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- (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, BN, 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, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
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[Continued on next page]

(54) Title: METHODS OF DETERMINING FRONT PROPAGATION WITHIN A SUBSURFACE VOLUME

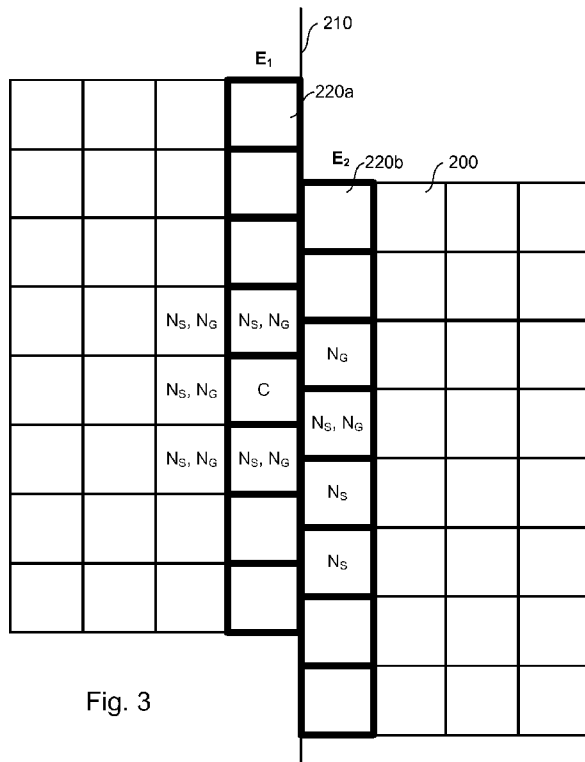


Fig. 3

(57) Abstract: Disclosed is a method of determining front propagation within a subsurface volume such as a reservoir. The subsurface volume comprises a plurality of cells and at least one geological fault (210). The method comprises performing a fast marching algorithm so as to determine said front propagation in terms of the time of arrival of the front at a particular cell from one or more neighbouring cells which make up the neighbourhood of said particular cell. For each faulted cell (C) that is adjacent a geological fault, the neighbourhood of the faulted cell is defined as comprising only its geometric neighbours (N_s , N_G cells and N_G cells) where the geometric neighbours are those cells that are in contact with the faulted cell in a geometric sense, regardless of stratification.



SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
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Published:

— *with international search report (Art. 21(3))*

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

27 August 2015

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2014/073981

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.:
1-7, 23-26

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.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/073981

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01V99/00
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)
G01V
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		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/057418 A1 (LI DACHANG [US] ET AL) 4 March 2010 (2010-03-04) figures 2, 4A, 4D, 5A-B, 7 paragraphs [0002], [0037], [0041] - [0044], [0054], [0056], [0066] - [0067], [0073] paragraphs [0112] - [0115] -----	1-7, 23-26
A	US 2010/252270 A1 (KIM CHUL-SUNG [US] ET AL) 7 October 2010 (2010-10-07) figures 1-4 paragraphs [0003] - [0004], [0024], [0033], [0036] - [0048], [0052] ----- -/--	1,2

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

4 March 2015

Date of mailing of the international search report

01/07/2015

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/073981

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 2008/154505 A1 (KIM CHUL-SUNG [US] ET AL) 26 June 2008 (2008-06-26) figure 4 paragraphs [0031] - [0032], [0034], [0039] - [0044], [0047] - [0048] -----	1
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A	US 2012/035896 A1 (WU JIANBING [US] ET AL) 9 February 2012 (2012-02-09) figure 7 paragraphs [0040], [0042] -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/EP2014/073981

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			WO 2012021292 A1	16-02-2012

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, 23-26

 fault modelling

2. claims: 8-22

 simulated well test
