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(71) Applicant (for all designated States except US): NATIONAL OILWELL VARCO, L.P. [US/US]; 7909 Parkwood Circle Drive, Houston, Texas 77036 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): KOEDERITZ, William, Leo [US/US]; 2300 El Sol Drive, Cedar Park, Texas 78613 (US).

(74) Agents: WILSON, David, M. et al.; CONLEY ROSE, P.C., P.O. Box 3267, Houston, Texas 77253-3267 (US).

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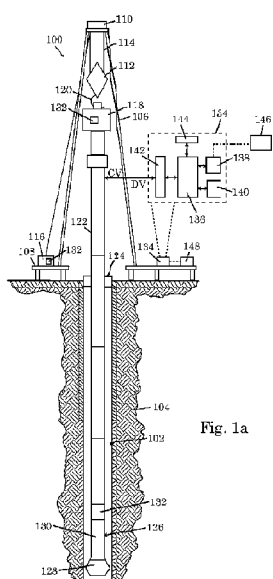


Fig. 1a

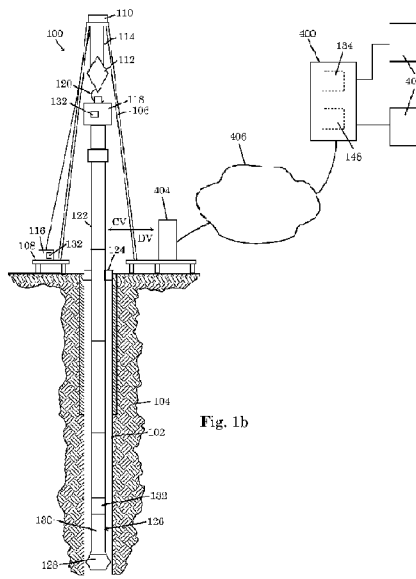


Fig. 1b

(57) Abstract: Apparatus and method for automated drilling of a borehole in subsurface formations. In one embodiment, a method includes selecting at least one control variable. A drilling performance objective having a value that is influenced by drilling of the borehole using the at least one control variable is defined. A first interval of the borehole is drilled maintaining the at least one control variable at a first value. A second interval of the borehole is drilled maintaining the at least one control variable at a second value. A third interval of the borehole is drilled maintaining the at least one control variable at a third value. The third value is selected based on a comparison of the value of the drilling performance objective while drilling the first interval and the value of the drilling performance objective while drilling the second interval to a predetermined optimal value of the drilling performance objective.

**INTERNATIONAL SEARCH REPORT**

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<b>A. CLASSIFICATION OF SUBJECT MATTER</b> INV. E21B44/00 ADD.				
According to International Patent Classification (IPC) or to both national classification and IPC				
<b>B. FIELDS SEARCHED</b>				
Minimum documentation searched (classification system followed by classification symbols) E21B				
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				
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	WO 2008/070829 A2 (NABORS GLOBAL HOLDINGS LTD; BOONE SCOTT [US]; ELLIS BRIAN [US]; KUTTEL) 12 June 2008 (2008-06-12) abstract figures 1,5 paragraph [0025] - paragraph [0027] paragraph [0033] - paragraph [0034] paragraph [0039] - paragraph [0040] paragraph [0050] paragraph [0057] - paragraph [0059] paragraph [0094] - paragraph [0107] paragraph [0116] - paragraph [0117] paragraph [0142] paragraph [0246] - paragraph [0247] ----- -/--	1-24		
<table style="width:100%; border: none;"> <tr> <td style="width:50%; border: none;"> <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.                 </td> <td style="width:50%; border: none;"> <input checked="" type="checkbox"/> See patent family annex.                 </td> </tr> </table>			<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.	<input checked="" type="checkbox"/> See patent family annex.
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.	<input checked="" type="checkbox"/> See patent family annex.			
* Special categories of cited documents :				
<table style="width:100%; border: none;"> <tr> <td style="width:50%; border: none; vertical-align: top;">                     "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                 </td> <td style="width:50%; border: none; vertical-align: top;">                     "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                      "&amp;" document member of the same patent family                 </td> </tr> </table>			"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
"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  <p align="center">30 November 2012</p>		Date of mailing of the international search report  <p align="center">11/12/2012</p>		
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer  <p align="center">Hustedt, Bernhard</p>		

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International application No  
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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X	<p>WO 01/79658 A1 (NOBLE DRILLING SERVICES INC [US]) 25 October 2001 (2001-10-25) abstract figures 1,2,5,6 page 3, line 28 - page 5, line 6 page 9, line 28 - page 10, line 9 page 10, line 22 - page 11, line 10 page 11, line 30 - page 12, line 7 page 12, line 27 - page 13, line 6 page 15, line 19 - line 26 page 16, line 30 - page 17, line 1 page 18, line 22 - page 19, line 13</p>	1-24
X	<p>US 5 842 149 A (HARRELL JOHN W [US] ET AL) 24 November 1998 (1998-11-24) abstract figures 1,8,9,10 column 3, line 56 - column 4, line 35 column 4, line 55 - line 58 column 19, line 22 - line 36 column 20, line 6 - line 32 column 21, line 28 - line 44 column 22, line 54 - line 61 column 23, line 21 - column 24, line 5</p>	1-24
X	<p>US 2003/015351 A1 (GOLDMAN WILLIAM A [US] ET AL) 23 January 2003 (2003-01-23) abstract figures 1,2 paragraph [0033] - paragraph [0037] paragraph [0040] paragraph [0056] - paragraph [0060] paragraph [0063] - paragraph [0064]</p>	1-24
A	<p>US 6 662 110 B1 (BARGACH SAAD [GB] ET AL) 9 December 2003 (2003-12-09) abstract figures 1-3 column 4, line 21 - line 50 column 5, line 4 - line 7 column 6, line 4 - line 17 column 6, line 40 - line 44 column 6, line 58 - column 7, line 3 column 7, line 18 - line 24 column 7, line 46 - line 57 column 8, line 54 - line 56 column 9, line 41 - column 10, line 41</p> <p style="text-align: center;">----- -/--</p>	1-24

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International application No  
PCT/US2011/059518

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>WO 2009/135157 A2 (BAKER HUGHES INC [US]; BYREDDY CHAKRADHAR R [US]; DASHEVSKIY DMITRIY []) 5 November 2009 (2009-11-05) abstract figures 1,7 paragraph [0011] - paragraph [0012] paragraph [0018] paragraph [0023] paragraph [0031] - paragraph [0033] paragraph [0035] paragraph [0038] -----</p>	1-24

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Information on patent family members

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