



(51) International Patent Classification:

G01S 17/42 (2006.01) G02B 5/09 (2006.01)
G01S 17/93 (2006.01) G02B 26/12 (2006.01)
G01S 7/481 (2006.01) G01S 17/87 (2006.01)
G01S 7/486 (2006.01)

(21) International Application Number:

PCT/US2018/052849

(22) International Filing Date:

26 September 2018 (26.09.2018)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/565,373 29 September 2017 (29.09.2017) US
62/594,284 04 December 2017 (04.12.2017) US
16/105,133 20 August 2018 (20.08.2018) US

(71) Applicant: VEONEER US, INC. [US/US]; 26545 American Drive, Southfield, MI 48034 (US).

(72) Inventors: HANSSON, Peter; c/o Veoneer US, Inc., 26545 American Drive, Southfield, MI 48034 (US). HAL-LSTIG, Emil; c/o Veoneer US, Inc., 26545 American Drive, Southfield, MI 48034 (US). DE MERSEMAN, Bernard; c/o Veoneer US, Inc., 26545 American Drive, Southfield, MI 48034 (US). ANDERSSON, Mauritz; c/o Veoneer US, Inc., 26545 American Drive, Southfield, MI 48034 (US).

(74) Agent: MILLS, Steven, M. et al.; Burns & Levinson, LLP, 125 Summer Street, Boston, MA 02110 (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, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, 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,

(54) Title: DETECTION SYSTEM WITH REFLECTIVE MEMBER ILLUMINATED FROM MULTIPLE SIDES

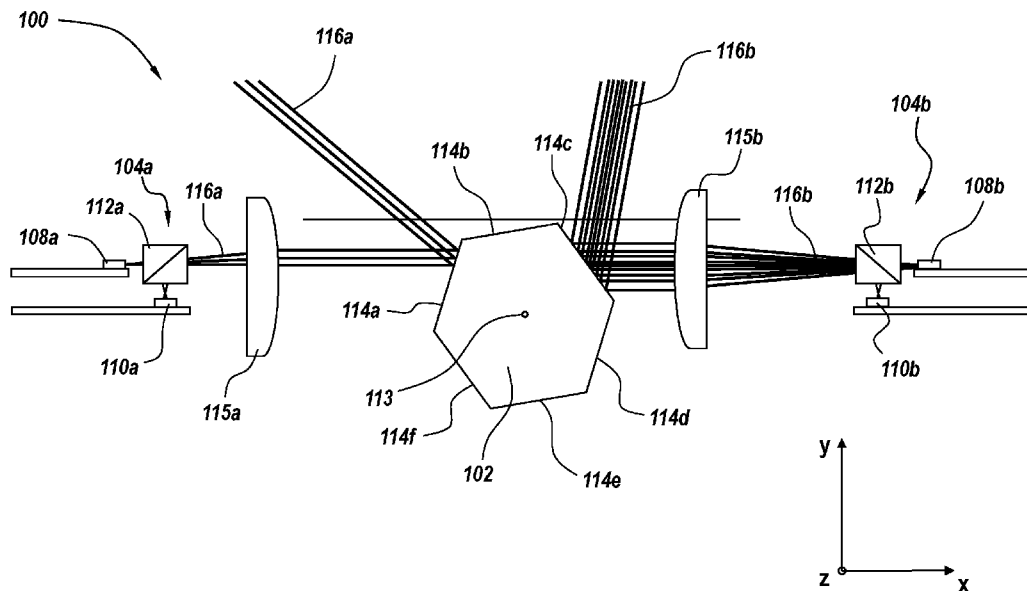


Fig. 1

(57) Abstract: A detection system for a vehicle in an environment includes at least one reflective member having a rotational axis and a plurality of reflective sides. Each of the reflective sides slopes towards the rotational axis at a slope angle different than the slope angle of at least one of the others of the reflective sides. The system includes a plurality of LiDAR systems with at least one light transmitter and at least one light receiver, each LiDAR system interacting with a different one of the reflective sides to scan the environment.



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).

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:

06 June 2019 (06.06.2019)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2018/052849

A. CLASSIFICATION OF SUBJECT MATTER
 INV. G01S17/42 G01S17/93 G01S7/481 G01S7/486 G02B5/09
 G02B26/12 G01S17/87
 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)
 G01S G02B

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 3 203 259 A1 (KONICA MINOLTA INC [JP]) 9 August 2017 (2017-08-09) paragraphs [0012] - [0082] figures 1-27	1-5, 11-18
A	----- US 2016/047895 A1 (DUSSAN LUIS CARLOS [US]) 18 February 2016 (2016-02-18) paragraphs [0162] - [0168] figure 11	1-18
A	----- DE 10 2004 033944 A1 (CONTI TEMIC MICROELECTRONIC [DE]) 2 February 2006 (2006-02-02) paragraphs [0061] - [0066] figures 1,2	1-18
	----- -/--	

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 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
- "&" document member of the same patent family

Date of the actual completion of the international search 5 December 2018	Date of mailing of the international search report 06/05/2019
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 Kruck, Peter

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2018/052849

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 94/19705 A1 (SHACHTER ISRAEL [IL]; SILICON HEIGHTS LTD [IL]; YAVNAYI AMOTZ [IL]; GA) 1 September 1994 (1994-09-01) page 26, line 26 - page 27, line 15 figure 18 -----	1-18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/052849

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:

see additional 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 an additional fees, this Authority did not invite payment of 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.:

1-18

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-18

defining a detection system for a vehicle comprising a rotating reflective member having a plurality of reflective sides, further comprising a plurality of Lidar systems interacting with different reflective sides of the rotating reflective member;

2. claims: 19-22

defining a detection system for a vehicle comprising a first lidar system interacting with reflective sides of a first reflective member, and a second lidar system interacting with reflective sides of a second reflective member.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2018/052849

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3203259	A1	09-08-2017	EP 3203259 A1
			US 2017219696 A1

US 2016047895	A1	18-02-2016	AU 2015301488 A1
			CA 2958204 A1
			CN 107076838 A
			EP 3195010 A2
			JP 2017530343 A
			KR 20170056546 A
			US 2016047895 A1
			US 2016047896 A1
			US 2016047897 A1
			US 2016047898 A1
			US 2016047899 A1
			US 2016047900 A1
			US 2016047903 A1
			US 2018143300 A1
			US 2019025407 A1
			WO 2016025908 A2

DE 102004033944	A1	02-02-2006	NONE

WO 9419705	A1	01-09-1994	AU 6008594 A
			EP 0685077 A1
			JP H08507371 A
			WO 9419705 A1
