

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
29 May 2008 (29.05.2008)

PCT

(10) International Publication Number  
WO 2008/064368 A3

- (51) International Patent Classification:  
*B01J 4/00* (2006.01)      *B82B 3/00* (2006.01)
- (21) International Application Number:  
PCT/US2007/085533
- (22) International Filing Date:  
26 November 2007 (26.11.2007)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
60/867,145      24 November 2006 (24.11.2006)      US

(74) Agents: BANAIT, Narinder, S. et al.; Fenwick & West LLP, Silicon Valley Center, 801 California Street, Mountain View, CA 94041 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

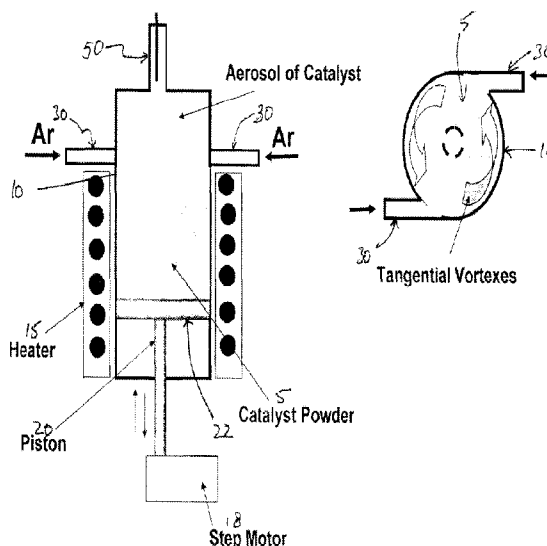
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

- (71) Applicant (for all designated States except US): HONDA MOTOR CO., LTD. [JP/JP]; 2-1-1, Minami-Aoyama, Minato-ku, Tokyo 107-8556 (JP).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): HARUTYUNYAN, Avetik [AR/US]; c/o Legal Department., Honda R & D America'S, Inc., 21001 State Route 739, Raymond, OH 93067-9705 (US).

Published:  
— with international search report

[Continued on next page]

(54) Title: INJECTOR FOR LARGE AMOUNT OF AEROSOL POWDER FOR SYNTHESIS OF CARBON NANOTUBES



(57) Abstract: Methods, processes, and apparatuses for the large scale synthesis of carbon nanostructures are provided. The apparatus for continuous large scale production of SWNTs includes a chamber. Positioned in one end of the chamber is a piston and at the other end is a tangential vortex created by gases forced into the chamber from opposite sides of the chamber walls. The chamber can be heated to reduce or eliminate agglomeration of small particles. The piston is used to push the catalyst towards the vortex, and the injection rate is controlled by the speed of the piston and the gas flow rate to create the vortex that also act as the transport gas. Thus, greater than 1kg/h of an aerosolized, deagglomerated dry powder catalyst can be delivered to the reactor at a constant flow rate.

WO 2008/064368 A3



---

(88) Date of publication of the international search report:  
2 April 2009

INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 07/85533

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC(8) - B01J 4/00, B82B 3/00 (2008.04)  
 USPC - 423/447.3; 422/139, 422/232, 977/843  
 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)  
 USPC: 423/447.3; 422/139, 422/232, 977/843

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 practicable, search terms used)  
 Electronic Databases Searched: USPTO WEST (PGPUB, EPAB, JPAB, USPT), Google Scholar, Google patents. Search Terms Used: powder adj inject\$, wall or bottom, piston, container, inlet, catalyst, aerosol, nozzle, bar or nozzle, supported catalyst, metal catalyst, Inject\$ aeros\$ adj powder, container

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2005/0121545 A1 (Harutyunyan et al. ) 09 June 2005 (09.06.2005), entire document especially abstract; figure 1; [0006]; [0021]; [0023]; [0025]; [0027]; [0028]; [0046]	1-11
Y	US 2003/0143151 A1 (Diener et al.) 31 July 2003 (31.07.2003), especially figure 1; para [0043]-[0044]	1-11
A	US 5816509 A (Ahn et al.) 06 October 1998 (06.10.1998), entire document	1-11
A	US 4,116,367 A (Kataoka et al.) 26 September 1978 (26.09.1978), entire document	1-11

Further documents are listed in the continuation of Box C.

- \* 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 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 05 April 2008 (05.04.2008)	Date of mailing of the international search report <b>07 MAY 2008</b>
---	--

Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774
---	--