



(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
25.10.2017 Bulletin 2017/43

(51) Int Cl.:
C10L 1/10 (2006.01) **C10L 10/02** (2006.01)
C10L 10/10 (2006.01) **C10L 1/16** (2006.01)
C10L 1/26 (2006.01) **C10L 1/30** (2006.01)

(43) Date of publication A2:
04.10.2017 Bulletin 2017/40

(21) Application number: **17161582.6**

(22) Date of filing: **17.03.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(72) Inventors:
• **Factor, Stephen A.**
Richmond, VA 23233 (US)
• **McAfee, Zachary John**
Richmond, VA 23226 (US)
• **Calderone III, Joseph Anthony**
Powhatan, VA 23139 (US)

(30) Priority: **29.03.2016 US 201615083964**

(74) Representative: **Schwabe - Sandmair - Marx**
Patentanwälte Rechtsanwalt
Partnerschaft mbB
Joseph-Wild-Straße 20
81829 München (DE)

(71) Applicant: **Afton Chemical Corporation**
Richmond, Virginia 23219 (US)

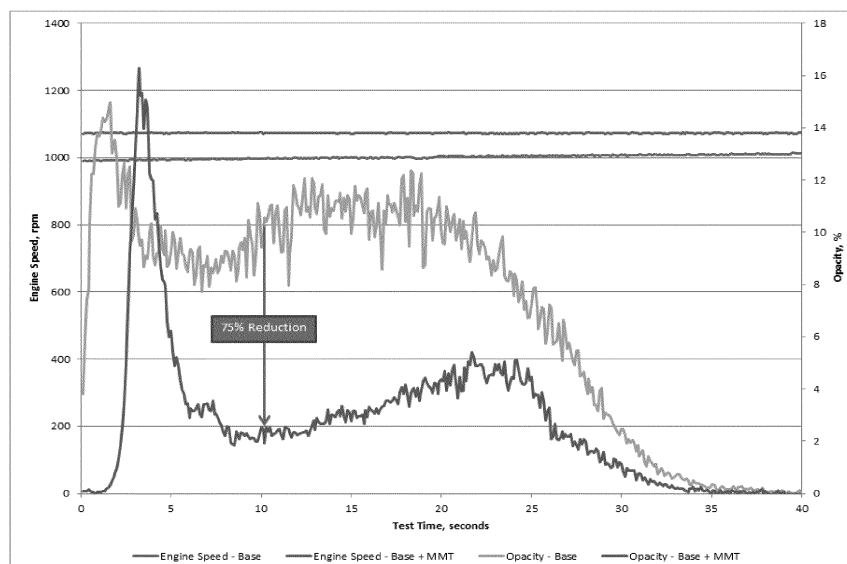
(54) **METHOD AND COMPOSITION FOR IMPROVING THE COMBUSTION OF AVIATION FUELS**

(57) An aviation fuel is formulated with manganese-containing compounds. The composition may include relatively high amounts of manganese up to about 500 mg Mn/l. A manganese-containing additive may reduce the smoke created during the combustion of the aviation fuel. Additionally, the aviation fuel composition

may include manganese to improve octane and include a phosphorus-containing scavenger to reduce manganese oxide engine deposits. Further, isooctane is added in order to, with the manganese-containing compound, improve the octane number of the fuel.

FIGURE 1

Idle Test – Zoom 0 – 40 Seconds





EUROPEAN SEARCH REPORT

Application Number
EP 17 16 1582

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2 818 417 A (BROWN JEROME E ET AL) 31 December 1957 (1957-12-31) * the whole document *	1-9	INV. C10L1/10 C10L10/02 C10L10/10 C10L1/16 C10L1/26 C10L1/30
Y	EP 0 609 089 A1 (ETHYL PETROLEUM ADDITIVES INC [US]) 3 August 1994 (1994-08-03) * the whole document *	1-9	
A	US 4 390 345 A (SOMORJAI GABOR A [US]) 28 June 1983 (1983-06-28) * claim 1 *	1-9	
A	Thomas A Ward: "3.4.1 Aviation fuel", Aerospace Propulsion Systems, 1 January 2010 (2010-01-01), pages 202-213, XP055375556, Retrieved from the Internet: URL: http://eu.wiley.com/WileyCDA/WileyTitle/productCd-0470824972.html [retrieved on 2017-05-04] * page 202 *	1-9	
			TECHNICAL FIELDS SEARCHED (IPC)
			C10L
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 24 May 2017	Examiner Greß, Tobias
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)



Application Number

EP 17 16 1582

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

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 European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ 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:

☒ 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:

1-9

☐ The present supplementary 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 (Rule 164 (1) EPC).

**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

EP 17 16 1582

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:

1. claims: 1-9

A substantially unleaded aviation fuel composition comprising aviation alkylate, optionally up to 50 vol-% isooctane, a cyclopentadienyl manganese tricarbonyl compound, and a manganese scavenger; wherein the composition is substantially lead-free, and the composition has a rating number of at least about 96 as determined by ASTM Test Method D 2700.

2. claims: 10-12

An aviation fuel additive composition comprising mandatory isooctane, a cyclopentadienyl manganese tricarbonyl compound, and a manganese scavenger; wherein the additive is substantially lead-free.

3. claims: 13, 14

A method of increasing the octane rating number of a substantially unleaded aviation fuel comprising the steps of: providing a (unleaded or leaded) fuel additive composition comprising mandatory isooctane, a cyclopentadienyl manganese tricarbonyl compound, and a manganese scavenger; adding the fuel additive composition to a substantially unleaded aviation base fuel composition, wherein the resulting fuel composition has a rating number of at least about 98 as determined by ASTM Test Method D 2700.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 16 1582

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

24-05-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2818417	A	31-12-1957	NONE
EP 0609089	A1	03-08-1994	AU 6167294 A 15-08-1994
		CA 2114499 A1 30-07-1994	
		DE 69400882 D1 19-12-1996	
		DE 69400882 T2 06-03-1997	
		EP 0609089 A1 03-08-1994	
		US 6238446 B1 29-05-2001	
		WO 9417158 A1 04-08-1994	
US 4390345	A	28-06-1983	NONE