



(51) International Patent Classification:
E21B 10/46 (2006.01) *E21B 10/42* (2006.01)

STEVENS, John, H. [US/US]; 9110 Grogans Mill Road,
The Woodlands, TX 77380 (US).

(21) International Application Number:
PCT/US2009/046110

(74) Agents: RIDDLE, J., Albert et al.; Intellectual Property
Counsel, Baker Hughes Incorporated, P.O. Box 4740,
Houston, TX 77210-4740 (US).

(22) International Filing Date:
3 June 2009 (03.06.2009)

(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, 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, IS, JP, KE, KG, KM, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE,
SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ,
UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12/133,988 5 June 2008 (05.06.2008) US

(71) Applicant (for all designated States except US): BAKER
HUGHES INCORPORATED [US/US]; P.O. Box 4740,
Houston, TX 77027 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): OVERSTREET,
James, L. [US/US]; 9110 Grogans Mill Road, The
Woodlands, TX 77380 (US). BUSKE, Robert, J.
[US/US]; 9110 Grogans Mill Road, The Woodlands, TX
77380 (US). GILMORE, Kenneth, E. [US/US]; 9110
Grogans Mill Road, The Woodlands, TX 77380 (US).

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ,
TM), European (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, SE, SI, SK, TR),

[Continued on next page]

(54) Title: PASSIVE AND ACTIVE UP-DRILL FEATURES ON FIXED CUTTER EARTH-BORING TOOLS AND RELATED METHODS

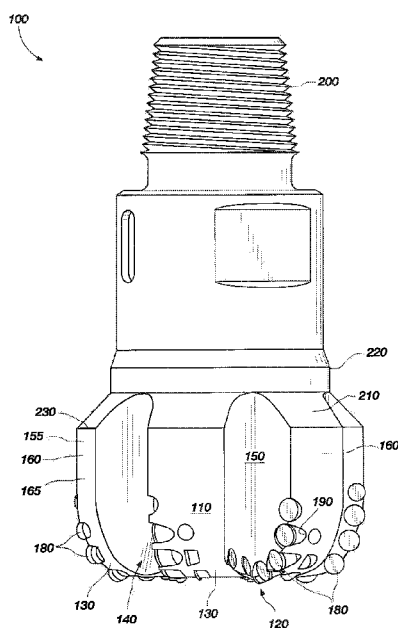


FIG. 1

(57) Abstract: Earth-boring tools include at least one up-drill feature disposed on a transition surface so as to be passive during down drilling and active during up drilling and/or back reaming operations. Systems for down drilling and up drilling with drill bits comprising one or more up-drill features are also disclosed. Furthermore, methods for forming a bore-hole with an earth-boring tool including such up-drill features and for forming an earth-boring tool comprising such up-drill features are also disclosed.



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

(88) Date of publication of the international search report:
25 February 2010

Published:

Date of publication of the amended claims and statement: 14
May 2010

- *with international search report (Art. 21(3))*
- *with amended claims and statement (Art. 19(1))*

AMENDED CLAIMS**received by the International Bureau on 05 March 2010 (05.03.2010)**What is claimed is:

1. An earth-boring tool, comprising:
a body comprising a face at a distal end thereof and gage regions defining an outer
5 diameter and comprising longitudinally upward extensions of a plurality of
blades and a shank secured to the body;
at least one transition surface comprising a chamfer positioned between the outer
diameter at an uppermost end of an associated gage region and the shank; and
at least one up-drill feature comprising an elongated structure disposed on the transition
10 surface extending from a position adjacent to a transition edge between the at
least one transition surface and the associated gage region, the at least one up-
drill feature positioned to be passive during down drilling and positioned and
structured to actively engage and cut formation material during up drilling or
back reaming.
15
2. The earth-boring tool of claim 1, wherein the body is comprised of at
least one material selected from the group consisting of a metal, a metal alloy, an
infiltrated particle-matrix composite, and a non-infiltrated particle-matrix composite, or
wherein the at least one up-drill feature comprises a material selected from the group
20 consisting of at least one of hardfacing, carbide, boride, diamond, and diamond
impregnated materials.
3. The earth-boring tool of claim 1, wherein the at least one up-drill
feature:
25 extends an entire length of the at least one transition surface;
has a radially outermost surface at least substantially flush with the outer diameter; or
comprises a thickness of about 2.54 mm or more.
4. The earth-boring tool of claim 1, wherein the at least one up-drill
30 feature comprises a plurality of up-drill features and wherein at least some of the up-
drill features of the plurality comprise at least one of differing thicknesses and differing
shapes.

5. The earth-boring tool of claim 1, wherein the at least one up-drill feature comprises a plurality of up-drill features and wherein the plurality of up-drill features are positioned adjacent each other in at least one of a rotational direction of the earth-boring tool and in a direction from a proximal end of the at least one transition surface toward a distal end of the at least one transition surface.

6. The earth-boring tool of claim 1, wherein the at least one up-drill feature is configured to extend diagonally across the at least one transition surface.

7. The earth-boring tool of claim 1, further comprising an attachment pad secured to the at least one transition surface, the at least one up-drill feature being disposed on the attachment pad.

8. A method of forming a fixed-cutter drilling tool, comprising:
forming a body comprising an active region and a passive region in a down drilling mode, the active region comprising portions of the body distal to a transition edge and the passive region comprising portions of the body proximal to the transition edge, wherein the passive region is active in an up drilling mode; and disposing at least one up-drill feature on the passive region by disposing the at least one up-drill feature on an attachment pad or forming the at least one up-drill feature integrally with an attachment pad; and securing the attachment pad to the passive region..

9. The method of claim 8, wherein forming the body comprising an active region and a passive region comprises forming a portion of the passive region as at least one top transition surface extending from the transition edge toward a shank.

10. The method of claim 9, wherein disposing the at least one up-drill feature on the passive region comprises at least one of disposing the at least one up-drill feature on the attachment pad to extend an entire length of the at least one top transition surface and disposing the at least one up-drill feature on the attachment pad to extend diagonally across the at least one top transition surface.

11. The method of claim 8, wherein disposing the at least one up-drill feature on the passive region comprises disposing the at least one up-drill feature on the attachment pad such that a radially outermost edge thereof is at least substantially flush with the transition edge.

5

12. The method of claim 8, wherein disposing the at least one up-drill feature on the passive region comprises disposing the at least one up-drill feature on the attachment pad by welding or brazing.

10

13. The method of claim 8, wherein disposing the at least one up-drill feature on the passive region comprises disposing the at least one up-drill feature on the attachment pad with a thickness of at least substantially 2.54 mm or more.

14. The method of claim 8, wherein disposing the at least one up-drill feature on the passive region comprises disposing a plurality of up-drill features on the attachment pad, wherein up-drill features of the plurality of up-drill features are configured with at least one of differing thicknesses and differing shapes.

15. The method of claim 8, further comprising forming at least one tooth-like protrusion in the at least one up-drill feature on the attachment pad.

20

16. The method of claim 15, wherein forming at least one tooth-like protrusion on the at least one up-drill feature on the attachment pad comprises at least one of disposing the at least one up-drill feature in such a manner as to form at least one tooth-like protrusion, machining a portion of the at least one up-drill feature into the shape of the at least one tooth-like protrusion, and molding the at least one up-drill feature to comprise the shape of the at least one tooth-like protrusion.

25

30

STATEMENT UNDER ARTICLE 19(1) (RULE 46.4)

Applicant has canceled claims 3, 4, 10-12, 22 and 23. Pending claim 1 has been amended and bears the same claim number as previously. The amendments to claim 1 include subject matter from claims 3 and 4, now canceled, and find additional support in as-filed drawing FIGS. 1-9 and accompanying descriptions, particularly at page 6, lines 10 through 26 and page 10, lines 4 through 16 of the as-published PCT application. Claims 5-9 have been renumbered as claims 3-7.

Claim 13 has been amended to include the subject matter of claim 22, now canceled, and renumbered as claim 8. Claims 14-21 have been amended to provide proper antecedent basis in light of the amendment to claim 13 (now claim 8) and proper dependency in light of the renumbering of claim 13 to claim 8, and have been renumbered respectively as claims 9-16

The amendments have no impact on the description and the drawings.