

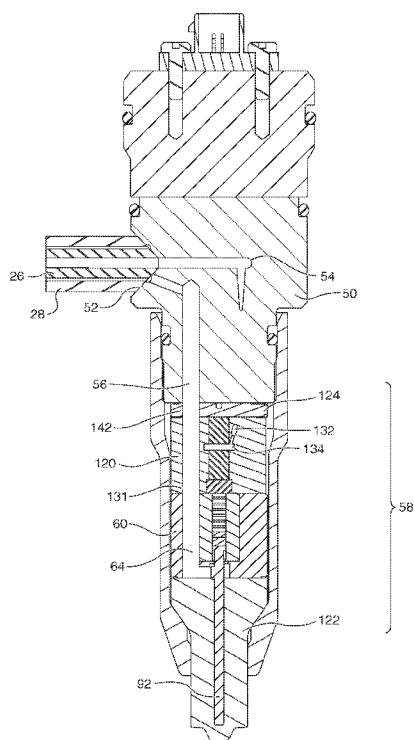


- (51) International Patent Classification:
F02M 63/00 (2006.01) *F02M 47/02* (2006.01)
F02M 43/02 (2006.01) *F02D 19/06* (2006.01)
F02M 43/04 (2006.01)
- (21) International Application Number:
PCT/US2012/022640
- (22) International Filing Date:
26 January 2012 (26.01.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
13/014,326 26 January 2011 (26.01.2011) US
- (71) Applicant (for all designated States except US): **CATERPILLAR INC.** [US/US]; 100 N.E. Adams Street, Peoria, IL 61629-9510 (US).
- (72) Inventors; and
(75) Inventors/Applicants (for US only): **DING, Xiangdong** [CA/US]; 3936 E. Creighton, Peoria, IL 61615 (US). **KIM, Hoisan** [KR/US]; 2617 W Carlisle Lane, Dunlap, IL 61525-7511 (US). **SOMMARS, Mark** [US/US]; 114 Running Elk Court, Sparland, IL 61565-9414 (US).
- (74) Agents: **ANYASO, Uchendu, O.** et al.; 100 N.E. Adams Street, Peoria, IL 61629-9510 (US).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD,

[Continued on next page]

(54) Title: DUAL FUEL INJECTOR FOR A COMMON RAIL SYSTEM

FIG. 2



(57) Abstract: A dual fuel common rail fuel injector includes a first and second control valve assembly and a first and second check needle. The dual fuel injector is capable of selectively injecting two different fuels such as diesel and liquefied natural gas. The first and second control valve assemblies operate using a single fuel, such as diesel, as the control medium. The dual fuel common rail injector further includes a hydraulic lock assembly.



SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(88) Date of publication of the international search report:

8 November 2012

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/022640

A. CLASSIFICATION OF SUBJECT MATTER INV. F02M63/00 F02M43/02 F02M43/04 F02M47/02 F02D19/06 ADD.																				
According to International Patent Classification (IPC) or to both national classification and IPC																				
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) F02M F02D Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data																				
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>US 2007/199539 A1 (LENNOX TIM [CA] ET AL) 30 August 2007 (2007-08-30)</td> <td>1,2,4, 6-8,10, 11,13 3,5,9,12</td> </tr> <tr> <td>A</td> <td>paragraphs [0010], [0023], [0024], [0042], [0043], [0052]; figures 1,3 -----</td> <td></td> </tr> <tr> <td>X</td> <td>US 2002/070295 A1 (BAKER S MICHAEL [CA] ET AL) 13 June 2002 (2002-06-13)</td> <td>1,2,4, 6-8,10, 11,13 3,5,9,12</td> </tr> <tr> <td>A</td> <td>paragraph [0082]; figures 9-12 -----</td> <td></td> </tr> <tr> <td>X</td> <td>EP 0 778 410 A1 (WAERTSILAE DIESEL INT [FI] WAERTSILAE NSD OY AB [FI]) 11 June 1997 (1997-06-11) abstract; figure 1 ----- -/-</td> <td>1,3,7,9</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	US 2007/199539 A1 (LENNOX TIM [CA] ET AL) 30 August 2007 (2007-08-30)	1,2,4, 6-8,10, 11,13 3,5,9,12	A	paragraphs [0010], [0023], [0024], [0042], [0043], [0052]; figures 1,3 -----		X	US 2002/070295 A1 (BAKER S MICHAEL [CA] ET AL) 13 June 2002 (2002-06-13)	1,2,4, 6-8,10, 11,13 3,5,9,12	A	paragraph [0082]; figures 9-12 -----		X	EP 0 778 410 A1 (WAERTSILAE DIESEL INT [FI] WAERTSILAE NSD OY AB [FI]) 11 June 1997 (1997-06-11) abstract; figure 1 ----- -/-	1,3,7,9
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.																		
X	US 2007/199539 A1 (LENNOX TIM [CA] ET AL) 30 August 2007 (2007-08-30)	1,2,4, 6-8,10, 11,13 3,5,9,12																		
A	paragraphs [0010], [0023], [0024], [0042], [0043], [0052]; figures 1,3 -----																			
X	US 2002/070295 A1 (BAKER S MICHAEL [CA] ET AL) 13 June 2002 (2002-06-13)	1,2,4, 6-8,10, 11,13 3,5,9,12																		
A	paragraph [0082]; figures 9-12 -----																			
X	EP 0 778 410 A1 (WAERTSILAE DIESEL INT [FI] WAERTSILAE NSD OY AB [FI]) 11 June 1997 (1997-06-11) abstract; figure 1 ----- -/-	1,3,7,9																		
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.																				
* Special categories of cited documents : <table border="0"> <tr> <td> "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed </td> <td> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family </td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family																
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family																			
Date of the actual completion of the international search		Date of mailing of the international search report																		
30 August 2012		06/09/2012																		
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Boye, Michael																		

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/022640

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 499 862 A (BAEUMER KLAUS [DE] ET AL) 19 February 1985 (1985-02-19) cited in the application abstract; figure 1 -----	1-13
E	EP 2 487 353 A2 (CATERPILLAR INC [US]) 15 August 2012 (2012-08-15) the whole document -----	1-13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/022640

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007199539 A1	30-08-2007	AU 2007200381 A1 CA 2532775 A1 US 2007199539 A1	29-03-2007 10-04-2006 30-08-2007
US 2002070295 A1	13-06-2002	AU 2002342473 A1 BR 0214298 A CA 2465182 A1 CN 1589369 A EP 1448884 A1 US 2002070295 A1 US 2004256495 A1 WO 03044358 A1	10-06-2003 21-09-2004 30-05-2003 02-03-2005 25-08-2004 13-06-2002 23-12-2004 30-05-2003
EP 0778410 A1	11-06-1997	DE 69607304 D1 DE 69607304 T2 EP 0778410 A1 FI 955900 A NO 965230 A	27-04-2000 30-11-2000 11-06-1997 09-06-1997 09-06-1997
US 4499862 A	19-02-1985	DE 3243176 A1 FR 2536462 A1 GB 2130650 A JP 1022470 B JP 1536799 C JP 59126060 A US 4499862 A	24-05-1984 25-05-1984 06-06-1984 26-04-1989 21-12-1989 20-07-1984 19-02-1985
EP 2487353 A2	15-08-2012	CN 102635472 A EP 2487353 A2 US 2012204835 A1	15-08-2012 15-08-2012 16-08-2012