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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
12 March 2009 (12.03.2009)

PCT

(10) International Publication Number
WO 2009/032709 A1

(51) International Patent Classification:
F23D 14/62 (2006.01)

(21) International Application Number:
PCT/US2008/074506

(22) International Filing Date: 27 August 2008 (27.08.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/968,479 28 August 2007 (28.08.2007) US

(71) Applicant *(for all designated States except US)*: **AIR PRODUCTS AND CHEMICALS, INC.** [US/US]; 7201 Hamilton Boulevard, Allentown, PA 18195 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **GIARDINIERE, Kevin, John** [US/US]; c/o Air Products and Chemicals, Inc., 7201 Hamilton Blvd, Allentown, PA 18195 (US). **GREEN, John, L.** [US/US]; c/o Air Products and Chemicals, Inc., 7201 Hamilton Blvd, Allentown, PA 18195 (US). **GHOSH, Ranajit** [IN/US]; c/o Air Products and Chemicals, Inc., 7201 Hamilton Blvd, Allentown, PA 18195 (US). **GIBSON, Daniel** [US/US]; c/o Air Products and Chemicals, Inc., 7201 Hamilton Blvd, Allentown, PA 18195 (US). **ZBIGNIEW, Zurecki** [US/US]; C/o Air Products and Chemicals, Inc., 7201 Hamilton Blvd, Allentown, PA 18195 (US).

(74) Agent: **NEAGLE, Damon, A.**; Design IP, P.C., 5100 W. Tilghman Street, Suite 205, Allentown, PA 18104 (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, ST, 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,

[Continued on next page]

(54) Title: APPARATUS AND METHOD FOR CONTROLLING THE TEMPERATURE OF A CRYOGEN

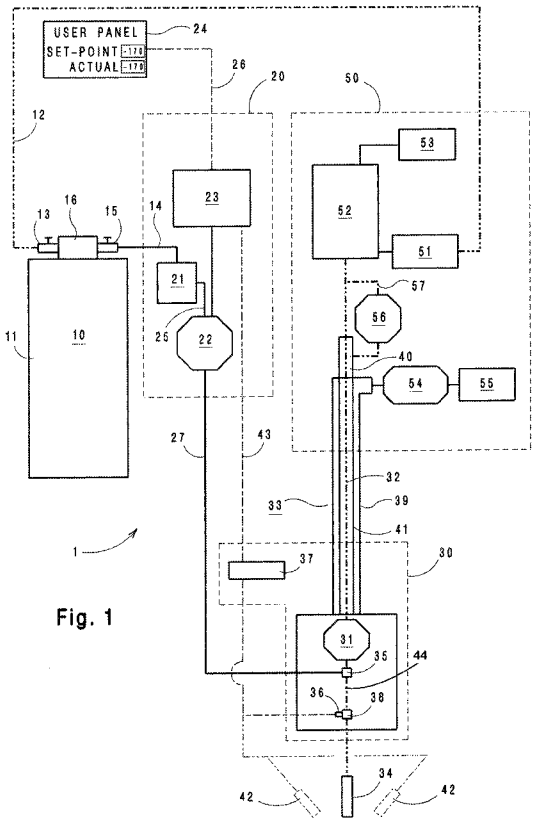


Fig. 1

(57) Abstract: A fluid spray device system (1) that maintains a resultant fluid discharge, or a material onto which the resultant fluid is discharged, within a predetermined range of a set-point temperature by regulating the flow rate of a throttling gas using a proportional valve (22). The resultant fluid has throttling gas and cryogenic fluid components. Both the throttling gas and cryogenic fluid are preferably supplied from a single tank (11) and the cryogenic fluid supply is pressure-regulated and includes a triaxial delivery hose (33) having a return line with a back- pressure regulator (54).

WO 2009/032709 A1

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*