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Declarations under Rule 4.17:

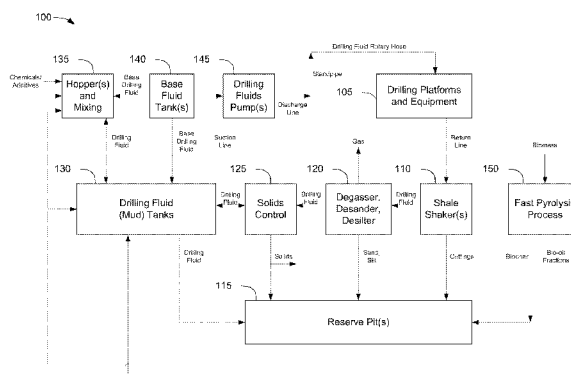
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

Published:

- with international search report (Art. 21(3))

[Continued on next page]

(54) **Title:** COMPOSITIONS, METHODS, APPARATUS, AND SYSTEMS FOR INCORPORATING BIO-DERIVED MATERIALS IN DRILLING AND HYDRAULIC FRACTURING

Fig. 1

(57) **Abstract:** The present invention provides compositions, methods, apparatus, and systems to minimize environmental impact, water use, and overall cost of drilling and hydraulic fracturing for crude oil and natural gas. Some variations of the invention provide a fracturing-fluid additive composition comprising a water-soluble portion of a biomass-pyrolysis liquid. In some embodiments, the fracturing-fluid additive composition is substantially biodegradable and is not toxic. Some variations provide improved proppants for oil or gas well fracturing. Other variations of this invention relate to drilling-fluid additive compositions, and methods of using these compositions. This invention can significantly improve the environmental, economic, and social sustainability associated with drilling and fracturing for production of oil and gas.



— *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))*

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/039486**A. CLASSIFICATION OF SUBJECT MATTER****E21B 43/20(2006.01)i, E21B 7/00(2006.01)i**

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)

E21B 43/20; C04B 24/02; C23G 1/02; E21B 43/267; E21B 37/00; E21B 33/16; C07C 1/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: fracturing fluid, biomass, pyrolysis, toxicity and biodegradable.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 7231976 B2 (SANDRA L. BERRY et al.) 19 June 2007	10
Y	See abstract and claims 1, 5, 10, 11, 16.	1-9, 11-25
Y	WO 2010-033512A1(REGENTS OF THE UNIVERSITY OF MINNESOTA et al.)25 March 2010	1-9, 11-25
A	See abstract, page 24, line 13 - page 26, line 13 and claims 1, 7, 8.	10
A	US 05614475A A (MOORHOUSE; RALPH et al.) 25 March 1997	1-25
	See abstract and claims 1, 20.	
A	EP 1728771 A2 (W.R. GRACE & CO.-CONN.) 06 December 2006	1-25
	See abstract and claims 1, 2.	



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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"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

07 DECEMBER 2012 (07.12.2012)

Date of mailing of the international search report

10 DECEMBER 2012 (10.12.2012)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/039486

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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