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[Continued on next page]

(54) Title: POLYCRYSTALLINE DIAMOND COMPACT CUTTERS WITH CONIC SHAPED END

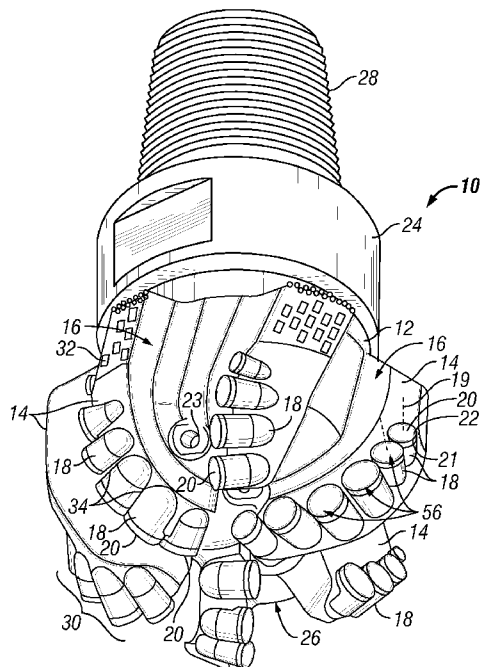


FIG. 1A

(57) Abstract: A cutting element may have a substrate; and an ultrahard material layer having a substantially planar upper surface disposed on an upper surface of the substrate; wherein at least a portion of the side surface between the upper surface of the substrate and a lower end of the substrate form at least one conic surface, wherein the at least one conic surface extends a height relative to the total height of the substrate and ultrahard material layer ranging from about 1:10 to 9:10, and wherein the substrate comprises a substantially planar lower surface. The cutting elements may also be rotatable cutting elements at least partially surrounded by outer support elements.



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

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/035087**A. CLASSIFICATION OF SUBJECT MATTER****E21B 10/46(2006.01)i, C22C 26/00(2006.01)i, C01B 31/06(2006.01)i, B24D 3/00(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E21B 10/46; E21B 10/633; B23P 11/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: cutting element, substrate, conic and similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009-0020339 A1 (SHERWOOD JR., WILLIAM H.) 22 January 2009	1,3,17
Y	See paragraphs 28-30 and figure 2	2,4
Y	US 2010-0219001 A1 (SHEN, YUELIN et al.) 02 September 2010 See paragraphs 55, 81 and figures 2A, 8A	2,4
A	US 05449048 A (THIGPEN, GARY M. et al.) 12 September 1995 See column 4, line 12-28 and figure 3	1-4,17



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

30 JANUARY 2013 (30.01.2013)

Date of mailing of the international search report

31 JANUARY 2013 (31.01.2013)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2012/035087**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☒ Claims Nos.: 5, 7, 8, 15, 16
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Independent claims 23 and 28 have been found to be unsearchable under PCT Article 17(2)(b) because of defects under PCT Article 17(2)(a).

Independent claims 1, 17 are directed to a cutting element and it is considered that a substrate forming conic surface comprises a first special technical feature. Claim 2 is referring claim 1.

Independent claims 6, 18 are directed to a cutter assembly and independent claim 27 is directed to a downhole cutting tool. It is considered that a inner rotatable cutting element disposed in outer support element comprises a second special technical feature.

Since above mentioned claim groups do not share any of the technical features identified, a technically special relationship between the inventions does not exist. Accordingly, the claims do not relate to one invention or to a single inventive concept, a priori.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-4, 17

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/035087

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