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10/686,894 15 October 2003 (15.10.2003) US(71) Applicant (for all designated States except US): **PI-COSYS, INC.** [US/US]; Building C, 35 South La Patera Lane, Santa Barbara, CA 93117 (US).

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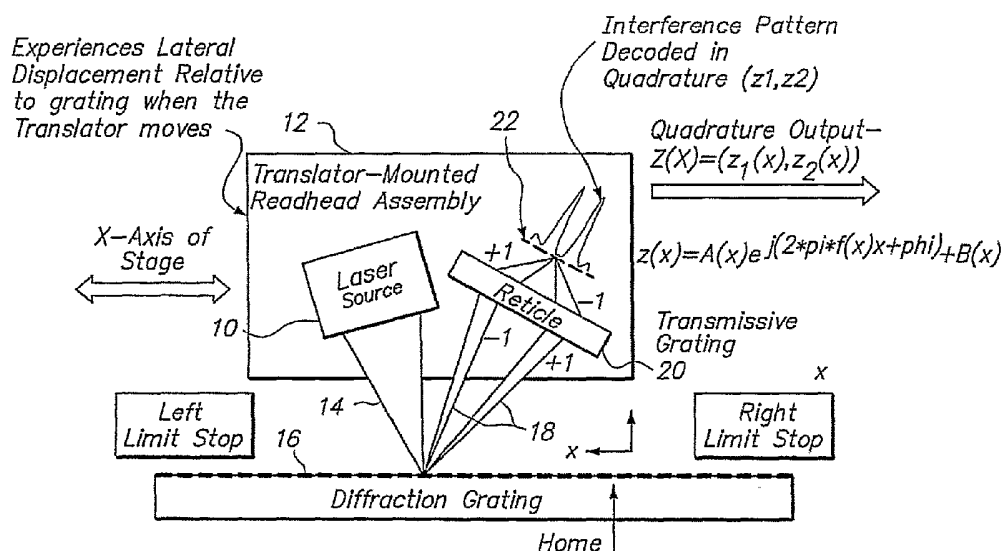
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Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, 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, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM,

[Continued on next page]

(54) Title: DIRECT-WRITE SYSTEM AND METHOD FOR ROLL-TO-ROLL MANUFACTURING OF REFLECTIVE GRATINGS



(57) Abstract: A reflective grating (24) for precision location measurement is disclosed. In one embodiment, the reflective grating has a non-reflective substrate (56) and a non-reflective adhesion layer (28) disposed on the substrate layer. A reflective surface layer (30) is disposed on the adhesion layer. In another embodiment, the reflective grating is manufactured on the reflective (polished) surface of a monolithic substrate. A series of grating lines (32) are formed in the reflective surface layer by vaporizing portions of the reflective surface layer with a laser in order to expose the non-reflective adhesion layer. Accordingly, alternating reflective and non reflective grating lines are formed that are used for making precision measurements.



ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, 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, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

— as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/33887

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G02B 5/18

US CL : 359/572

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)

U.S. : 359/572,566,569,576;216/24

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 practicable, search terms used)
EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,708,437 A (KRAUS) 24 November 1987 (24.11.1987), See entire document, including Figure 1, col. 2, lines 33-59.	1
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Y		2-22
Y	US 4,846,552 A (VELDKAMP et al) 11 July 1989 (11.07.1989), See entire document, including Figure 5.	2, 6-7, 10-14
Y	US 4,757,196 A (YAMADA et al) 12 July 1988 (12.07.1988), See entire document, including Figures 1-2, 4-6, 9-11; col. 3, lines 17-31.	6-7, 10-22
Y	WO 03/034105 A2 (JOHANNES HEIDENHAIN GMBH) 24 April 2003 (24.04.2003), See entire document, including Abstract; Figures 1-3; Pages 5-6.	3-5, 9,16-18, 21
A	US 2005/0052743 A1 (SPECKBACHER et al) 10 March 2005 (10.03.2005), See entire document.	3-5,9,16-18,21
Y	US 5,331,443 A (STANISCI) 19 July 1994 (19.07.1994), See entire document, including Figures 1-2.	8,20
Y	JP 05265365 A (TAKAHARA et al) 15 October 1993 (15.10.1993), See entire document, including	23-29
Y	US 6,291,797 B1 (KOYAMA et al) 18 September 2001 (18.09.2001), See entire document, including	23-29

☒ 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 application or patent 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

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US04/33887

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,580,054 B1 (LIU et al) 17 June 2003 (17.06.2003), See entire document, including	24
Y	US 5,629,068 A (MIEKKA et al) 13 May 1997 (13.05.1997), See entire document, including	25
Y	US 5,364,493 A (HUNTER, JR et al) 15 November 1994 (15.11.1994), See entire document, including	28

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/33887

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:
Please See Continuation 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 additional fees, this Authority did not invite payment of any 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/US04/33887

BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, Claim(s) 1-22, drawn to a reflective grating for precision location measurement, including a non-reflective substrate layer; a non-reflective adhesion layer disposed on the substrate layer; and a reflective surface layer disposed on the adhesion layer.

Group II, Claim(s) 23-29, drawn to a system for forming a reflective grating from a tape having a substrate, an adhesion layer, and a surface layer, the system including a feed roll having the tape rolled thereon; a drive roller for retrieving the tape from the feed roll; a laser for writing grating lines onto the tape; and a take-up reel for rolling the tape into a roll after being vaporized by the laser.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

For each of Groups I and II, each of the listed groups has special technical features not required for the other group. The special technical features exclusive to each group are listed above in the listing of the groups.