to the orifice diameter.

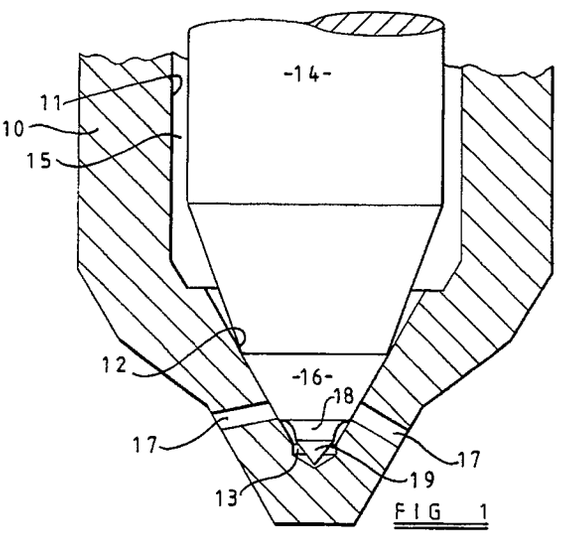

FIG 1

EP 0 460 326 A1

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 defining at its inner end a seat engaging portion which when the valve member is in the closed position co-operates with the seating to prevent flow of fuel through the orifices from a fuel inlet in the nozzle body, said seat engaging portion 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 and 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 lift of the valve member from its closed position to its open position is substantially equal to the diameter of the inner ends of the orifices and the valve member has a projection having a circumferential groove formed therein, the groove in the fully open position of the valve member being aligned with the inner ends of the orifices.

An example of a fuel injection nozzle in accordance with the invention will be described with reference to the accompanying drawings which shows to enlarged scale, and in sectional side elevation the nozzle tip, Figure 1 show the valve member in the closed position and Figure 2 the valve member in the fully open position.

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 the machining 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 conical seat engaging 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.

Extending beyond the seat engaging portion 16 of the valve member 14 is a projection 19 which is initially machined to conical form with a cone angle which is slightly greater than that of the seat engaging portion. In the closed position of the valve member the end of the projection 19 lies in close proximity to the end of the recess 13. The junction of the projection 19 and the seating is arranged so that in the closed position of the valve member it lies just beyond the inlet ends of the orifices 17. The projection 19 is formed with a circumferential groove 18 which extends to the aforesaid junction.

The orifices 17 in the closed position of the valve member are effectively closed off from the space 13. The lift of the valve member to attain the fully open position as shown in Figure 2, is substantially equal to the diameters of the orifices and the width of the groove 18 is also substantially equal to the lift. As a result in the fully open position the groove 18 is aligned with the inner ends of the orifices 17.

In the open position of the valve member the fuel flows from the space 15 along the tapering annular gap between the inner end of the valve member and the seating. Some of the fuel flows directly into the inlet ends of the orifices. However, apart from the fact that the fuel flow has to divide to feed the two orifices it also has to flow towards the orifices. The provision of the groove 18 on the valve member assists the division of the fuel and helps to ensure that the flow of fuel through the orifices is substantially equal.

Claims

1. A fuel injection nozzle for supplying fuel to an internal combustion engine, the 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 nozzle body the 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 defining at its inner end a seat engaging portion (16) which co-operates with the seating to prevent flow of fuel through the outlet orifices from a fuel inlet, the seat engaging portion (16) when in engagement with the seating covering the inner ends of the orifices (17) characterised in that the lift of the valve member (14) from its closed position to its fully open position is substantially equal to the diameter of the inner ends of the orifices and in that the valve member (14) has a projection (19) having a circumferential groove (18) formed therein, the groove (18) in the fully open position of the valve member being aligned with the inner ends of the orifices (17).

2. A nozzle according to Claim 1, characterised in that the projection (19) is formed as a cone having a cone angle slightly greater than that of the seat engaging portion (16) of the valve member.

3. A nozzle according to Claim 1 or Claim 2, characterised in that said projection extends into a recess (13) defined at the blind end of the bore.

4. A nozzle according to Claim 1, characterised in that the width of the groove (18) is substantially equal to the diameter of the inner ends of the orifices.

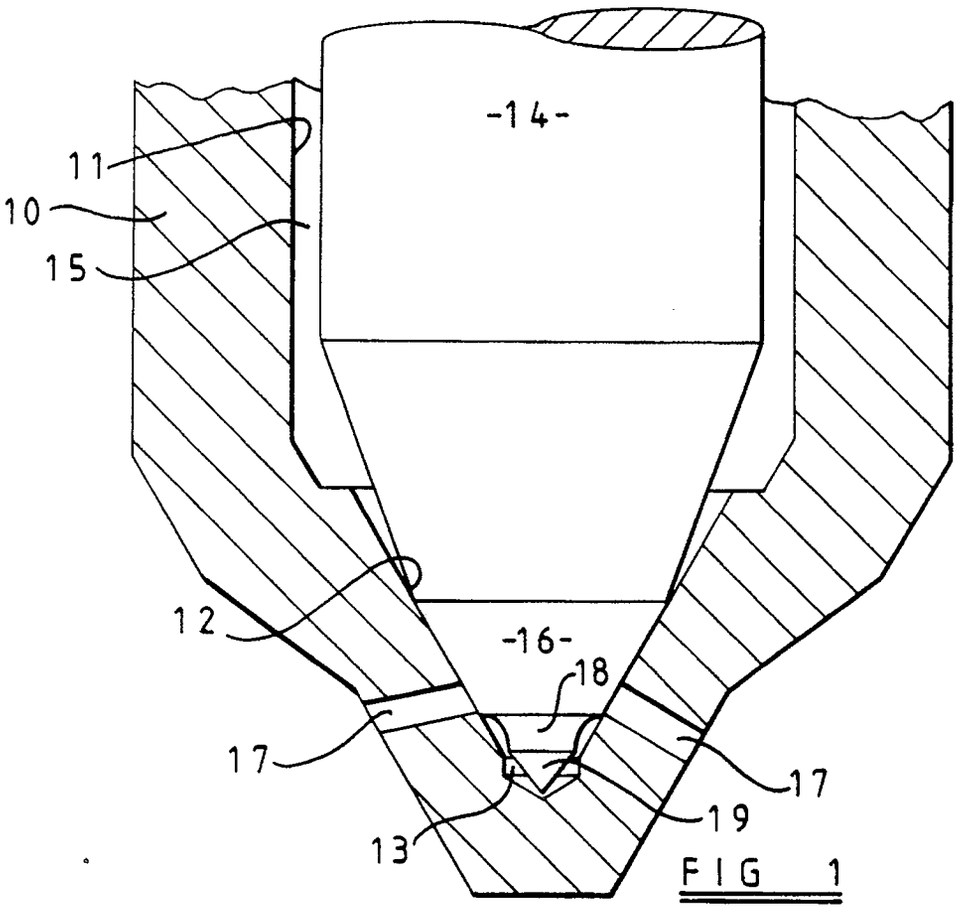

FIG 1

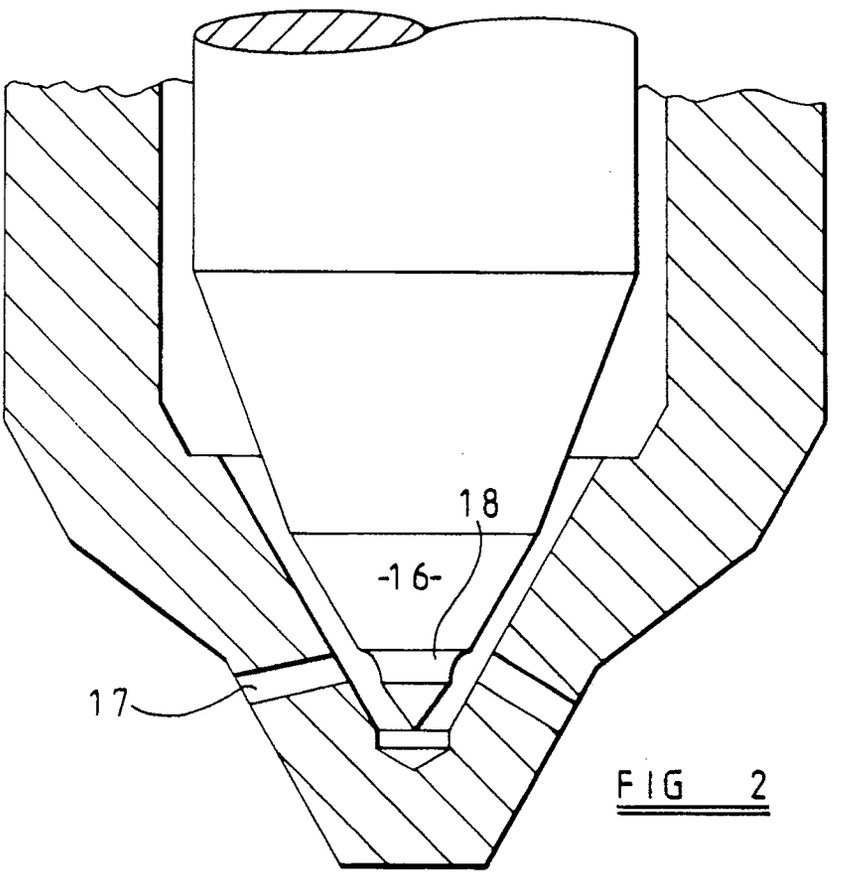

FIG 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 31 3450

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 F 02 M 61/06
A	FR-A-2 383 324 (BOSCH) * page 4, lines 14 - 24; figure 3 *	1,3,4	
A	EP-A-0 345 348 (NAUCHNO-PROIZVODSTVENNOE) * abstract; figure 1 *	2	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F 02 M

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	12 July 91	SIDERIS M.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
Y: particularly relevant if combined with another document of the same catagory
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