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(54) Title: CRYOGENIC FUEL COMPOSITIONS AND DUAL FUEL AIRCRAFT SYSTEM

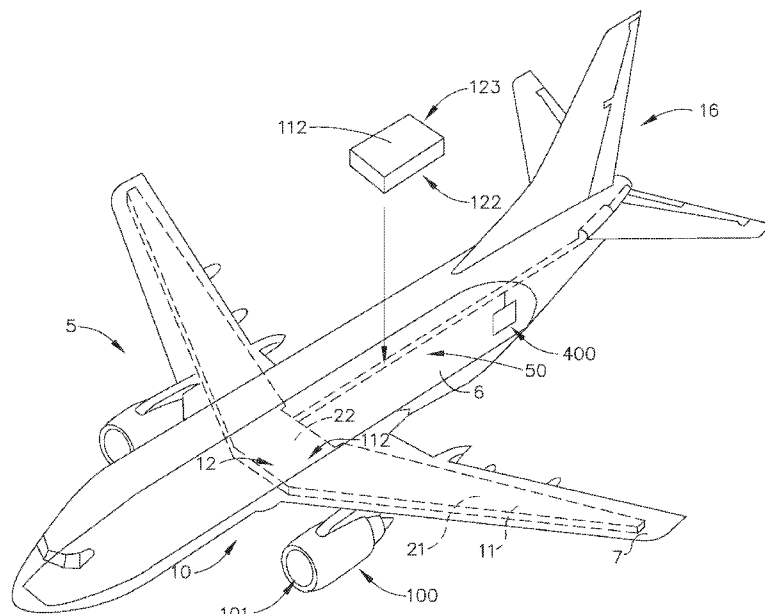


FIG. 1

(57) Abstract: Cryogenic fuel compositions including a cryogenic fuel and paraxylene and a dual fuel aircraft system for an aircraft having at least one turbine engine, including a first fuel system for providing a first fuel from a first fuel tank to the turbine engine and a second fuel system for providing a cryogenic fuel composition and having a second fuel tank storing LNG and fluidly coupled to the turbine engine, an additive tank storing additives and fluidly coupled to the turbine engine and a mixing device configured to create the cryogenic fuel composition.



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- *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:**
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INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER

INV. C10L3/00 C10L3/08 C10L10/08 F02C7/22 F02M25/00
ADD. C10L1/16

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)

C10L F02C F02M

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, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 1 274 803 A (SHELL INT RESEARCH [NL]) 17 May 1972 (1972-05-17) page 1, line 37 - line 96 examples	1-7
A	----- WO 2011/022086 A1 (SYNFUELS INT INC [US]; PETERSON EDWARD R [US]; ROLFE THOMAS A [US]) 24 February 2011 (2011-02-24) paragraphs [0003], [0008], [0009], [0024], [0029], [0041] claims 1,3; figure 2 ----- -/-	1-7



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"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

5 August 2014

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13/08/2014

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/071800

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	LUKS K D ET AL: "SOLUBILITY OF HYDROCARBONS IN CRYOGENIC NGL AND LNG", HYDROCARBON PROCESSING, GULF PUBLISHING CO. HOUSTON, US, vol. 54, no. 5, 1 May 1975 (1975-05-01), pages 181-184, XP009177882, ISSN: 0018-8190 table 4	1-7
A	----- SINGH A P ET AL: "Determination of benzene and total aromatics in commercial gasolines using packed column GC and NMR techniques", FUEL, IPC SCIENCE AND TECHNOLOGY PRESS, GUILDFORD, GB, vol. 82, no. 1, 1 January 2003 (2003-01-01), pages 23-33, XP004385972, ISSN: 0016-2361, DOI: 10.1016/S0016-2361(02)00157-6 abstract page 26, paragraph 3.1 - page 32, paragraph 3.5 figure 1; tables 2, 4, 6, 8	1-7
Y	----- WO 2012/045028 A1 (GEN ELECTRIC [US]; EPSTEIN MICHAEL JAY [US]; MURROW KURT DAVID [US]; D) 5 April 2012 (2012-04-05) abstract paragraph [0027] claims 29-31	8-13
Y	----- AU 62058 80 A (BARRY HODSON NOMINEES PTY LTD) 20 August 1981 (1981-08-20) the whole document	8-13
Y	----- EP 0 761 961 A1 (METEOR [US] ORBITAL ENG PTY [AU]) 12 March 1997 (1997-03-12) column 1, line 3 - line 9 column 2, line 2 - line 5 column 3, line 5 - line 11 column 3, line 28 - line 36 column 5, line 12 - line 17 column 5, line 43 - line 50 column 8, line 22 - line 37 column 9, line 29 - line 56	8-13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/071800

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-7

A cryogenic fuel composition comprising LNG and paraxylene being soluble in the LNG.

2. claims: 8-13

A dual fuel aircraft system for an aircraft having at least one turbine engine, comprising a first fuel system for providing a first fuel from a first fuel tank to the turbine engine; and a second fuel system for providing a cryogenic fuel composition and having a second fuel tank suitable for storing LNG and fluidly coupled to the turbine engine, an additive tank suitable for storing benzene, toluene and/or xylenes, and fluidly coupled to the turbine engine and a mixing device configured to create a cryogenic fuel composition comprising a major amount of LNG and a minor amount of the additive to the turbine engine.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2013/071800

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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WO 2011022086	A1	24-02-2011	AU 2010284611 A1	16-02-2012
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			DE 69628979 T2	12-02-2004
			EP 0761961 A1	12-03-1997
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