### (12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization

International Bureau





(10) International Publication Number WO 2016/108992 A3

(43) International Publication Date 7 July 2016 (07.07.2016)

(51) International Patent Classification: *G01D 5/16* (2006.01) *G01D 5/14* (2006.01)

(21) International Application Number:

PCT/US2015/055230

(22) International Filing Date:

13 October 2015 (13.10.2015)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

14/529,606 31 October 2014 (31.10.2014)

US

- (71) Applicant: ALLEGRO MICROSYSTEMS, LLC [US/US]; 115 Northeast Cutoff, Worcester, Massachusetts 01606 (US).
- (72) Inventors: FOLETTO, Andrea; 1, Rue des Pavillons, 74000 Annecy (FR). VUILLERMET, Yannick; Chemin des Massettes, 73420 Voglans (FR). FRIEDRICH, Andreas, P.; 51 Route des Grands Prés, 74370 Metz-Tessy (FR).
- (74) Agents: ROBINSON, Kermit et al.; Daly, Crowley, Mofford & Durkee, LLP, Suite 301A, 354A Turnpike Street, Canton, Massachusetts 02021 (US).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,

HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, 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.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

#### **Declarations under Rule 4.17:**

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

#### Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))
- (88) Date of publication of the international search report:

1 September 2016

(54) Title: MAGNETIC FIELD SENSOR FOR SENSING A MOVEMENT OF A TARGET OBJECT

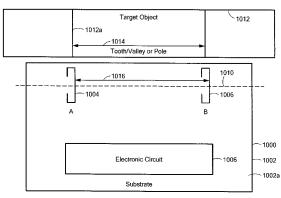


FIG. 10

(57) Abstract: A magnetic field sensor operates as a motion detector for sensing a movement of a ferromagnetic target object having features. The magnetic field sensor has a plurality of magnetoresistance elements to generate, in a first channel, a feature signal indicative of a proximity of a feature of a ferromagnetic target object and, in a second channel, an edge signal indicative of a proximity of an edge of a feature of a ferromagnetic target object.



### **INTERNATIONAL SEARCH REPORT**

International application No PCT/US2015/055230

A. CLASSIFICATION OF SUBJECT MATTER INV. G01D5/16 G01D5/14 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) G01D

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)

EPO-Internal, WPI Data

Y EP 0 504 583 A1 (SWF AUTO ELECTRIC GMBH [DE]) 23 September 1992 (1992-09-23) pages 2-4; figures 2,3   Y US 6 291 989 B1 (SCHROEDER THADDEUS [US]) 1 8 September 2001 (2001-09-18) column 3, line 8 - column 4, line 65;	Relevant to claim No.
[DE]) 23 September 1992 (1992-09-23) pages 2-4; figures 2,3 Y US 6 291 989 B1 (SCHROEDER THADDEUS [US]) 18 September 2001 (2001-09-18) column 3, line 8 - column 4, line 65;	1-30
18 September 2001 (2001-09-18) column 3, line 8 - column 4, line 65;	
figures 5,6	1-10
	8,9,18, 19
Y US 2009/206827 A1 (AIMUTA KYOHEI [JP] ET 1 AL) 20 August 2009 (2009-08-20) paragraphs [0052] - [0122]; figures 3,10	11-30

X Further documents are listed in the continuation of Box C.	X See patent family annex.	
"A" document defining the general state of the art which is not considered to be of particular relevance  "E" earlier application or patent but published on or after the international filling 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	
Date of the actual completion of the international search	Date of mailing of the international search report	
25 July 2016	03/08/2016	
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  Kurze, Volker	

2

# **INTERNATIONAL SEARCH REPORT**

International application No
PCT/US2015/055230

		PC1/032013/033230
C(Continua	ation). DOCUMENTS CONSIDERED TO BE RELEVANT	
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2009/146647 A1 (AUSSERLECHNER UDO [AT]) 11 June 2009 (2009-06-11) paragraphs [0003], [0018], [0028], [0033], [0038], [0062] - [0064]; figures 1,3	1-30
A	[0033], [0038], [0062] - [0064]; figures 1,3 US 2010/072988 A1 (HAMMERSCHMIDT DIRK [AT] ET AL) 25 March 2010 (2010-03-25) paragraphs [0001], [0002], [0049] - [0053], [0068] - [0070]; figures 1,2,4,5	1-30

## **INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No
PCT/US2015/055230

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0504583 A1	23-09-1992	DE 4104902 A1 EP 0504583 A1	20-08-1992 23-09-1992
US 6291989 B1	18-09-2001	DE 10039354 A1 US 6291989 B1	26-04-2001 18-09-2001
US 2012007589 A1	12-01-2012	NONE	
US 2009206827 A1	20-08-2009	JP 4273363 B2 JP 4324813 B2 JP 2009025319 A US 2009206827 A1 WO 2008062778 A1	03-06-2009 02-09-2009 05-02-2009 20-08-2009 29-05-2008
US 2009146647 A1	11-06-2009	DE 102008058896 A1 US 2009146647 A1	25-06-2009 11-06-2009
US 2010072988 A1	25-03-2010	DE 102009041989 A1 US 2010072988 A1 US 2012313623 A1 US 2016076911 A1	08-04-2010 25-03-2010 13-12-2012 17-03-2016