



(51) International Patent Classification:
E21B 21/08 (2006.01) *E21B 44/00* (2006.01)

(21) International Application Number:
PCT/US2013/063528

(22) International Filing Date:
4 October 2013 (04.10.2013)

(25) Filing Language: English

(26) Publication Language: English

(71) Applicant: **LANDMARK GRAPHICS CORPORATION** [US/US]; 2107 City West Boulevard, Building 2, Houston, Texas 77042 (US).

(72) Inventors: **SAMUEL, Robello**; 11306 Dawnheath Dr., Cypress, Texas 77433 (US). **MORALES-OCANDO, Gabriela M.**; 5314 Heatherdawn Ct., Katy, Texas 77494 (US). **ZHOU, Zexun**; 511 Somerset Dr., Sugarland, Texas 77479 (US). **HUANG, Xiaoqian**; 3702 Gable Grove Ln, Katy, Texas 77494 (US).

(74) Agents: **HILTON, Robert C.** et al.; Patton Boggs LLP, 2550 M Street, Nw, Washington, District of Columbia 20037 (US).

(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, LT, 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.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,

[Continued on next page]

(54) Title: DYNAMIC METHOD AND REAL TIME MONITORING OF UBD OPERATION TUNNEL ENVELOPE WITH MUD MOTOR

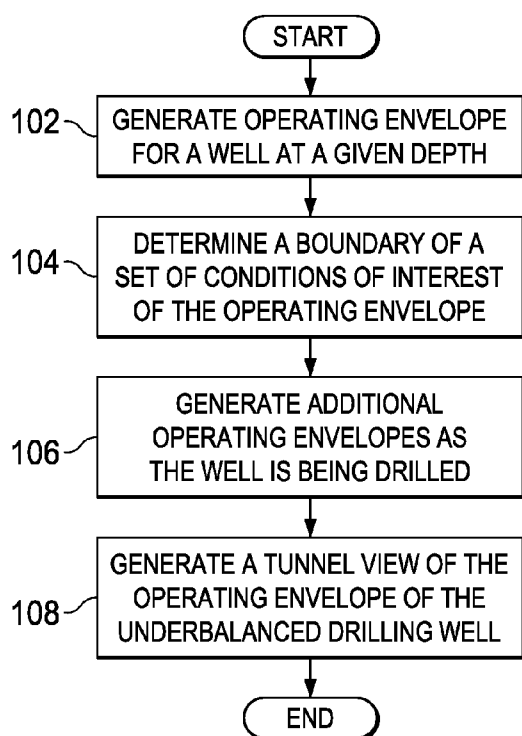


FIG. 1

(57) Abstract: The disclosed embodiments include a method, apparatus, and computer program product for monitoring underbalanced drilling operations. For example, one disclosed embodiment is a system that includes at least one processor and at least one memory coupled to the at least one processor and storing instructions that when executed by the at least one processor performs operations for generating a three dimensional tunnel view of an operating envelope of a well as the well is being drilled.

WO 2015/050563 A1



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

— *with international search report (Art. 21(3))*