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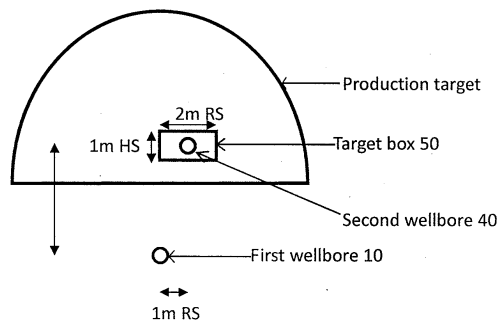
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(54) Positioning techniques in multi-well environments

(57) A method is provided to determine a distance, a direction, or both between an existing first wellbore and at least one sensor module of a drill string within a second wellbore being drilled. The method includes using the at least one sensor module to measure a magnetic field and to generate at least one first signal indicative of the measured magnetic field. The method further includes using the at least one sensor module to gyroscopically measure an azimuth, an inclination, or both of the at least one

sensor module and to generate at least one second signal indicative of the measured azimuth, inclination, or both. The method further includes using the at least one first signal and the at least one second signal to calculate a distance between the existing first wellbore and the at least one sensor module, a direction between the existing first wellbore and the at least one sensor module, or both a distance and a direction between the existing first wellbore and the at least one sensor module.

Figure 1:



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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 180 349 A2 (GYRODATA INC [US]) 28 April 2010 (2010-04-28) * paragraph [0090] - paragraph [0099] * * paragraph [0111] - paragraph [0116] * * paragraph [0138] * -----	1-15	INV. E21B47/022 E21B47/024 E21B43/30 E21B44/00 E21B47/09 E21B47/00 E21B7/04
X	US 6 985 814 B2 (MCELHINNEY GRAHAM [GB]) 10 January 2006 (2006-01-10) * column 20, line 64 - line 67 * -----	1-15	
X	US 5 676 212 A (KUCKES ARTHUR F [US]) 14 October 1997 (1997-10-14) * column 6, line 60 - line 62 * -----	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			E21B G01C
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 May 2016	Examiner Ott, Stéphane
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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06-05-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
EP 2180349	A2	28-04-2010	CA 2683359 A1	22-04-2010
			EP 2180349 A2	28-04-2010
			US 2010100329 A1	22-04-2010
			US 2012126817 A1	24-05-2012
			US 2013282287 A1	24-10-2013

US 6985814	B2	10-01-2006	GB 2402746 A	15-12-2004
			US 2004249573 A1	09-12-2004

US 5676212	A	14-10-1997	CA 2250769 A1	23-10-1997
			US 5676212 A	14-10-1997
			WO 9739218 A1	23-10-1997
