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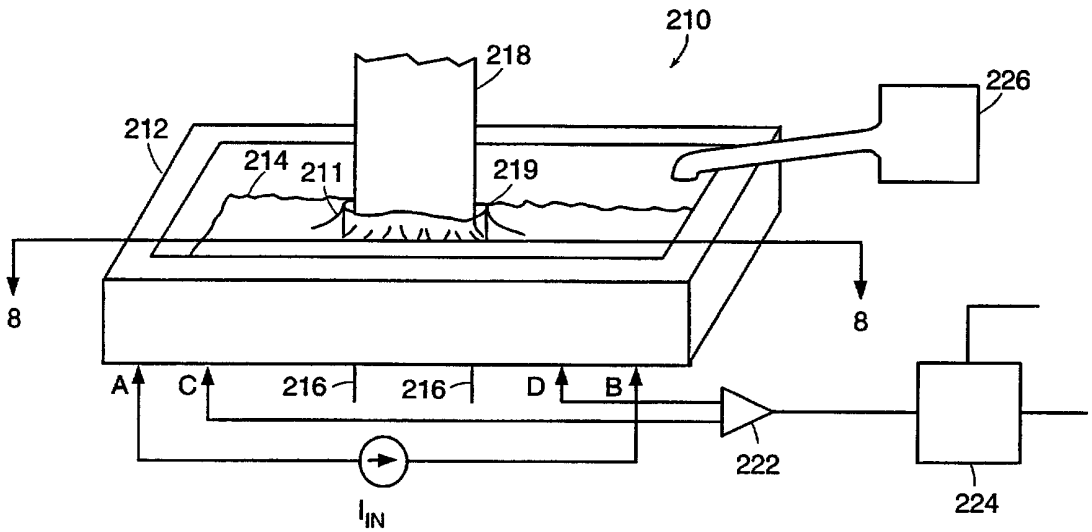
(54) Title: EDGE MENISCUS CONTROL OF CRYSTALLINE RIBBON GROWTH



(57) Abstract: An apparatus for growing a crystalline ribbon includes a crucible for holding a melt of a semiconductor material, a pair of strings passing through a pair of openings in the crucible, and a meniscus controller. The pair of strings defines edges of the crystalline ribbon grown from the melt. The crystalline ribbon and an upper surface of the melt form a meniscus. The meniscus controller controls a property of the meniscus near the edges of the crystalline ribbon.

WO 01/04388 A3

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C30B15/00 C30B29/06 C30B15/24

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)
IPC 7 C30B

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)
PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 4 861 416 A (MORRISON ANDREW D) 29 August 1989 (1989-08-29) the whole document	1,2,5 6,7, 16-20, 24-26
Y	US 4 627 887 A (SACHS EMANUEL M) 9 December 1986 (1986-12-09) cited in the application column 21, line 31 - line 58; figures 28B-30B	6,7, 16-20, 24-26
X	ANON: "Filament guides for silicon-ribbon growth" NASA TECH BRIEFS., February 1986 (1986-02), XP002159840 NASA. WASHINGTON., US the whole document	1,2,5

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

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
8 February 2001	22/02/2001

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, Fax: (+31-70) 340-3016	Cook, S

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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	FR 2 550 965 A (COMP GENERALE ELECTRICITE) 1 March 1985 (1985-03-01) page 3, line 17 -page 4, line 20; figures 4-7	1-34
A	ZOUTENDYKE: "Gas Jet meniscus control in ribbon growth" NASA TECH BRIEFS., March 1984 (1984-03), XP002159841 NASA. WASHINGTON., US the whole document	1
A	US 5 370 078 A (KOU SINDO ET AL) 6 December 1994 (1994-12-06)	
A	PATENT ABSTRACTS OF JAPAN vol. 008, no. 030 (C-209), 8 February 1984 (1984-02-08) & JP 58 194798 A (TOKYO SHIBAURA DENKI KK), 12 November 1983 (1983-11-12) abstract	

INTERNATIONAL SEARCH REPORT

information on patent family members

Inte onal Application No
PCT/US 00/17651

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4861416 A	29-08-1989	NONE	
US 4627887 A	09-12-1986	CA 1169336 A	19-06-1984
		DE 3100245 A	14-01-1982
		FR 2473072 A	10-07-1981
		GB 2067920 A,B	05-08-1981
		GB 2135594 A,B	05-09-1984
		GB 2135595 A,B	05-09-1984
		IL 61852 A	31-05-1984
		IT 1143254 B	22-10-1986
		US 4689109 A	25-08-1987
FR 2550965 A	01-03-1985	AT 25931 T	15-04-1987
		AU 561637 B	14-05-1987
		AU 3250384 A	07-03-1985
		CA 1224027 A	14-07-1987
		DE 3462660 D	23-04-1987
		EP 0141941 A	22-05-1985
		JP 1428084 C	25-02-1988
		JP 60232272 A	18-11-1985
		JP 62038031 B	15-08-1987
		US 4520752 A	04-06-1985
US 5370078 A	06-12-1994	NONE	
JP 58194798 A	12-11-1983	NONE	