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[Continued on next page]

(54) Title: PROJECTION SYSTEM WITH METROLOGY

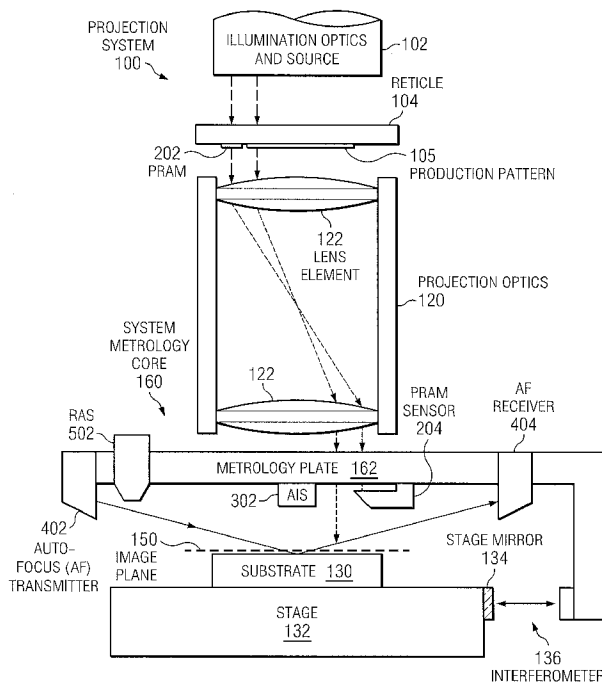


FIG. 1A

(57) Abstract: Projection systems and methods with mechanically decoupled metrology plates according to embodiments of the present invention can be used to characterize and compensate for misalignment and aberration in production images due to thermal and mechanical effects. Sensors on the metrology plate measure the position of the metrology plate relative to the image and to the substrate during exposure of the substrate to the production image. Data from the sensors are used to adjust the projection optics and/or substrate dynamically to correct or compensate for alignment errors and aberration-induced errors. Compared to prior art systems and methods, the projection systems and methods described herein offer greater design flexibility and relaxed constraints on mechanical stability and thermally induced expansion. In addition, decoupled metrology plates can be used to align two or more objectives simultaneously and independently.

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NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/043121

A. CLASSIFICATION OF SUBJECT MATTER
INV. G03F7/20
ADD.

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)
G03F H01L

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 950 793 A1 (NIPPON KOGAKU KK [JP]) 30 July 2008 (2008-07-30) abstract paragraphs [0019] - [0050]; claim 1; figures 1-5	1-38
A	US 2009/201513 A1 (SHIBAZAKI YUICHI [JP]) 13 August 2009 (2009-08-13) paragraphs [0056] - [0061]; figure 1	1-38
A	US 2008/074629 A1 (GROENEVELD ROGIER HERMAN MATHI [NL] ET AL) 27 March 2008 (2008-03-27) abstract paragraphs [0052] - [0053]; claim 1; figure 3B	1-38
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Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"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</p> <p>"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.</p> <p>"&" document member of the same patent family</p>
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Date of the actual completion of the international search 13 February 2012	Date of mailing of the international search report 17/02/2012
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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, Fax: (+31-70) 340-3016	Authorized officer Weckesser, Jens
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/043121

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 all searchable 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.:

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.

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2011/043121

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 341 044 A2 (ASML NETHERLANDS BV [NL]) 3 September 2003 (2003-09-03) paragraphs [0043] - [0044]; figures 10A, 10B -----	1-38
Y	US 6 320 644 B1 (SIMPSON CRAIG R [US] ET AL) 20 November 2001 (2001-11-20) cited in the application	46
A	the whole document -----	1-38,47
X	US 2005/264777 A1 (GARDNER STEVEN D [US] ET AL) 1 December 2005 (2005-12-01)	39-45, 47-53
Y	paragraphs [0056], [0075], [0083] - [0089]; figures 1,5 -----	46
X	RAAB E L ET AL: "ANALYZING DEEP-UV LENS ABERRATIONS USING AERIAL IMAGE AND LATENT IMAGE METROLOGIES", PROCEEDINGS OF SPIE, SPIE, US, vol. 2197, 2 March 1994 (1994-03-02), pages 550-565, XP009007247, ISSN: 0277-786X, DOI: 10.1117/12.175450	39-45, 47-53
Y	sections 3.2, 4.1 figures 2,3,7a,7b,8,9a,9b -----	46
X	US 5 914 774 A (OTA KAZUYA [JP]) 22 June 1999 (1999-06-22)	39-45, 47-53
Y	column 4, lines 25 -50; figures 2,3,4,5 column 7, lines 6-54 -----	46

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2011/043121

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1950793	A1	30-07-2008	EP 1950793 A1 30-07-2008
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			EP 1751623 A2 14-02-2007
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			JP 8167558 A 25-06-1996
			US 5914774 A 22-06-1999

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-38

Estimate a position of an image relative to a substrate based on the positions of a metrology plate relative to the substrate and the image, wherein the metrology plate is mechanically decoupled from the projection optics which is configured to project the image.

2. claims: 39-53

Estimate field curvature of an image based on sagittal and tangential foci of the image.
