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

(11) EP 0 790 395 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
19.11.1997 Bulletin 1997/47

(43) Date of publication A2:
20.08.1997 Bulletin 1997/34

(21) Application number: **97102329.6**

(22) Date of filing: **13.02.1997**

(51) Int. Cl.[6]: **F02B 51/00**, C10G 9/00

(84) Designated Contracting States:
DE FR GB

(30) Priority: **14.02.1996 JP 26903/96**

(71) Applicant:
TOYOTA JIDOSHA KABUSHIKI KAISHA
Aichi-ken (JP)

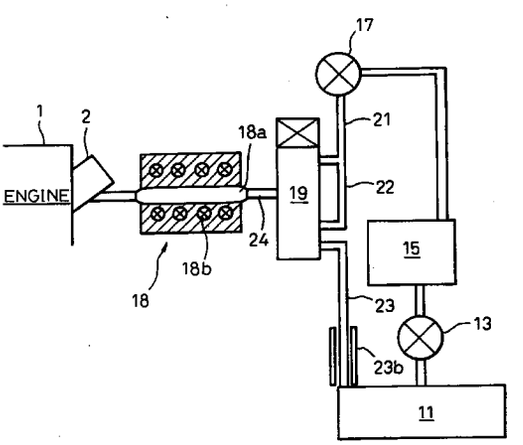
(72) Inventors:
- **Ishikiriyama, Mamoru**
  Toyota-shi, Aichi (JP)
- **Kamiya, Sumio**
  Toyota-shi, Aichi (JP)
- **Hiei, Makoto**
  Toyota-shi, Aichi (JP)
- **Takazawa, Nobuaki**
  Toyota-shi, Aichi (JP)
- **Takahashi, Yasushi**
  Toyota-shi, Aichi (JP)
- **Miyazaki, Syozi**
  Toyota-shi, Aichi (JP)

(74) Representative:
Pellmann, Hans-Bernd, Dipl.-Ing.
Patentanwaltsbüro
Tiedtke-Bühling-Kinne & Partner
Bavariaring 4
80336 München (DE)

(54) A method and a device for supplying fuel to an internal combustion engine

(57) According to the present invention, the state of a liquid fuel such as diesel fuel is made a supercritical state by raising the pressure and the temperature of the fuel above the critical pressure and temperature. Then, the fuel is injected from the fuel injection valve into the combustion chamber of the engine in the supercritical state. When the fuel in the supercritical state is injected into the combustion chamber of the engine, it forms an extremely fine uniform mist in the entire combustion chamber. Therefore, the combustion of the engine is largely improved.

Fig.1



EP 0 790 395 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 10 2329

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.6)
X	EP 0 506 069 A (UNION CARBIDE CHEM PLASTIC) 30 September 1992 * page 4, line 27 - line 40 * * page 6, line 4 - line 45 * * page 9, line 36 - page 18, line 19; figures *	1,4,7, 10,11	F02B51/00 C10G9/00
X	SU 1 242 250 A (MARTYNYUK M M) 7 July 1986	1	
X	& DATABASE WPI Derwent Publications Ltd., London, GB; * abstract *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 018, no. 444 (M-1658), 18 August 1994 & JP 06 137218 A (KIICHI TAGA), 17 May 1994, * abstract *	1	
A	US 4 189 914 A (COOPER LARRY P ET AL) 26 February 1980 * the whole document *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	US 4 522 183 A (MEIER GERD E A ET AL) 11 June 1985 * column 2, line 6 - column 5, line 36; figures *	1	F02M F02B C10G
A	US 4 358 930 A (POPE WILLIAM L ET AL) 16 November 1982 * column 4, line 48 - column 14, line 46; figures *	1	
A	DE 34 28 783 A (VEBA OEL ENTWICKLUNGS GMBH) 6 February 1986 * abstract *	18,19	

-/--

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 September 1997	Mouton, J

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

EPO FORM 1503 03.82 (P04C01)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 10 2329

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.6)
A	EP 0 423 960 A (STANDARD OIL CO OHIO) 24 April 1991 * abstract * ---	18,19	
A	US 5 007 381 A (KAKEGAWA TOSHIAKI ET AL) 16 April 1991 -----		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 September 1997	Mouton, J

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

EPO FORM 1503 03.82 (P04C01)

European Patent Office

Application Number
EP 97 10 2329

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescibed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

SEE SHEET B

☐ All further search fees have been paid within the fixed time limit. The present Eurpean search report has been drawn up for all claims.

☒ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

18,19

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions, or groups of inventions, namely:

1. Claims 1-17 : Method and device for supplying fuel to an internal combustion engine.
2. Claims 18,19 : Method for reforming diesel fuel.