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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 nextpage]

(54) **Title:** MULTI ZONE MONITORING IN BOREHOLES

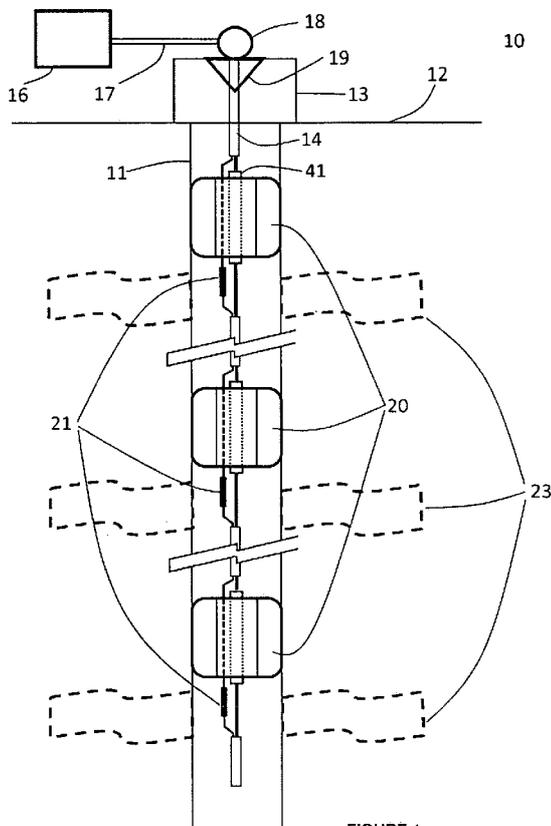


FIGURE 1

(57) **Abstract:** A multi-zone monitoring system allowing simultaneous measurement of separate zones of multi-zone well bore formations comprising a multi-component umbilical containing both electrical lines and a hydraulic fluid lines, an inflatable isolation packer that can traverse through the well bore and be inflated with hydraulic fluid to seal off a portion of the well bore wherein the inflatable isolation packer is connected to a hydraulic line of the multicomponent umbilical, wherein the inflatable isolation packer further comprises: one or more cable bypass feed throughs for the umbilical's electric and hydraulic fluid lines, wherein the hydraulic line is attached to the inflatable isolation packer with compression fittings.





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

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Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.1 7(H))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.1 7(iii))*

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

5 November 2015

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 14/54009

<p>A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - E21B 33/12, 33/124, 33/127 (2015.01) CPC - E21B 33/122, 33/1265, 33/1293 According to International Patent Classification (IPC) or to both national classification and IPC</p>																													
<p>B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC(8): E21B 33/00, 33/12, 33/124, 33/127 (2014.01) CPC: E21B 33/122, 33/1265, 33/1293; USPC: 166/1 18, 119, 120, 385 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 Granted, US Applications, EP-A, EP-B, WO, JP, DE-G, DE-A, DE-T, DE-U, GB-A, FR-A); Google.com.scholar.google.com; DialogPro (Derwent, INSPEC, NTIS, PASCAL, Current Contents Search, Dissertation Abstracts Online, Inside Conferences); KEYWORDS: packer, inflatable, deflate, expand, seal, hydraulic, electrical, umbilical, bypass, fitting, connector, pu</p>																													
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>us 2011/0036560 A1 (VAIL III W. B. et al.) February 17, 2011; figures 1A, 6; paragraph [0370]</td> <td>1-15, 16A</td> </tr> <tr> <td>X</td> <td>us 2006/0266530 A1 (ECHOLS R. H.) November 30, 2006; paragraph [0045]</td> <td>26-27</td> </tr> <tr> <td>A</td> <td>us 2005/0257928 A1 (ARIZMENDI N. et al.) November 24, 2005; entire document</td> <td>1-27</td> </tr> <tr> <td>A</td> <td>us 2007/0151735 A1 (RAVENSBERGEN J. E. et al.) July 05, 2007; entire document</td> <td>1-27</td> </tr> <tr> <td>A</td> <td>us 2011/0011320 A1 (YEMINGTON C. R.) January 20, 2011; entire document</td> <td>1-27</td> </tr> <tr> <td>A</td> <td>us 6,325,144 B1 (TURLEY R. A. et al.) December 04, 2001; entire document</td> <td>1-27</td> </tr> <tr> <td>A</td> <td>us 8,061,430 B2 (DU M. H. et al.) November 22, 2011; entire document</td> <td>1-27</td> </tr> <tr> <td>A</td> <td>us 8,353,348 B2 (CHITWOOD J. E. et al.) January 15, 2013; entire document</td> <td>1-27</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	us 2011/0036560 A1 (VAIL III W. B. et al.) February 17, 2011; figures 1A, 6; paragraph [0370]	1-15, 16A	X	us 2006/0266530 A1 (ECHOLS R. H.) November 30, 2006; paragraph [0045]	26-27	A	us 2005/0257928 A1 (ARIZMENDI N. et al.) November 24, 2005; entire document	1-27	A	us 2007/0151735 A1 (RAVENSBERGEN J. E. et al.) July 05, 2007; entire document	1-27	A	us 2011/0011320 A1 (YEMINGTON C. R.) January 20, 2011; entire document	1-27	A	us 6,325,144 B1 (TURLEY R. A. et al.) December 04, 2001; entire document	1-27	A	us 8,061,430 B2 (DU M. H. et al.) November 22, 2011; entire document	1-27	A	us 8,353,348 B2 (CHITWOOD J. E. et al.) January 15, 2013; entire document	1-27
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<p><input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/></p>																													
<p>* 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</p>																													
<p>Date of the actual completion of the international search 05 May 2015 (05.05.2015)</p>		<p>Date of mailing of the international search report 04 JUN 2015</p>																											
<p>Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201</p>		<p>Authorized officer. Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774</p>																											

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 14/54009

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.:

- 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.

-"-Certain defects in the international application-"-

Claim 16, as it currently appears in the instant PCT application, contains the following defects: Claim 16 contains a period after the second line, then appears to continue as an independent claim. For the purposes of this opinion, claim 16 should be broken into claims 16A and 16B, claim 16A containing everything before the first period and claims 16B containing everything after the first period.

-"-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 1-11, 16A are directed toward a multi-zone monitoring system comprising one or more cable bypass feed throughs for the umbilical's electric and hydraulic fluid lines.

Group II: claims 12-15, 16B are directed toward a multi-zone borehole monitoring system comprising: a) a winch; b) an umbilical comprising a plurality of metal jacketed tubes.

Group III: claims 17-25 are directed toward a method of monitoring geologic formations comprising attaching monitoring equipment to the umbilical.

Group IV: claims 26-27 are directed toward a cutting or piercing a bladder of the inflatable isolation packer.

The inventions listed as Groups I-IV 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 a) a multi-component umbilical containing both electrical lines and hydraulic fluid lines (which is not present in Groups II-IV); b) an inflatable isolation packer that can be inflated with hydraulic fluid to seal off a portion of the well bore (which is not present in Group II); c) wherein the inflatable isolation packer further comprises: one or more cable bypass feed throughs for the umbilical's electric and hydraulic fluid lines; d) wherein an hydraulic line of the multi-component umbilical is attached to a pump and the inflatable isolation packer with pressure testable sealed connectors and compression fittings (which is not present in Groups II-IV).

The special technical features of Group II include a) a winch; b) an umbilical comprising a plurality of metal jacketed tubes structured to be positioned downhole in a wellbore; c) at least one jacketed metal tube of the umbilical containing electrical wires; d) at least one jacketed metal tube of the umbilical in communication with a fluid pump; e) at least one inflatable isolation packer in communication with the umbilical; and f) electrically powered wellbore monitoring sensors positioned downhole in the wellbore in communication with the umbilical (which is not present in Groups I, III-IV).

The special technical features of Group III include a) attaching a plurality of inflatable isolation packers at predetermined distances to an umbilical containing a hydraulic line for inflating each packer; b) monitoring each connection of the hydraulic line to each inflatable isolation packer; c) attaching monitoring equipment to the umbilical at predetermined distances to the umbilical; d) lowering the monitoring equipment and inflatable isolation packers down a wellbore using the umbilical; and e) monitoring at least one equipment connection and hydraulic line connection at a surface (which is not present in Groups I-II, IV).

The special technical features of Group IV include cutting or piercing a bladder of the inflatable isolation packer to discharge the inflating fluid causing the inflatable isolation packer to deflate (which is not present in Groups I-III).

The common technical features of Groups I-IV include an umbilical containing electrical lines and hydraulic fluid lines; b) an inflatable isolation packer that can traverse through the well bore and be inflated with hydraulic fluid to seal off a portion of the well bore; wherein the umbilical is attached to a pump.

These common technical features are disclosed by US 2011/0036560 A1 (VAIL): an umbilical (5500/116; figures 1A, 6; paragraphs [0264], [0361]) containing electrical lines (5510, 5512, 5514, 5516, 5518, 5520, 5522, 5524, 5526, 5528, 5530, 5532; shown in figure 1A; paragraph [0285]) and hydraulic fluid lines (5502, 5504; figure 1A; paragraph [0281]); an inflatable isolation packer (AWOBMs 140, 142 (inflatable isolation packers) comprise inflatable packer like elements; figure 6; paragraph [0363]) that can traverse through the well bore (equipment is conveyed (traversed) into a wellbore; abstract) and be inflated with hydraulic fluid to seal off a portion of the well bore (pressurized (hydraulic) wellbore fluid provide hydraulic seals in the wellbore (e.g., seal off portion); abstract); wherein the umbilical is attached to a pump (pump 180 is attached to the umbilical 5500/116, comprising channel 5502 and sheath 5504 (hydraulic lines); figures 1A, 6; paragraph [0167]).

Because the common technical features are disclosed by VAIL, the inventions are not so linked as to form a single general inventive concept. Therefore, Groups I-IV lack unity.