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[Continued on next page]

(54) Title: OIL COMPOSITION COMPRISING FUNCTIONALIZED NANOPARTICLES

(57) Abstract: An improved oil composition is disclosed. The oil composition includes a base oil comprising a hydrocarbon, the base oil having a base thermal conductivity. The oil composition also includes a first additive comprising a plurality of derivatized first additive nanoparticles dispersed within the base oil to form a modified oil having a modified thermal conductivity, wherein the modified thermal conductivity is greater than the base thermal conductivity. Alternately, an improved oil composition includes a base oil comprising a hydrocarbon and a first additive comprising a plurality of derivatized first additive nanoparticles dispersed within the base oil to form a modified oil comprising a stabilized suspension of the derivatized first additive nanoparticles in the base oil.

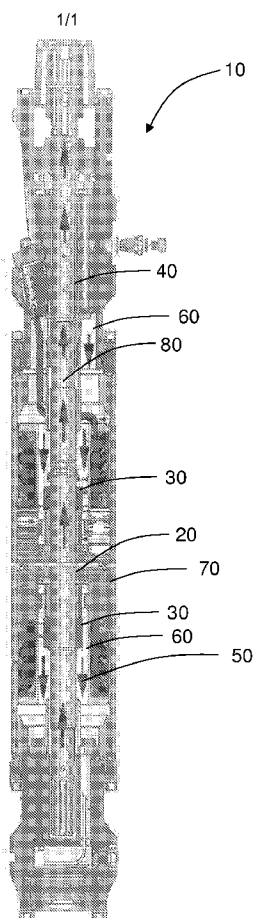


FIG. 1





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))
- 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))

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

28 March 2013

A. CLASSIFICATION OF SUBJECT MATTER*C10M 169/04(2006.01)i, B82B 3/00(2006.01)i, C10N 40/25(2006.01)n*

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)

C10M 169/04; C10M 129/26; H01B 1/16; H01B 1/00; C10M 125/02

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: base oil, thermal conductivity, additive, nanoparticles, oil property, fullerene, graphite, metallic oxide, functional group, nanotube, suspension

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 7449432 B2 (LOCKWOOD et al.) 11 November 2008 See the abstract; claims; column 6, line 20 - column 12, line 17.	1-18
X	US 7348298 B2 (ZHANG et al.) 25 March 2008 See the abstract; claims; column 4, line 55 - column 6, line 63 and column 10, line 51 - column 12, line 67.	1-18
X	US 2010/0022422 A1 (WU et al.) 28 January 2010 See the abstract; claims; paragraphs [0007]-[0012] and [0043].	1-18
A	US 2003/0151030 A1 (GURIN) 14 August 2003 See the abstract; claims; paragraphs [0028]-[0029] and [0090].	1-18



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 NOVEMBER 2012 (30.11.2012)

Date of mailing of the international search report

03 DECEMBER 2012 (03.12.2012)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORTInternational application No.
PCT/US2012/021271**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:

see the extra sheet.

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.: 1-18

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.

Box No. III

Invention 1: an oil composition comprising: a base oil comprising a hydrocarbon, the base oil having a base thermal conductivity; and a first additive comprising a plurality of derivatized first additive nanoparticles dispersed within the base oil to form a modified oil having a modified thermal conductivity, wherein the modified thermal conductivity is greater than the base thermal conductivity (claims 1-18).

Invention 2: an oil composition comprising: a base oil comprising a hydrocarbon; and a first additive comprising a plurality of derivatized first additive nanoparticles dispersed within the base oil to form a modified oil comprising a stabilized suspension of the derivatized first additive nanoparticles in the base oil (claims 19-24).

Invention 3: an electric motor comprising: a rotatable shaft; a stator; a rotor disposed with the stator and spaced from the stator by a running clearance therebetween, the rotor configured for rotation of the shaft; and an oil composition disposed in the running clearance. the oil composition comprising a base oil comprising a hydrocarbon, the base oil having a base thermal conductivity, and a first additive comprising a plurality of derivatized first additive nanoparticles dispersed within the base oil to form a modified oil comprising a stabilized suspension of the derivatized nanoparticles in the base oil and having a modified thermal conductivity, wherein the modified thermal conductivity is greater than the base thermal conductivity (claims 25).

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/021271

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7449432 B2	11.11.2008	US 2008-0242566 A1 WO 2007-103497 A2 WO 2007-103497 A3	02.10.2008 13.09.2007 13.12.2007
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