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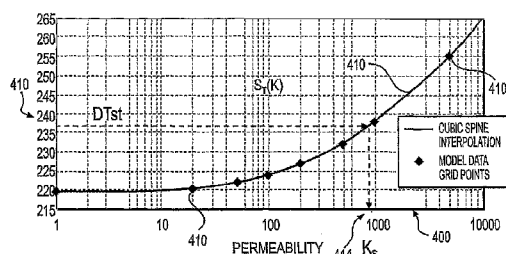
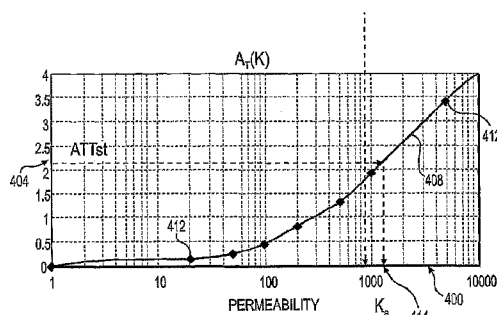
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(54) Title: METHOD FOR PERMEABLE ZONE DETECTION

**FIG. 4A****FIG. 4B**

(57) Abstract: A method for estimating formation permeability from measured sonic wave Stoneley attributes and particularly the Stoneley attributes of slowness (DTst) and attenuation (ATTst), taking into consideration the existence of a heavy walled drill collar at the end of the drill string and the relative lack of borehole mud cake during a drilling operation. In the subject LWD application a real-time qualitative indication for fracture and permeable zones is estimated from Stoneley measurements. This information is useful to a driller to make important timely decisions about drilling and completion programs.



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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2007/001746 A1 (EXXONMOBIL UPSTREAM RES CO [US]; WU XIANYUN [US]; YIN HEZHU [US]) 4 January 2007 (2007-01-04) * abstract; claims 1-3; figure 5 paragraphs [0002], [0004], [0005], [0012], [0050] - [0052], [0126] -----	1-4, 6, 7, 9, 10, 13
Y	US 5 784 333 A (TANG XIAOMING [US] ET AL) 21 July 1998 (1998-07-21) * abstract; figure 6 column 1, line 9 - column 2, line 53 column 11, line 1 - column 12, line 36 ----- -/--	1-4, 6, 7, 9, 10, 13



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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 2006/120217 A1 (WU PETER T [US] ET AL) 8 June 2006 (2006-06-08) * abstract; figures 2a,b paragraphs [0002], [0009], [0034] - [0036], [0043], [0044], [0049] - [0051], [0054], [0058] - [0060], [0071], [0074] -----	1-13
A	WO 2006/121640 A1 (SCHLUMBERGER SERVICES PETROL [FR]; SCHLUMBERGER CA LTD [CA]; SCHLUMBER) 16 November 2006 (2006-11-16) paragraphs [0014] - [0017], [0048], [0063] -----	1-13

INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007001746 A1	04-01-2007	AU 2006262684 A1 CA 2612515 A1 EA 200800122 A1 EP 1899748 A1 US 2009145600 A1	04-01-2007 04-01-2007 30-06-2008 19-03-2008 11-06-2009
US 5784333 A	21-07-1998	NONE	
US 2006120217 A1	08-06-2006	CA 2527808 A1 GB 2421079 A MX PA05013185 A	08-06-2006 14-06-2006 07-09-2006
WO 2006121640 A1	16-11-2006	CA 2608222 A1 GB 2440095 A US 2006256655 A1 US 2009225627 A1	16-11-2006 16-01-2008 16-11-2006 10-09-2009