

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
17 April 2008 (17.04.2008)

PCT

(10) International Publication Number
WO 2008/044162 A3

- (51) International Patent Classification:
G01N 33/543 (2006.01) G01R 33/12 (2006.01)
G01R 33/09 (2006.01)
- (21) International Application Number:
PCT/IB2007/053944
- (22) International Filing Date:
28 September 2007 (28.09.2007)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
06121980.4 9 October 2006 (09.10.2006) EP
- (71) Applicant (for all designated States except US): KONINKLIJKE PHILIPS ELECTRONICS N.V. [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): DURIC, Haris [NL/NL]; c/o High Tech Campus 44, NL-5656 AE Eindhoven (NL). KAHLMAN, Josephus Arnoldus Henricus Maria [NL/NL]; c/o High Tech Campus 44, NL-5656 AE Eindhoven (NL). BLANKEN, Pieter, G. [NL/NL]; c/o High Tech Campus 44, NL-5656 AE Eindhoven (NL).
- (74) Agent: SCHOUTEN, Marcus, M.; High Tech Campus 44, NL-5656 AE Eindhoven, (NL).

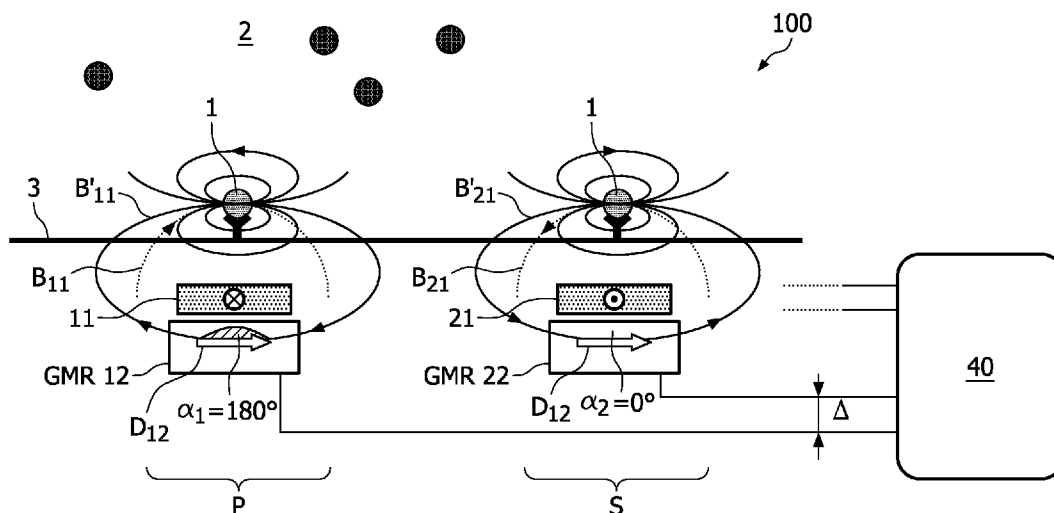
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, 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, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

[Continued on next page]

(54) Title: MAGNETIC SENSOR DEVICE WITH PAIRS OF DETECTION UNITS



(57) Abstract: The invention relates to a magnetic sensor device (100) with a primary and secondary detection unit (P, S), each of which comprises a magnetic sensor element and a magnetic field generator. In a preferred embodiment, the magnetic sensor elements are GMR elements (12, 22) with the same sensitive directions (D₁₂, D₂₂), and the magnetic field generators are parallel wires (11, 21) which are supplied by an evaluation and control unit (40) with anti-parallel magnetic excitation currents. The magnetic excitation currents generate magnetic excitation fields (B_n, B_{2i}) with opposite sense of rotation which in turn induce oppositely directed magnetic reaction fields (B'₁₁, B'₂₁) in magnetized particles (1) provided in an investigation region (2). The magnetic reaction fields (B'₁₁, B'₂₁) therefore have opposite effects on the GMR elements, yielding an increase in the difference (Δ) between the output signals of these elements. In a preferred embodiment, four detection units are arranged in a Wheatstone bridge.

WO 2008/044162 A3



(88) Date of publication of the international search report:
17 July 2008

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2007/053944

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01N33/543 G01R33/09 G01R33/12

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)
G01N G01R

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2005/116661 A (KONINKL PHILIPS ELECTRONICS NV [NL]; KAHLMAN JOSEPHUS A H M [NL]; PRIN) 8 December 2005 (2005-12-08) page 17, line 23 - page 18, line 7; figure 10 page 20, line 7 - line 12; figure 16	1-13
X	WO 2005/010503 A (KONINKL PHILIPS ELECTRONICS NV [NL]; KAHLMAN JOSEPHUS A H M [NL]) 3 February 2005 (2005-02-03) abstract page 11, line 29 - page 14, line 16; figures 6-11 ----- -/--	1-13

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 document but 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.
- *Z* document member of the same patent family

Date of the actual completion of the international search

16 May 2008

Date of mailing of the international search report

30/05/2008

Name and mailing address of the ISA/
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

Authorized officer

Bergado Colina, J

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2007/053944

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 981 297 A (BASELT DAVID R [US]) 9 November 1999 (1999-11-09) abstract column 6, line 32 - column 9, line 17; figures 1-7	1-13
X	SMITH C H ET AL: "High-Resolution, Chip-Size Magnetic Sensor Arrays" INTERNET CITATION, [Online] XP002300944 Retrieved from the Internet: URL:www.sensormag.com/articles/0303/44/main.shtml> [retrieved on 2004-10-15] page 2 - page 3; figures 1,2	1-13
A	WO 2005/111596 A (KONINKL PHILIPS ELECTRONICS NV [NL]; PRINS MENNO W J [NL]; VAN DER MAR) 24 November 2005 (2005-11-24) abstract figures 8-14	1-13
A	WO 2006/018811 A (INST DE ENGENHARIA DE SIST S E [PT]; UNIV COLLEGE CORK NAT UNIVERSI [I]) 23 February 2006 (2006-02-23) abstract figures 4-10	1-13
A	WO 03/054566 A (KONINKL PHILIPS ELECTRONICS NV [NL]; PRINS MENNO W J [NL]; COEHOORN RE) 3 July 2003 (2003-07-03) cited in the application abstract compounds 7,8	1-13
A	WO 03/054523 A (KONINKL PHILIPS ELECTRONICS NV [NL]; COEHOORN REINDER [NL]; PRINS MENN) 3 July 2003 (2003-07-03) cited in the application abstract figures 1,7,8	1-13
A	WO 2005/010543 A (KONINKL PHILIPS ELECTRONICS NV [NL]; KAHLMAN JOSEPHUS A H M [NL]; DE B) 3 February 2005 (2005-02-03) cited in the application abstract figures 26-30	1-13
A	WO 2005/010542 A (KONINKL PHILIPS ELECTRONICS NV [NL]; KAHLMAN JOSEPHUS A H M [NL]; PRIN) 3 February 2005 (2005-02-03) cited in the application abstract figures 15-18	1-13
	-/--	

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2007/053944

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	<p>WO 2007/132366 A (KONINKL PHILIPS ELECTRONICS NV [NL]; NIEUWENHUIS JEROEN HANS [NL]; VAN) 22 November 2007 (2007-11-22) abstract page 11, line 6 - page 13, line 25; figures 1-3</p> <p style="text-align: center;">-----</p>	1-13
E	<p>WO 2008/017970 A (KONINKL PHILIPS ELECTRONICS NV [NL]; KAHLMAN JOSEPHUS ARNOLDUS HENR [N]) 14 February 2008 (2008-02-14) abstract page 6, line 5 - page 11, line 21; figures 1-7</p> <p style="text-align: center;">-----</p>	1-13
E	<p>WO 2007/129284 A (KONINKL PHILIPS ELECTRONICS NV [NL]; NIEUWENHUIS JEROEN H [NL]; LANKVE) 15 November 2007 (2007-11-15) abstract figures 6-8</p> <p style="text-align: center;">-----</p>	1-13
E	<p>EP 1 884 763 A (MAGIC TECHNOLOGIES INC [US]; APPLIED SPINTRONICS INC [US]) 6 February 2008 (2008-02-06) abstract page 5, paragraph 24 - page 7, paragraph 33; figures 4,5</p> <p style="text-align: center;">-----</p>	1-13

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2007/053944

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 2005116661	A	08-12-2005	CN 1957257 A JP 2008500548 T US 2008024118 A1	02-05-2007 10-01-2008 31-01-2008
WO 2005010503	A	03-02-2005	JP 2007501379 T KR 20060059980 A US 2006214658 A1	25-01-2007 02-06-2006 28-09-2006
US 5981297	A	09-11-1999	NONE	
WO 2005111596	A	24-11-2005	CN 1957251 A JP 2007538252 T US 2007172890 A1	02-05-2007 27-12-2007 26-07-2007
WO 2006018811	A	23-02-2006	EP 1781820 A1 US 2007264159 A1	09-05-2007 15-11-2007
WO 03054566	A	03-07-2003	AU 2002348754 A1 CN 1605031 A JP 2005513485 T TW 290225 B US 2005035757 A1	09-07-2003 06-04-2005 12-05-2005 21-11-2007 17-02-2005
WO 03054523	A	03-07-2003	AT 326697 T AU 2002366904 A1 CN 1608206 A DE 60211555 T2 JP 2005513475 T US 2006128035 A1 US 2005087000 A1	15-06-2006 09-07-2003 20-04-2005 22-02-2007 12-05-2005 15-06-2006 28-04-2005
WO 2005010543	A	03-02-2005	NONE	
WO 2005010542	A	03-02-2005	CN 1829922 A JP 2007500347 T KR 20060054351 A US 2006194327 A1	06-09-2006 11-01-2007 22-05-2006 31-08-2006
WO 2007132366	A	22-11-2007	NONE	
WO 2008017970	A	14-02-2008	NONE	
WO 2007129284	A	15-11-2007	NONE	
EP 1884763	A	06-02-2008	JP 2008039782 A US 2008032423 A1	21-02-2008 07-02-2008