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(54) Title: FRACTURE WATER TREATMENT METHOD AND SYSTEM

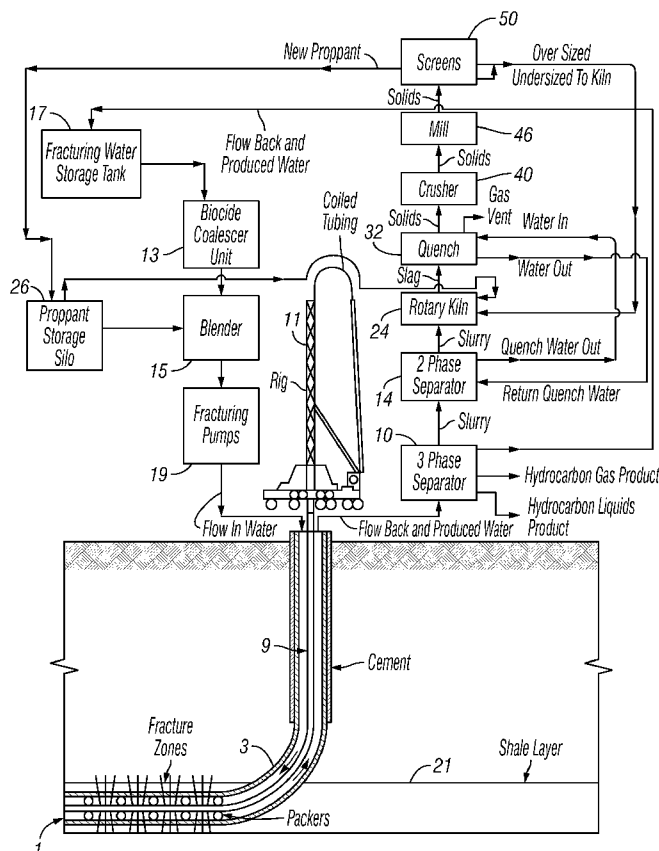


FIG. 1

(57) Abstract: A method and system for treatment of flow-back and produced water from a hydrocarbon well in which fracturing operations are carried out using a phase separation and creating of positive charge in the water.



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- *with international search report (Art. 21(3))*
- *the filing date of the international application is within two months from the date of expiration of the priority period (Rule 26bis.3)*

Declarations under Rule 4.17:

- *of inventorship (Rule 4.17(iv))*

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

25 June 2015

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US13/53125

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - E21B 43/34 (2014.01)

USPC - 166/305.1; 210/194; 241/24.11

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)

IPC(8) : B02C13/00, 15/00, 19/00, 23/00; E21B 43/12, 34, 43/36 (2014.01)

USPC : 166/305.1; 507/200; 210/194, 737; 241/3, 21, 23, 24.11, 65, 79, 81, 152.2

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)

MicroPatent (US-G, US-A, EP-A, EP-B, WO, JP-bib, DE-C,B, DE-A, DE-T, DE-U, GB-A, FR-A); Google Scholar; IEEE; ProQuest;
KEYWORDS: Water, Fractur*, Breakthrough, crack*3, split*4, Separat*, Divi*4, Parting, Screen*3, Flow*, Stream*1, Suspen*, Flotat*,
Flow*3, solid*1, Positiv*, Plus, Charg*, Ioniz*, manifold, area, diameter,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2012/0181014 A1 (DAUSSIN R et al.) July 19, 2012; figures 2-3; paragraphs [0006], [0007], [0008], [0021], [0033]	1, 3, 5-9, 12, 20, 28-34 --- 2, 4, 10-11, 13-15, 21-27, 35-36
Y	US 2004/0244983 A1 (APPLEFORD D et al.) December 9, 2004; abstract; paragraphs [0006], [0009]	2, 15
Y	US 6,063,267 A (CREWSON W et al.) May 16, 2000; abstract; column 1, lines 5-14; column 3, lines 2-10; lines 29-35; column 6, lines 10-14; lines 20-27	4, 21-27
Y	US 2009/0133578 A1 (BRAS E et al.) May 28, 2009; figure 1; paragraphs [0002], [0005], [0011], [0018], [0023], [0054], [0072]	10-11, 13-15, 35-36

☐ Further documents are listed in the continuation of Box C.

* 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

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US13/53125

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:

-Please See Supplemental Page-

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 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.:
1-36

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.

Continued from Box No. III: Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-36 are directed toward a means for separating solids from fracture water.

Group II: Claims 37-42 are directed toward a multi-phase separator.

Group III: Claims 43-52 are directed toward establishing a water/liquid hydrocarbon interface in a three-phase separator.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons.

The special technical features of Group I include means for separating solids from fracture water, wherein a flow of water with suspended solids results; means for separating the flow of water into a plurality of flows of water; means for generating positive charge in the plurality of flows of water, wherein a plurality of flows of positively-charged water results; and means for comingling the plurality of flows of positively-charged water after said generating (which are not present in Groups II, III).

The special technical features of Group II include a multi-phase separator; a manifold having an input port connected to an output of the multi phase separator and having multiple output ports; a plurality of pipes, each having coils wound on the pipe, wherein each pipe has an input end connected to an output port of the manifold and each pipe has an output end; a co-mingling manifold having input ports connected to the output ends of the plurality of pipes (which are not present in Groups I, III).

The special technical features of Group III include establishing a water/liquid hydrocarbon interface in a three-phase separator; measuring the water/liquid hydrocarbon interface in the three-phase separator, wherein a water/liquid hydrocarbon interface measurement signal results; comparing the water/liquid hydrocarbon interface measurement signal to a set point, wherein a comparison signal results; reducing the flow-back or produced water into the three-phase separator of hydrocarbon well fracture water when the comparison signal indicates the water/liquid hydrocarbon interface is above the set point; and increasing flow into the three-phase separator when the comparison signal indicates the water/liquid hydrocarbon interface is below the set point, wherein the increasing flow comprises hydrocarbon well fracture water from a well and make-up water from a storage tank or a lagoon (which are not present in Groups I, II).

The common technical features of Groups I, II, and III are treating hydrocarbon well fracture water with a separator.

These common technical features are disclosed by US 2012/0181014 A1 (DAUSSIN): treating hydrocarbon well fracture water method for servicing (treating) a wellbore (hydrocarbon well) water stream (fracture water) from a hydrocarbon well; paragraph [0006]) with a separator (fluid treatment system 210 generally comprises an electrocoagulation unit 360, a separation unit 370 (separator), an ozone generator 380, and an ultraviolet irradiation unit 390; figure 3; paragraph [0029]).

Because the common technical features are disclosed by Daussin, the inventions are not so linked as to form a single general inventive concept. Therefore, Groups I, II, and III lack unity.