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Reckmann et al.

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(54) **DRILLING CONTROL SYSTEM AND METHOD**

(56) **References Cited**

(75) Inventors: **Hanno Reckmann**, Nienhagen (DE);
Bernhard Meyer-Heye, Bremen (DE);
Tristan Lippert, Celle (DE); **Christian Herbig**, Lower Saxony (DE)

U.S. PATENT DOCUMENTS

4,554,819	A	11/1985	Ali	
5,117,926	A	6/1992	Worrall et al.	
5,216,917	A *	6/1993	Detournay	73/152.59
5,507,353	A	4/1996	Pavone	
8,622,153	B2 *	1/2014	McCloughlin et al.	175/325.5
2006/0000643	A1	1/2006	Jenkins	
2007/0289373	A1	12/2007	Sugiura	
2009/0090555	A1 *	4/2009	Boone et al.	175/45
2012/0217067	A1 *	8/2012	Mebane et al.	175/57

(73) Assignee: **BAKER HUGHES INCORPORATED**, Houston, TX (US)

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OTHER PUBLICATIONS

International Search Report PCT/US2011/060167 filing date Nov. 10, 2011, mailed Aug. 29, 2012, 12 pages.

Ledgerwood, L.W., Jr.; "Efforts to Develop Improved Oilwell Drilling Methods"; Journal of Petroleum Technology; vol. 12, No. 4; p. 61-74; Apr. 1960.

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CPC **E21B 44/04** (2013.01); **E21B 47/0006** (2013.01)

(58) **Field of Classification Search**
USPC 175/40, 26
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* cited by examiner

Primary Examiner — Giovanna C Wright
(74) *Attorney, Agent, or Firm* — Cantor Colburn LLP

(57) **ABSTRACT**

A method of operating a drill string includes receiving signals indicative of rotation of a bottom hole assembly (BHA) of the drill string; receiving signals indicative of the torque experienced by the BHA; determining from the received signals an average slipping torque and a maximum sticking torque; determining a friction ratio based on the maximum sticking torque and the average slipping torque; and generating an indication that the friction ratio exceeds a limit.

18 Claims, 3 Drawing Sheets

