

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
1 May 2003 (01.05.2003)

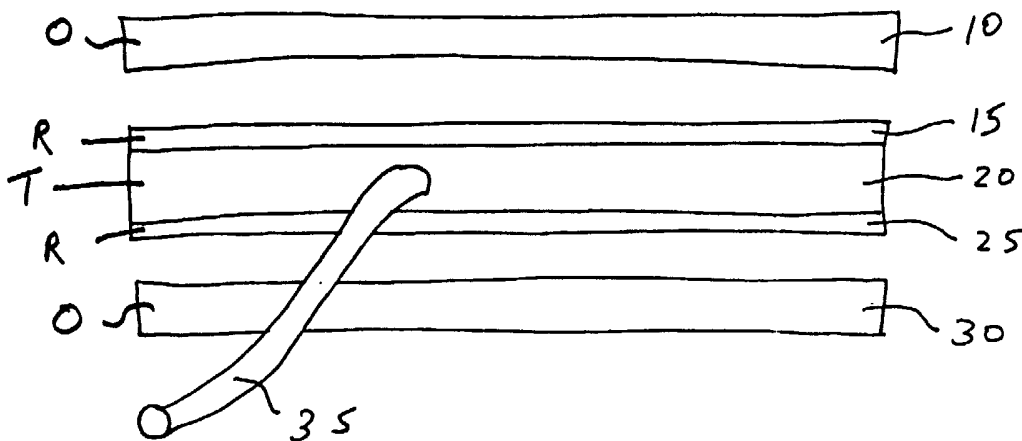
PCT

(10) International Publication Number
WO 03/036338 A3

- (51) International Patent Classification⁷: **G02B 6/26**, 6/42 (74) Agents: **GRAF, Ernest, R.** et al.; The Johns Hopkins University, Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel, MD 20723-6099 (US).
- (21) International Application Number: PCT/US02/34377
- (22) International Filing Date: 25 October 2002 (25.10.2002) (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, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/343,724 25 October 2001 (25.10.2001) US
- (71) Applicant (*for all designated States except US*): **THE JOHNS HOPKINS UNIVERSITY** [US/US]; 34th and N. Charles Streets, Baltimore, MD 21218 (US). (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, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- (72) Inventors; and
- (75) Inventors/Applicants (*for US only*): **GAUTHIER, Leo, R., Jr.** [US/US]; 106 Oakway Road, Timonium, MD 21093 (US). **DREWRY, David, G., Jr.** [US/US]; 111 Ivy Hill Drive, Middletown, MD 27169 (US). **BRUNNER, Leroy** [US/US]; 8115 Woodward Street, Savage, MD 20763 (US).
- Published:
— with international search report

[Continued on next page]

(54) Title: AN OPTICAL SENSOR AND METHOD FOR DETECTING PROJECTILE IMPACT LOCATION AND VELOCITY VECTOR



(57) Abstract: An optical sensor (P) and method for detecting a projectile velocity vector includes optically detecting the arrival of a projectile. The sensor (P) includes a sandwich of a transparent layer (20) within two reflective layers (15), which in turn are within two opaque layers. An optical sensor structure includes a set of sensors positioned in respective planes, wherein at least two non-parallel optical sensors (P) are used for each trajectory dimension of interest that differs from the primary direction of motion of the projectile and one additional optical sensor (P) may be used for independent measurement of velocity attenuation. An optical sensor structure includes a set of sensors positioned in respective planes, wherein at least two of the optical sensors (P) are oriented in respective planes that are parallel and potentially offset from each other. A tiling of the optical sensors or optical structures is also possible.



(88) Date of publication of the international search report:
21 August 2003

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/US02/34377

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G02B 6/26, 42

US CL : 385/15

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. : 385/15

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPAT, USPG-PUB, EPO, JPO, DERWENT

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.
Y	US 5,157,262 A (MARSONER et al.) 20 October 1992, column 1, line 11-column 12, line 34.	1-28
Y,P	US 2002/0003231 A1 (SUN et al.) 10 January 2002, page 1, first paragraph-page 7, paragraph 0100.	1-28
Y	US 5,991,479 A (KLEINERMAN) 23 November 1999, column 1, line 25-column 53, line 53.	1-28
Y	US 6,045,888 A (CHEN et al.) 04 April 2000, column 1, line 9-column 21, line 36.	1-28
Y	US 6,198,694 B1 (KROLING et al.), 06 March 2001, column 1, line 6-column 9, line 25.	1-28
Y	US 5,258,962 A (KARLSEN) 02 November 1993, column 1, line 1, column 8, line 62.	1-28
Y	US 5,988,645 A (DOWNING) 23 November 1999, column 1, line 15-column 38, line 34.	1-28

☐ 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	"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
"E" earlier application or patent published on or after the international filing date	"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
"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)	"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
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

22 April 2003 (22.04.2003)

Date of mailing of the international search report

27 MAY 2003

Name and mailing address of the ISA/US

Commissioner of Patents and Trademarks

Box PCT

Washington, D.C. 20231

Facsimile No. (703)305-3230

Authorized officer

Frank Font

Telephone No. 305-4770