

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
28 February 2002 (28.02.2002)

(10) International Publication Number
WO 02/016075 A3

PCT

- (51) **International Patent Classification⁷:** **B24B 37/04,** 53/007

(21) **International Application Number:** PCT/US01/22846

(22) **International Filing Date:** 19 July 2001 (19.07.2001)

(25) **Filing Language:** English

(26) **Publication Language:** English

(30) **Priority Data:**
09/644,135 22 August 2000 (22.08.2000) US

(71) **Applicant (for all designated States except US):** **LAM RESEARCH CORPORATION** [—/US]; 4650 Cushing Parkway, Fremont, CA 94568 (US).

(72) **Inventors; and**

(75) **Inventors/Applicants (for US only):** **SALDANA, Miguel, A.** [MX/US]; Apt. 16-B, 38850 Farwell Dr., Fremont, CA 94536 (US). **BOYD, John, M.** [CA/US]; 8730 Sierra Vista Rd., Atascadero, CA 93422 (US). **GOTKIS, Yehiel I.** [IL/US]; 37789 Peachtree Ct., Fremont, CA 94536 (US). **OWCZARZ, Aleksander, A.** [US/US]; 7523 Deveron Crt., San Jose, CA 95135 (US).

(74) **Agent:** **PENILLA, Albert, S.;** Martine & Penilla, LLP, Suite 170, 710 Lakeway Drive, Sunnyvale, CA 94085 (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, 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, US, 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

(88) **Date of publication of the international search report:**
15 August 2002

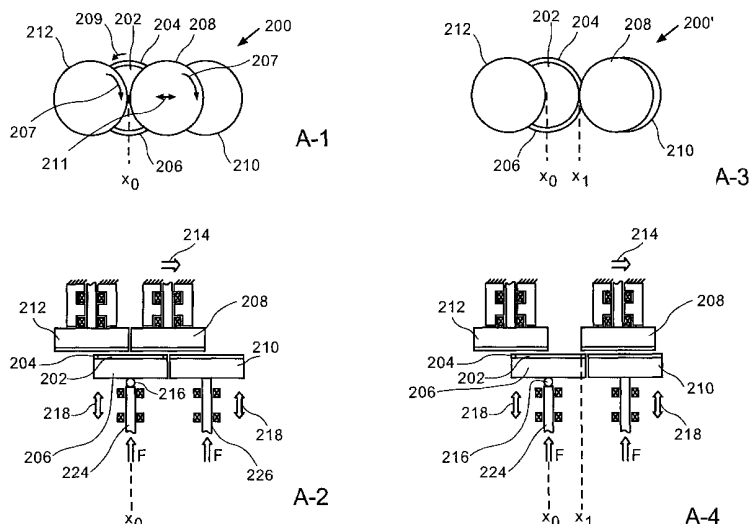
Published:

— *with international search report*

(88) Date of publication of the international search report: 15 August 2002

[Continued on next page]

- (54) Title:** CMP APPARATUS WITH AN OSCILLATING POLISHING PAD ROTATING IN THE OPPOSITE DIRECTION OF THE WAFER



- (57) Abstract:** A chemical mechanical polishing (CMP) system (200) is provided. A carrier (206) has a top surface and a bottom region. The top surface of the carrier is designed to hold and rotate a wafer (202) having a one or more formed layers to be prepared. A preparation head (208) is also included and is designed to be applied to at least a portion of the wafer (202) that is less than an entire portion of the surface of the wafer (202). Preferably, the preparation head (208) and the carrier (206) are configured to rotate in opposite directions. In addition, the preparation (208) head is further configured to oscillate while linearly moving from one of the direction of a center of the wafer (202) to an edge of the wafer (202) and from the edge of the wafer (202) to the center of the wafer (202). A support head (212) to support the top face of the wafer is also included, as well as a conditioning head (210).

WO 02/016075 A3



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

International Application No.

PCT/US 01/22846

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 B24B37/04 B24B53/007

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 B24B

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, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	WO 01 54862 A (GOTKIS YEHIEL ;KISTLER ROD (US); LAM RES CORP (US)) 2 August 2001 (2001-08-02) page 3, line 13 - line 30 page 4, line 24 -page 5, line 16 page 6, line 2 - line 10 page 8, line 24 - line 29 page 9, line 10 - line 15 page 10, line 19 - line 23 page 11, line 13 - line 25 page 12, line 15 - line 24; figures 1,7 ----	1-5,8,9, 17-22
P,X	US 6 155 913 A (QUEK SER WEE) 5 December 2000 (2000-12-05) column 5, line 8 - line 59 column 7, line 1 - line 35 figures 4A,5-6B ----- -/--	1-3

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* 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 document 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

19 April 2002

Date of mailing of the international search report

15. 05. 2002

Name and mailing address of the ISA

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

Authorized officer

Petrucchi, L

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 01/22846

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 599 423 A (PARKER NORMAN W ET AL) 4 February 1997 (1997-02-04) column 4, line 22 - line 41; figure 1 column 5, line 33 - line 44; figure 2	1-3,7, 17-19
Y	column 10, line 29 - line 57 ----	4,5,20
Y	US 5 944 582 A (TALIEH HOMAYOUN) 31 August 1999 (1999-08-31) column 5, line 1 - line 50; figure 1 ----	4,5,20
X	US 5 931 722 A (OHMI TADAHIRO ET AL) 3 August 1999 (1999-08-03) column 8, line 31 - line 51; figure 5	1-3
Y	column 9, line 55 - column 10, line 3 ----	6,22
Y	US 5 762 544 A (BLUMENKRANZ STEPHEN J ET AL) 9 June 1998 (1998-06-09)	6
A	abstract; figure 18 ----	23
X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 04, 31 August 2000 (2000-08-31) -& JP 2000 015557 A (EBARA CORP), 18 January 2000 (2000-01-18)	1,2,8,9, 21
Y	abstract; figures 1,2,4,5 ----	22
X	US 5 860 851 A (BEPPU TOSHIYASU ET AL) 19 January 1999 (1999-01-19) column 4, line 24 - line 41; figure 4 column 5, line 19 - line 26 column 6, line 28 - line 55; figure 6 column 6, line 64 - column 7, line 9; figure 7 ----	1,2,17, 18
X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 04, 31 August 2000 (2000-08-31) & JP 2000 011601 A (KIORITZ CORP), 14 January 2000 (2000-01-14) abstract	1-3
E	-& US 6 312 320 B2 (SATO Y, AIYAMA F, YONEKAWA M AND KONDO T) 6 November 2001 (2001-11-06) column 8, line 30 - line 50; figure 7 ----	1-3
X	EP 0 865 874 A (CANON KK) 23 September 1998 (1998-09-23) column 1, line 50 - line 56; figure 8 ----	1,7
X	GB 2 345 013 A (NIPPON ELECTRIC CO) 28 June 2000 (2000-06-28) page 10, line 6 - page 12, line 20 figures 4-5C ----- -/--	1-5, 17-20

INTERNATIONAL SEARCH REPORT

Int'l. Patent Application No.

PCT/US 01/22846

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 950 468 A (SPEEDFAM CO LTD) 20 October 1999 (1999-10-20) column 8, line 40 -column 9, line 5 column 9, line 40 - line 50 column 10, line 6 - line 41; figure 3 column 12, line 43 -column 13, line 3; figure 6 -----	1,10-12, 14,15
A	US 6 012 970 A (IYER SUBRAMONEY V ET AL) 11 January 2000 (2000-01-11) column 2, line 62 -column 3, line 13 column 4, line 16 - line 21; figure 5 ----	4,5
A	EP 0 860 237 A (SPEEDFAM CO LTD) 26 August 1998 (1998-08-26) column 5, line 9 -column 6, line 1 column 7, line 21 -column 9, line 13; figures 3,8 -----	1,10

INTERNATIONAL SEARCH REPORT

international application No.
PCT/US 01/22846

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-9, 17-23

CMP apparatus with an oscillating polishing pad rotating in the opposite direction of the wafer.

1.1. Claims: 1-5, 17-20

CMP apparatus with an oscillating polishing pad rotating in the opposite direction of the wafer.

1.2. Claim : 1+6

CMP apparatus with a gimbaled carrier head

1.3. Claims: (1+8)-9, 21-23

CMP apparatus with a conditioning head.

2. Claims: (1+10)-16

CMP apparatus with support head for the top face of the wafer

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.

INTERNATIONAL SEARCH REPORT

Information on patent family members

In International Application No

PCT/US 01/22846

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0154862	A	02-08-2001	US 6340326 B1 AU 2940301 A WO 0154862 A1 US 2001012751 A1	22-01-2002 07-08-2001 02-08-2001 09-08-2001
US 6155913	A	05-12-2000	NONE	
US 5599423	A	04-02-1997	NONE	
US 5944582	A	31-08-1999	US 6159080 A US 6179690 B1 US 5938504 A US 5934979 A	12-12-2000 30-01-2001 17-08-1999 10-08-1999
US 5931722	A	03-08-1999	JP 9277160 A	28-10-1997
US 5762544	A	09-06-1998	JP 9168968 A	30-06-1997
JP 2000015557	A	18-01-2000	NONE	
US 5860851	A	19-01-1999	DE 69322491 D1 DE 69322491 T2 EP 0607441 A1 JP 3024417 B2 JP 5285825 A WO 9315878 A1	21-01-1999 26-08-1999 27-07-1994 21-03-2000 02-11-1993 19-08-1993
JP 2000011601	A	14-01-2000	JP 3070917 B2 US 2001014575 A1	31-07-2000 16-08-2001
EP 0865874	A	23-09-1998	JP 10329012 A EP 0865874 A2 US 2001019934 A1	15-12-1998 23-09-1998 06-09-2001
GB 2345013	A	28-06-2000	JP 2968784 B2 JP 2000006004 A US 6270392 B1 US 2002037680 A1	02-11-1999 11-01-2000 07-08-2001 28-03-2002
EP 0950468	A	20-10-1999	JP 11300607 A EP 0950468 A2 TW 393370 B US 6074277 A	02-11-1999 20-10-1999 11-06-2000 13-06-2000
US 6012970	A	11-01-2000	US 6146250 A	14-11-2000
EP 0860237	A	26-08-1998	JP 10230451 A EP 0860237 A2 TW 416889 B US 6066230 A	02-09-1998 26-08-1998 01-01-2001 23-05-2000