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[Continued on next page]

(54) Title: ROTARY NANOTUBE BEARING STRUCTURE AND METHODS FOR MANUFACTURING AND USING THE SAME

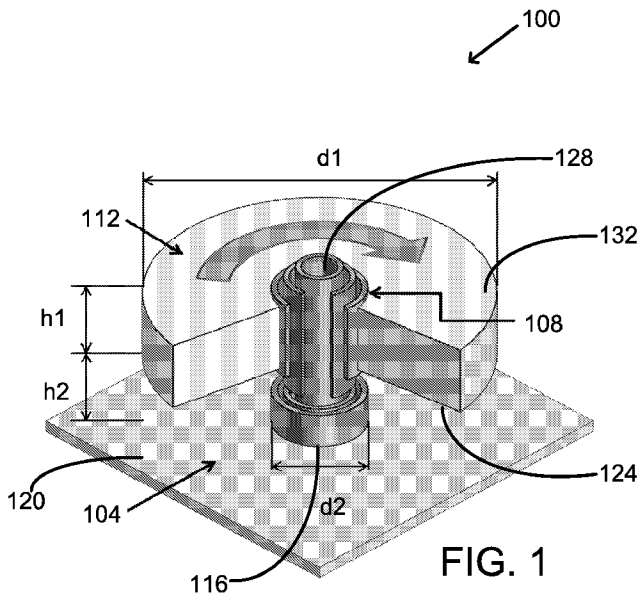

FIG. 1

(57) Abstract: In one embodiment, a rotary device includes a multiwall nanotube that extends substantially perpendicularly from a substrate. A rotor may be coupled to an outer wall of the multiwall nanotube, be spaced apart from the substrate, and be free to rotate around an elongate axis of the multiwall nanotube.

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INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. B81B5/00 B81C1/00

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)
G01C

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2005/017598 A1 (ZETTL ALEXANDER K [US] ET AL ZETTI ALEXANDER K [US] ET AL) 27 January 2005 (2005-01-27) page 4, paragraph 41-48 figures 3A-3F page 3, paragraph 33	1-34
A	US 5 535 902 A (GREIFF PAUL [US]) 16 July 1996 (1996-07-16) column 10, line 58 - column 12, line 21 figure 7	1-34

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[X] Further documents are listed in the continuation of Box C.

[X] 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 document 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 another 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	Date of mailing of the international search report
26 October 2009	27/01/2010

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Ekoué, Adamah

INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	MURAKOSHI T ET AL.: "Electrostatically levitated ring-shaped rotational-Gyro/Accelerometer" JAPANESE JOURNAL OF APPLIED PHYSICS, vol. 42, no. 4B, April 2003 (2003-04), pages 2468-2472, XP002552177 abstract page 2469, right-hand column, paragraph 1 - page 2471, paragraph 2 figure 2	1-34
A	US 2007/026636 A1 (GOGOI BISHNU P [US]) 1 February 2007 (2007-02-01) page 1, paragraph 14 figure 1	1-34
A	WO 02/080360 A (CALIFORNIA INST OF TECHN [US]) 10 October 2002 (2002-10-10) claims 1,14 figure 1	1-34
A	JONES R.: "The future of nanotechnology" PHYSICS WORLD, August 2004 (2004-08), pages 25-29, XP002552178 figure 5	1-34

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/033972

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 additional 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 fees, this Authority did not invite payment of additional fees.

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 - 34

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-34

Rotary device (and methods for fabricating said device) comprising a substrate, a multiwall nanotube coupled to a top surface of the substrate and a rotor coupled coupled to an outer wall of the multiwall nanotube and free to rotate around an elongate axis of the multiwall nanotube, wherein the multiwall nanotube extends perpendicularly from the substrate.

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2. claims: 35-37

A dynamically tuned gyroscope comprising a multiwall carbon nanotube, a drive hub coupled to the multiwall carbon nanotube, a gimbal coupled to the drive hub, and a peripheral rotor coupled to the gimbal.

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3. claims: 38-40

A pumping mechanism, comprising:
- a housing defining a cavity, the cavity comprising an inlet, an outlet, and a channel therebetween;
-and a rotary device located within the cavity, the rotary device comprising a multiwall carbon nanotube coupled to a rotor for propagating gas particles, that collide with a surface of the rotor, along the channel.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2009/033972

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005017598 A1	27-01-2005	US 2007114880 A1 WO 2005008708 A2	24-05-2007 27-01-2005
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WO 02080360 A	10-10-2002	NONE	