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(71) Applicant (for all designated States except US): **KLA-TENCOR CORPORATION** [US/US]; 160 Rio Robles, San Jose, California 95134 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **ZYWNO, Marek** [US/US]; 7049 Bret Harte Drive, San Jose, California 95120 (US). **BAREKET, Noah** [US/US]; 12344 Saraglen Drive, Saratoga, California 95070 (US).

(74) Agent: **ISENBERG, Joshua, D.**; JDI PATENT, 809 Corporate Way, Fremont, CA 94539 (US).

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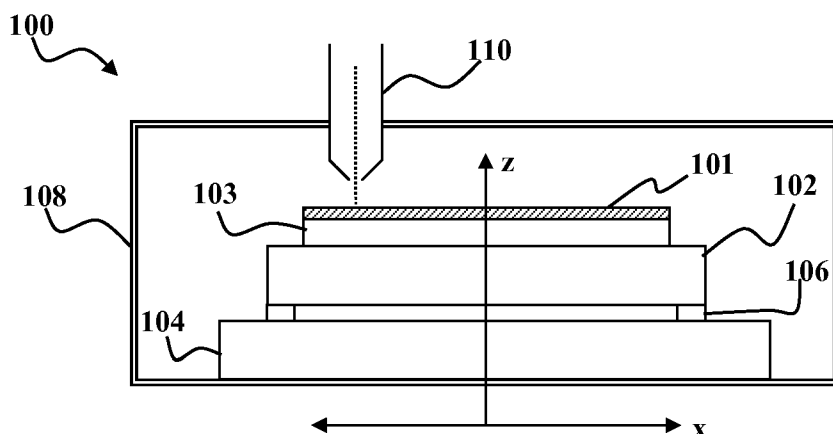
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(54) Title: SUBSTRATE PROCESSING APPARATUS AND METHOD



(57) Abstract: Substrate processing methods and apparatus are disclosed. In some embodiments a substrate processing apparatus may comprise a support structure and a moveable stage including first and second stages. The moveable stage has one or more maglev units attached to the first stage and/or second stage proximate an edge of the first stage. The first stage retains one or more substrates and moves with respect to a first axis that is substantially fixed with respect to the second stage. The second stage translates along a second axis with respect to the support structure. In other embodiments, a primary motor may maintain a rotary stage at an angular speed and/or accelerate or decelerate the stage from a first angular speed to a second angular speed. A secondary motor may accelerate the stage from rest to the first angular speed and/or decelerate the stage from a non-zero angular speed.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

INV. G03F7/20 F16C39/06 G01N21/95 H01L21/68

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)

F16C G01N G03F G11B H01L H02K

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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2006/007167 A (NIPPON KOGAKU KK [JP]; WILLIAMS MARK [US]) 19 January 2006 (2006-01-19) abstract figures 1,2 page 1, line 20 - line 24 page 4, line 21 - page 5, line 20 -----	1, 30-44
Y	US 2006/054494 A1 (REISS IRA [US]) 16 March 2006 (2006-03-16) abstract figures 1,2 paragraph [0001] paragraph [0007] paragraph [0015] paragraph [0023] - paragraph [0031] ----- -/--	1-29



Further documents are listed in the continuation of Box C.



See patent family 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.
- *G* document member of the same patent family

Date of the actual completion of the international search

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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

Andersen, Ole

INTERNATIONAL SEARCH REPORT

International application No

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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.
Y	WO 97/15978 A (SATCON TECHNOLOGY CORP [US]) 1 May 1997 (1997-05-01) abstract figures 1-3 page 1, line 4 - page 2, line 14 page 5, line 33 - page 6, line 2 page 8, line 20 - page 11, line 35 -----	1-29
A	US 2003/230323 A1 (YOU WEI-MING [TW] ET AL) 18 December 2003 (2003-12-18) abstract figure 6 paragraph [0001] paragraph [0030] -----	1
A	US 5 641 960 A (OKUBO KAZUO [JP] ET AL) 24 June 1997 (1997-06-24) abstract figures 1-3 column 1, line 8 - line 10 column 1, line 42 - line 45 column 2, line 62 - column 6, line 62 -----	1
A	US 2002/047542 A1 (HIGUCHI TAKANOBU [JP]) 25 April 2002 (2002-04-25) abstract figure 1 paragraph [0002] paragraph [0029] - paragraph [0053] -----	1
A	US 6 515 742 B1 (RUPRECHT DAVID JOHN [US]) 4 February 2003 (2003-02-04) abstract figure 1 column 1, line 6 - line 7 column 4, line 39 - column 5, line 15 -----	1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2007/087953

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 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 No. III Observations where unity of invention is lacking (Continuation of item 3 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 allsearchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
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.:

see annex

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ 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: 1-44

Closest prior art: US 2003/230323 A disclosing (figure 6 embodiment) a substrate processing apparatus (wafer scrubbing) comprising a first stage (rotary platform 70) and a second stage (implicit feature) arranged to translate the rotary platform (see paragraph 0030; in one embodiment rotary platform 70 is arranged to perform axial movement). A plurality of substrates (78) are simultaneously rotated and translated by the rotary-linear stage arrangement. Special technical feature, taking due account of the description and drawings: one or more magnetic levitation units attached to the first stage and/or second stage proximate an edge of the first stage. Technical effect of this special technical feature: the rotary stage bearing is less sensitive to wear. Problem solved by this special technical feature: provision of a low-wear bearing for high rotation-speed applications.

2. claims: 45-52

Closest prior art: US 5 641 960 A disclosing (figures 1 - 3) a substrate processing apparatus (multiple-wafer inspection) comprising a rotary stage (52) arranged to retain a plurality of substrates. Special technical feature, taking due account of the description and drawings: combined rotary-linear stage and control system arranged to control the position of the substrates to within 10 nm of a desired position. Technical effect of this special technical feature: reduced positioning time of detectors relative to substrates. Problem solved by this special technical feature: how to reduce the positioning time of the substrates relative to the detectors.

3. claims: 53-110

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Closest prior art: US 5 641 960 A disclosing (figures 1 - 3) a substrate processing apparatus (multiple-wafer inspection) comprising a rotary stage (52) arranged to retain a plurality of substrates and a carrier stage (frame 140) arranged to support the rotary stage.

Special technical feature, taking due account of the description and drawings: separate motor for maintaining the rotary stage at a desired rotary angular speed and/or rotationally accelerate or decelerate the rotary stage from a first angular speed to a second angular speed.

Technical effect of this special technical feature: reduced angular-speed noise.

Problem solved by this special technical feature: improving inspection accuracy.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2007/087953

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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US 2006054494	A1	16-03-2006	NONE	
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