## (19) World Intellectual Property **Organization**

International Bureau





(43) International Publication Date 18 September 2003 (18.09.2003)

**PCT** 

## (10) International Publication Number WO 2003/076891 A3

(51) International Patent Classification<sup>7</sup>: G01M 11/02

(21) International Application Number:

PCT/EP2003/002283

(22) International Filing Date: 6 March 2003 (06.03.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

60/362,552 8 March 2002 (08.03.2002) US

(71) Applicant (for all designated States except US): CARL ZEISS SMT AG [DE/DE]; Carl-Zeiss-Strasse 22, 73447 Oberkochen (DE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): WEGMANN, Ulrich [DE/DE]; Erlenweg 5, 89551 Königsbronn (DE). SCHELLHORN, Uwe [DE/DE]; Hegelstrasse 40, 73431 Aalen (DE). KLAESGES, Ralph [DE/DE]; Brandenburger Strasse 41, 73431 Aalen (DE). STUEHLER, Joachim [DE/DE]; Hannah-Arendt-Strasse 9, 73431 Aalen (DE).

- PATENTANWÄLTE RUFF, WILHELM, (74) Agent: BEIER, DAUSTER & PARTNER: Kronenstrasse 30. 70174 Stuttgart (DE).
- (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, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

#### **Declaration under Rule 4.17:**

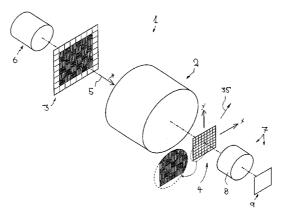
of inventorship (Rule 4.17(iv)) for US only

## **Published:**

with international search report

[Continued on next page]

(54) Title: MOIRÉ METHOD AND MEASURING SYSTEM FOR MEASURING THE DISTORTION OF AN OPTICAL IMAG-**ING SYSTEM** 



(57) Abstract: In the case of a method and a measuring system for measuring the distortion of an optical imaging system (1) with the aid of moiré patterns, an object grating (3) with an object pattern is arranged in the object plane of the imaging system, and an image grating (4) with an image pattern is arranged in the image plane of the imaging system. Both the object pattern and the image pattern in each case have a multiplicity of cells with sub-gratings of different grating properties, it being possible, in particular, for the sub-gratings to have different directions of periodocity and different phase angles. The object pattern and the image pattern are coordinated with one another in such a way that, when the object pattern is projected onto the image pattern with the aid of the imaging system (1), images of the sub-gratings (15, 16) of the object pattern superimpose in each case with assigned sub-gratings of the image pattern, accompanied by the generation of moiré sub-patterns, which are likewise present in the form of cells situated next to one another. As a result, it is possible simultaneously to determine distortion components for a plurality of image directions aligned transverse to one another. It is preferred to use phase-shift methods in order to evaluate the moiré sub-pattern.



#### 

(88) Date of publication of the international search report:  $$27\ \mathrm{May}\ 2004$ 

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 A 1 No PCT/EP 03/02283

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 G01M11/02

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 GO1M

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, PAJ, WPI Data

Category °	Citation of document, with indication, where appropriate, of the	rolovant naceados	Relevant to claim No.
Jalegory	Citation of document, with indication, where appropriate, or the	relevant passages	Tolovan to dam ivo.
Y	EP 0 418 054 A (MATSUSHITA ELEC LTD) 20 March 1991 (1991-03-20) column 3 - column 12	TRIC IND CO	1,17,30
Y	US 4 386 849 A (HAEEUSLER GERD 7 June 1983 (1983-06-07) column 3 - column 6	ET AL)	1
Υ	US 6 236 448 B1 (OTA KAZUYA) 22 May 2001 (2001-05-22) claims 1-24		17
Υ	US 5 621 497 A (OKAZAKI SHINJI 15 April 1997 (1997-04-15) column 8 - column 12	ET AL)	30
		-/	
X Fur	ther documents are listed in the continuation of box C.	Patent family members are	e listed in annex.
"A" docum consi "E" earlier filing: "L" docum which citatic: "O" docum other "P" docum	ategories of cited documents:  ent defining the general state of the art which is not dered to be of particular relevance document but published on or after the international date ent which may throw doubts on priority claim(s) or a lis cited to establish the publication date of another on or other special reason (as specified) ent referring to an oral disclosure, use, exhibition or means tent published prior to the international filing date but than the priority date claimed	"T" later document published after tor priority date and not in conficited to understand the princip invention  "X" document of particular relevance cannot be considered novel or involve an inventive step wher  "Y" document of particular relevance cannot be considered to involve document is combined with on ments, such combination being in the art.  "8." document member of the same	ict with the application but le or theory underlying the re; the claimed invention cannot be considered to the document is taken alone re; the claimed invention re an inventive step when the e or more other such docugo byvious to a person skilled

03/02/2004

Dietrich, A

Authorized officer

Name and mailing address of the ISA

26 January 2004

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

# INTERNATIONAL SEARCH REPORT

International Ar n No
PCT/EP 03/02283

		FC1/EF 03/02283		
	ation) DOCUMENTS CONSIDERED TO BE RELEVANT			
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
Α	US 5 834 767 A (HASEGAWA MASANOBU ET AL) 10 November 1998 (1998-11-10) column 3 - column 7	17-29		
А	US 5 973 773 A (KOBAYASHI NAOYUKI) 26 October 1999 (1999-10-26) column 3 - column 8	1,17,30		
Α	US 5 759 744 A (BRUECK STEVEN R J ET AL) 2 June 1998 (1998-06-02) claims 1-22	1-33		
A,P	US 2002/033936 A1 (SHIRAISHI NAOMASA) 21 March 2002 (2002-03-21) claims 30-35	1-16, 30-33		
A,P	US 2002/080365 A1 (MONSHOUWER RENE ET AL) 27 June 2002 (2002-06-27) page 4 - page 9	1-33		
	·			

# INTERNATIONAL SEARCH REPORT

International n No
PCT/EP 03/02283

					1 10	1/11 03/02203
	tent document in search report		Publication date		Patent family member(s)	Publication date
FP	0418054	A	20-03-1991	JP	2543200 B	2 16-10-1996
L. I	0410004	,,	F0 00 132 1	JΡ	3100432 A	
				JP	3134537 A	
				JP	3134538 A	<del>-</del>
				DE	69014180 D	
			•		0418054 A	
				EP		
		<u></u>		US 	5062705 A	05-11-1991
US	4386849	Α	07-06-1983	DE	3019930 A	
				DE	3162343 D	
				EP	0040704 A	1 02-12-1981
US	6236448	B1	22-05-2001	JP	3379237 B	
				JP	8078313 A	22-03-1996
				JP	3379238 B	2 24-02-2003
				JР	8078314 A	
				ÜS	6388735 B	
				US	6249336 B	
				US	6018384 A	
US 	5621497 	A 	15-04-1997 	JP	7326573 A	12-12-1995
US	5834767	Α	10-11-1998	JP	9210629 A	12-08-1997
US	5973773	Α	26-10-1999	US	5767959 A	16-06-1998
US	5759744	Α	02-06-1998	AU	5298196 A	
				WO	9626468 A	29-08-1996
115	2002033936	A1	21-03-2002	JP	3148818 B	2 26-03-2001
00	200200000	713		JP	4180612 A	
				JΡ	3268501 B	
				JP	4180613 A	
					3049774 E	
				JP		
				JP	4225357 A	
				JP	3049775 E	
				JP	4225358 <i>F</i>	
				JP	3049776 E	32 05-06-2000
				JР	4225359 <i>A</i>	14-08-1992
				JΡ	3049777 E	
				ĴΡ	4225514 <i>A</i>	
				ÜS	5638211	
				US	2002196416	
				DE	69132120	
				DE	69132120	
				EP	0486316 /	
				EP	0967524 <i>F</i>	
				US	2002101572 <i>F</i>	1 01-08-2002
				US	2003043356 /	
				ÜS	6211944 E	
				US	6252647	
				US	6233041 E	
	•				6636293 E	
				US	0030293 l	
 US	2002080365	A1	27-06-2002	EP WO	1348149 / 02052350 /	