(19) World Intellectual Property Organization International Bureau





(43) International Publication Date 23 May 2002 (23.05.2002)

PCT

(10) International Publication Number WO 02/040145 A3

(51) International Patent Classification⁷: B22F 9/08, B07B 13/10

B01J 2/04,

(21) International Application Number: PCT/US01/45246

(22) International Filing Date: 31 October 2001 (31.10.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data: 09/710,030 9 November 2000 (09.11.2000) US

(71) Applicant: HONEYWELL INTERNATIONAL INC. [US/US]; Box 2245, 101 Columbia Road, Morristown, NJ 07962 (US).

(72) Inventors: EDIE, Colin; 15125 E. Terrace Lane, Veradale, WA 99037 (US). KENO, David, B.; 606 West Marl Court, Fairfield, WA 99012 (US). PARFENIUK, Christopher, L.; 8107 East Elde Drive, Spokane, WA 99212 (US).

(74) Agents: LATWESEN, David, G.; 601 West First Avenue, Suite 1300, Spokane, Washington, DC 99201 et al. (US).

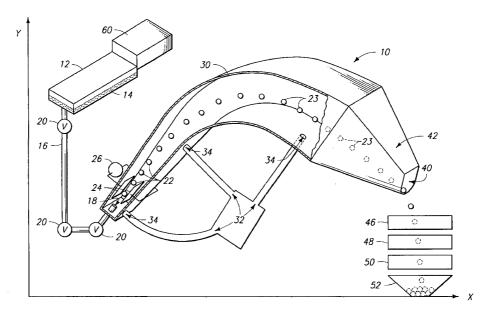
- (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.
- (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (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
- (88) Date of publication of the international search report:
 6 September 2002

[Continued on next page]

(54) Title: SPHERES AND METHOD OF FORMING A PLURALITY OF SPHERES



(57) Abstract: The invention includes a method of forming a plurality of spheres. A passageway (16) is provided, and the passageway terminates in an orifice (18). A liquid is flowed through the passageway and expelled through the orifice to form drops (22). The drops are then passed through a fluid to cool and solidify the drops into a plurality of spheres (23). At least some of the spheres are collected. A pressure of the liquid is maintained within about ± 10 % of a value during the formation of the drops that are cooled into the collected spheres. The invention also includes a plurality of at least several hundred spheres having a diameter of less than about 0.05 inches and characterized by at least 95 % of the spheres being within ± 1.3 % of a mean diameter of the spheres.







For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

tional Application No PCT/US 01/45246

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 B01J2/04 B22F B22F9/08 B07B13/10 According to International Patent Classification (IPC) or to both national classification and IPC Minimum documentation searched (classification system followed by classification symbols) B01J B22F IPC 7 B07B 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 C. DOCUMENTS CONSIDERED TO BE RELEVANT Citation of document, with indication, where appropriate, of the relevant passages Relevant to claim No. X FR 1 128 599 A (CHEMICAL CONSTRUCTION 1-4,10CORP) 8 January 1957 (1957-01-08) Υ 12 - 24page 2, right-hand column, paragraph 3 -page 3, left-hand column, paragraph 1 page 5; figure; example 2 χ US 2 811 748 A (SMITH PHILIP A) 1-6, 10,5 November 1957 (1957-11-05) 40-47 the whole document -/--Further documents are listed in the continuation of box C. Patent family members are listed in annex. ° Special categories of cited documents: "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 *A* document defining the general state of the art which is not considered to be of particular relevance invention *E* earlier document but published on or after the international "X" document of particular relevance; the claimed invention filing date cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another "Y" document of particular relevance; the claimed invention citation or other special reason (as specified) cannot be considered to involve an inventive step when the document is combined with one or more other such docu-"O" document referring to an oral disclosure, use, exhibition or ments, such combination being obvious to a person skilled *P* document published prior to the international filing date but later than the priority date claimed 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 24 June 2002 02/07/2002 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, Tx. 31 651 epo nl, Cubas Alcaraz, J Fax: (+31-70) 340-3016

INTERNATIONAL SEARCH REPORT

tional Application No
PCT/US 01/45246

		PC1/US 01/45246	
	ation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	
X	EP 0 325 798 A (ELECTROPLATING ENG) 2 August 1989 (1989-08-02) column 3, line 25 - line 36 column 6, line 12 - line 30 column 8, line 20 - line 37 column 9, line 45 -column 10, line 1 column 10, line 40 -column 11, line 24; figures 7,9,17	1-6,10, 11,40-47	
X	US 5 183 493 A (KADNER MARTIN ET AL) 2 February 1993 (1993-02-02) example 2	40-47	
Υ	FR 1 065 273 A (NORANDA MINES) 21 May 1954 (1954-05-21) page 2 -page 4; figures 1-3	12-24	
Α	US 3 294 511 A (HESS FREDERIC 0) 27 December 1966 (1966-12-27) the whole document	1,7	
A	US 4 133 854 A (HENDRICKS CHARLES D) 9 January 1979 (1979-01-09) claims 1-5; figure		

INTERNATIONAL SEARCH REPORT

Information on patent family members

tional Application No PCT/US 01/45246

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
FR 1128599	Α	08-01-1957	NONE		
US 2811748	Α	05-11-1957	NONE		
EP 0325798	Α	02-08-1989	JP JP DE DE EP KR US	1184201 A 1255609 A 3883964 D1 3883964 T2 0325798 A1 9301513 B1 4904311 A	21-07-1989 12-10-1989 14-10-1993 13-01-1994 02-08-1989 02-03-1993 27-02-1990
US 5183493	A	02-02-1993	DE AT CA DE DK EP ES GR JP JP JP	4022648 A1 128640 T 2047151 A1 59106612 D1 467221 T3 0467221 A2 2077729 T3 3017886 T3 1982957 C 4227043 A 7012422 B	23-01-1992 15-10-1995 18-01-1992 09-11-1995 19-02-1996 22-01-1992 01-12-1995 31-01-1996 25-10-1995 17-08-1992 15-02-1995
FR 1065273	Α	21-05-1954	NONE		
US 3294511	Α	27-12-1966	NONE		
US 4133854	Α	09-01-1979	US	4163637 A	07-08-1979