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*B24D 18/00* (2006.01)    *B24D 3/10* (2006.01)
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- (71) **Applicant (for all designated States except US):** **BAKER HUGHES INCORPORATED** [US/US]; P.O. Box 4740, Houston, Texas 77210-4740 (US).
- (72) **Inventor; and**
- (75) **Inventor/Applicant (for US only):** **DIGIOVANNI, Anthony A.** [US/US]; 8910 Opper Lane, Houston, TX 77064 (US).
- (74) **Agents:** **WELBORN, Brian, S.** et al.; Intellectual Property Counsel, Baker Hughes Incorporated, P.O. Box 4740, Houston, TX 77210-4740 (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, 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, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, 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.

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**Declarations under Rule 4.17:**

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

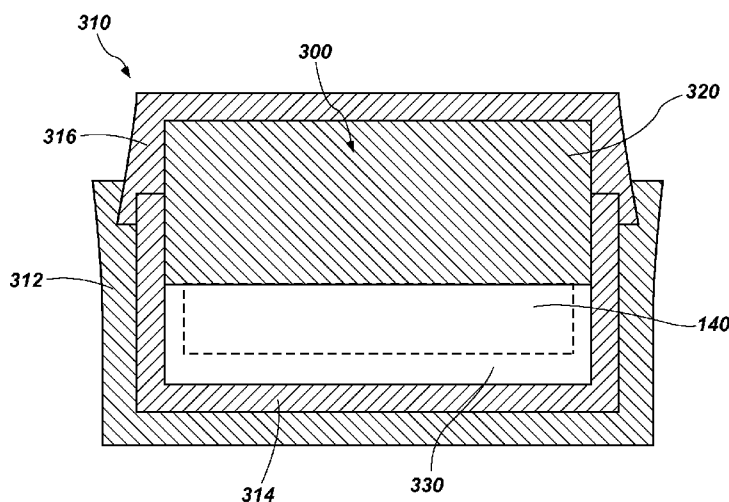
**Published:**

- with international search report (Art. 21(3))

**(88) Date of publication of the international search report:**

4 April 2013

(54) **Title:** METHODS OF FORMING POLYCRYSTALLINE COMPACTS, CUTTING ELEMENTS AND EARTH-BORING TOOLS



**FIG. 3**

(57) **Abstract:** Methods of forming a polycrystalline compact using at least one metal salt as a sintering aid. Such methods may include forming a mixture of the at least one metal salt and a plurality of grains of hard material and sintering the mixture to form a hard polycrystalline material. During sintering, the metal salt may melt or react with another compound to form a liquid that acts as a lubricant to promote rearrangement and packing of the grains of hard material. The metal salt may, thus, enable formation of hard polycrystalline material having increased density, abrasion resistance, or strength. The metal salt may also act as a getter to remove impurities (e.g., catalyst material) during sintering. The methods may also be employed to form cutting elements and earth-boring tools.



**A. CLASSIFICATION OF SUBJECT MATTER***E21B 10/46(2006.01)i, B24D 18/00(2006.01)i, B01J 3/06(2006.01)i, B24D 3/10(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 10/36; C22C 1/05; B23F 21/03; B22F 1/00; B24D 3/04

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) &amp; Keywords: metal salt, particle, mixture, sintering 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 A	JP 2000-313929 A (SANDVIK AB) 14 November 2000 See pages 1-3	1, 4, 6-11, 14, 15 2, 3, 5, 12, 13
A	US 6238280 B1 (RITT, WALTER et al.) 29 May 2001 See the abstract and claim 19	1-15
A	US 7806206 B1 (MIESS, DAVID P.) 05 October 2010 See the abstract, claims 1, 11, 13 and figures 1-4	1-15
A	US 2010-0199573 A1 (MONTROSS, CHARLES STEPHAN et al.) 12 August 2010 See paragraphs 7-15 and figures 3-5	1-15

 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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

20 DECEMBER 2012 (20.12.2012)

Date of mailing of the international search report

**26 DECEMBER 2012 (26.12.2012)**

Name and mailing address of the ISA/KR

Korean Intellectual Property Office  
189 Cheongsu-ro, Seo-gu, Daejeon Metropolitan  
City, 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

Bonghoon Lee

Telephone No. 82-42-481-8553



**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.: 16  
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:  
  
Claim 16 is referring itself and the definition of the subject matter of said claim is unclear.
  
3.  Claims Nos.:  
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 26 and 28 share “interbonded grains of diamond having a metal diffused thereof” as a common technical feature. However, as independent claims 26 and 28 do not share any technical feature identified with independent claims 1 and 17, a technical relationship between the inventions, as defined in PCT Rule 13.2 does not exist.

Moreover, the only common technical feature between independent claims 1, 17 is combining hard particles with a metal salt and sintering the mixture. However, this feature lacks novelty in that JP2000-313929A discloses mixing hard particle and metallic salt and sintering the mixture for manufacturing a metal composite. Thus there is no technical relationship left over the prior art among the claimed inventions, leaving the claims without a single general inventive concept. Hence there is lack of unity a posteriori (PCT Rules 13.1 and 13.2).

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.: 1-15

- 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/US2012/025262**

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