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- (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,

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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))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

[Continued on next page]

(54) **Title:** EXPANDING MILL HAVING CAMMING SLEEVE FOR EXTENDING CUTTING BLADE

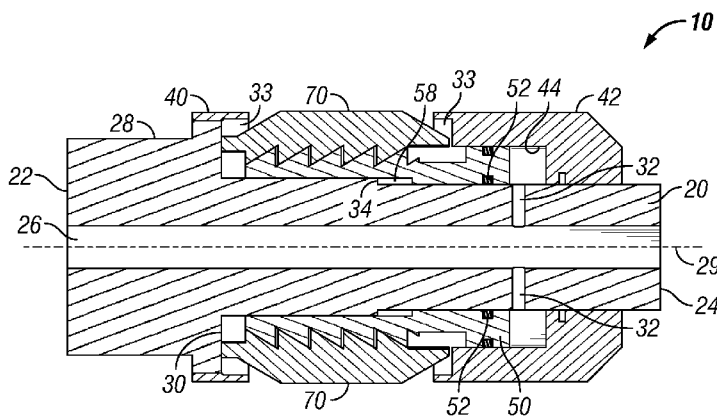


FIG. 1

(57) **Abstract:** Downhole cutting tools comprise a mandrel, a housing, a sleeve and a cutting blade. The mandrel comprises an inner wall surface defining a bore, and an outer wall surface. The housing is secured to the outer wall surface of the mandrel and comprises an opening. The sleeve is engaged with the outer wall surface of the mandrel. The sleeve comprises a profile that is operatively associated with a profile of the cutting blade such that movement of the sleeve causes the profile of the piston to slide along the profile of the cutting blade. In so doing, the cutting blade is radially extended outward through the opening in the housing to abrade an object located outside the housing. Movement of the sleeve can be achieved by pumping fluid down a bore in the mandrel to slide the sleeve long the outer wall surface of the mandrel.



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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/065788**A. CLASSIFICATION OF SUBJECT MATTER***E21B 10/62(2006.01)i, E21B 10/32(2006.01)i, E21B 37/02(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 10/62; E21B 23/04; E21B 10/32; E21B 7/06; E21B 7/28; E21B 34/10

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: mill, blade, piston, expand 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	US 2004-0222022 A1 (NEVLUD, KENNETH M. et al.) 11 November 2004 See paragraphs 49-59 and figures 1, 3, 5	1-9 10, 11
A	EP 1405983 A2 (HALLIBURTON ENERGY SERVICES, INC.) 07 April 2004 See paragraphs 55-66 and figure 1	1-11
A	US 2002-0070052 A1 (ARMELL, RICHARD A. et al.) 13 June 2002 See paragraph 19 and figure 1A	1-11

 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

05 SEPTEMBER 2012 (05.09.2012)

Date of mailing of the international search report

12 SEPTEMBER 2012 (12.09.2012)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/065788

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/065788

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.:
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:

This ISA found multiple inventions as follows:

- 1. Independent claim 1 is directed to a downhole cutting tool.
- 2. Independent claim 12 is directed to a downhole cutting tool.
- 3. Independent claim 19 is directed to a method of cutting an object disposed in a wellbore.

- 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.: 1-11

- 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.