(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
22 January 2009 (22.01.2009)

PCT

(10) International Publication Number
WO 2009/011984 A1

(51) International Patent Classification:
D01C 5/00 (2006.01) *B01J 8/08* (2006.01)

(21) International Application Number:
PCT/US2008/065746

(22) International Filing Date: 4 June 2008 (04.06.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

60/933,599	6 June 2007 (06.06.2007)	US
60/933,600	6 June 2007 (06.06.2007)	US
60/933,598	6 June 2007 (06.06.2007)	US
11/974,954	17 October 2007 (17.10.2007)	US
11/974,953	17 October 2007 (17.10.2007)	US
11/974,952	17 October 2007 (17.10.2007)	US

(71) Applicant *(for all designated States except US)*: **LINDE INC.** [US/US]; 575 Mountain Avenue, Murray Hill, NJ 07974 (US).

(72) Inventors: **MCKEIGUE, Kevin**; 40 Timothy Field Rd., Berkeley Heights, NJ 07922 (US). **JIANG, Weibin**; 3720 S. Emporia Way, At. W107, Aurora, CO 80014 (US). **KRISHNAMURTHY, Ramachandran**; 13 Ross Avenue, Chestnut Ridge, NY 10977 (US).

(74) Agent: **HEY, David, A.**; Linde, Inc., 575 Mountain Avenue, Murray Hill, NJ 07974 (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, 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, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(54) **Title:** INTEGRATED PROCESSES FOR GENERATING CARBON MONOXIDE FOR CARBON NANOMATERIAL PRODUCTION

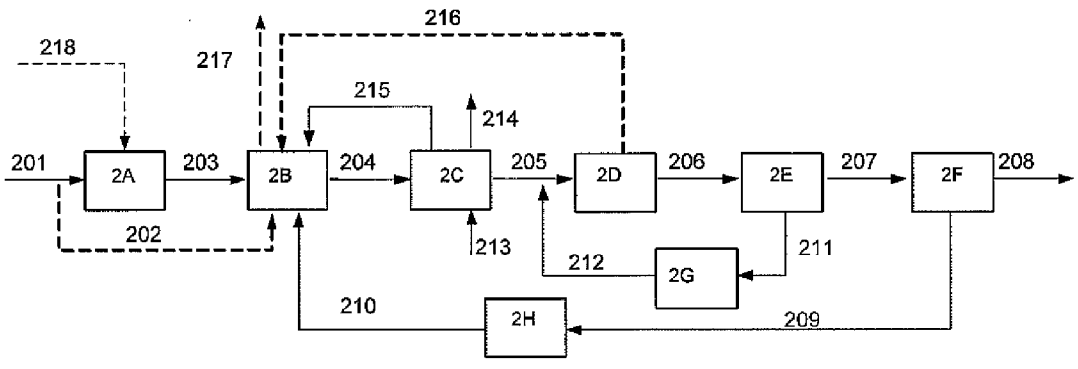

FIG. 2

(57) **Abstract:** The integrated processes of the dry reforming or partial oxidation upstream of the carbon nanotube-producing reactor are described allowing the carbon monoxide to be produced on an as-needed basis, negating the need to transport carbon monoxide to the production site or store large quantities of carbon monoxide on-site. The apparatuses allowing to carry out such integrated processes are also provided. Carbon dioxide emissions may be eliminated from the carbon nanotube production process. This may be achieved by recycling the carbon dioxide byproduct and mixing it with the feed to the partial oxidation process.

WO 2009/011984 A1