



- (51) **International Patent Classification:**
A61B 8/08 (2006.01) A61B 8/04 (2006.01)
A61B 8/00 (2006.01)
- (21) **International Application Number:**
PCT/US2016/065926
- (22) **International Filing Date:**
9 December 2016 (09.12.2016)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
62/294,876 12 February 2016 (12.02.2016) US
15/186,225 17 June 2016 (17.06.2016) US
- (71) **Applicant: QUALCOMM INCORPORATED [US/US];**
ATTN: International IP Administration, 5775 Morehouse Drive, San Diego, California 92121-1714 (US).
- (72) **Inventors: BAEK, David Boettcher;** 5775 Morehouse Drive, San Diego, California 92121-1714 (US). **SCHNEIDER, Philip John;** 5775 Morehouse Drive, San Diego, California 92121-1714 (US). **LADING, Lars;** 5775 Morehouse Drive, San Diego, California 92121-1714 (US). **ABDEL-MALEK, Aiman;** 5775 Morehouse Drive, San Diego, California 92121-1714 (US). **SCHNEIDER, John**

Keith; 5775 Morehouse Drive, San Diego, California 92121-1714 (US).

- (74) **Agents: SAMPSON, Roger S. et al.;** Weaver Austin Villeneuve & Sampson LLP, P. O. Box 70250, Oakland, California 94612-0250 (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, 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, 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,

[Continued on next page]

(54) **Title:** ULTRASOUND DEVICES FOR ESTIMATING BLOOD PRESSURE AND OTHER CARDIOVASCULAR PROPERTIES

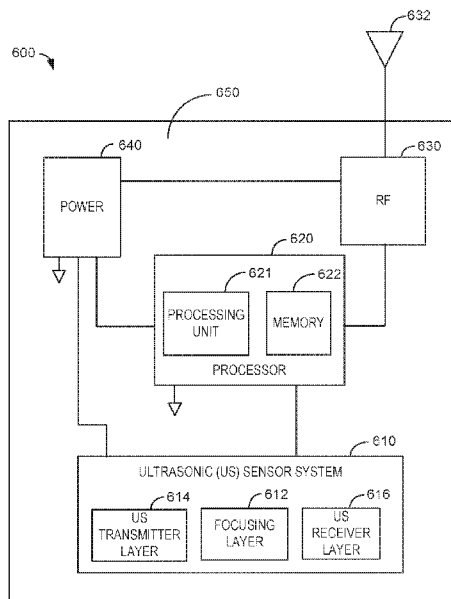


FIGURE 6A

(57) **Abstract:** An ultrasound cardiovascular measuring device may include an ultrasonic sensor system having an ultrasound transmitter layer configured to generate ultrasonic plane waves and a focusing layer that includes one or more lenses. One or more of the lenses may be configured to generate output signals corresponding to detected ultrasonic reflections. The measuring device may include a control system capable of processing the output signals to calculate values corresponding to one or more cardiovascular properties.

WO 2017/139015 A3



SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

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))*

- *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:

14 September 2017

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/065926

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B8/08 A61B8/00 A61B8/04
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)
A61B
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	WO 2015/011594 A1 (KONINKL PHILIPS NV [NL]) 29 January 2015 (2015-01-29)	1,3,4,6,8,9,17,19,21-24
Y	page 1, lines 1-7; claims; figures	5,7,10-16,18,25
A	page 2, line 9 - page 14, line 8	2,20
X	EP 2 289 419 A1 (HITACHI MEDICAL CORP [JP]) 2 March 2011 (2011-03-02)	1-4,6,8,9,17,19-24
A	paragraphs [0001], [0007], [0009], [0012], [0018] - [0035]; claims; figures	
A	JP 2012 061131 A (SEIKO EPSON CORP) 29 March 2012 (2012-03-29)	1-4,6,8,9,17,19-24
	the whole document	
	----- -/--	

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 28 July 2017	Date of mailing of the international search report 09/08/2017
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 Mundakapadam, S

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/065926

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 722 347 A (ABRAMS JEROME H [US] ET AL) 2 February 1988 (1988-02-02) the whole document -----	1-4,6,8, 9,17, 19-24
Y	US 2014/352440 A1 (FENNELL LEONARD EUGENE [US] ET AL) 4 December 2014 (2014-12-04) paragraphs [0002], [0020] - [0028]; claims; figures -----	10
Y	US 2005/154299 A1 (HOCTOR RALPH T [US] ET AL) 14 July 2005 (2005-07-14) paragraphs [0001], [0024] - [0025], [0072] - [0075], [0112] - [0113]; claims; figures -----	5,7, 14-16, 18,25
Y	US 2002/067359 A1 (BRODSKY MICHAEL [US] ET AL) 6 June 2002 (2002-06-06) paragraphs [0148] - [0149]; claims; figures -----	12,13
Y	WO 2005/053664 A2 (TERATECH CORP [US]) 16 June 2005 (2005-06-16) page 12, line 1 - line 11; claims; figures -----	11

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2016/065926

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
WO 2015011594	A1	29-01-2015	CN 105407807 A	16-03-2016
			EP 3024396 A1	01-06-2016
			JP 2016525405 A	25-08-2016
			US 2016157826 A1	09-06-2016
			WO 2015011594 A1	29-01-2015

EP 2289419	A1	02-03-2011	CN 102026581 A	20-04-2011
			EP 2289419 A1	02-03-2011
			JP 5314008 B2	16-10-2013
			JP WO2009139400 A1	22-09-2011
			US 2011071396 A1	24-03-2011
			WO 2009139400 A1	19-11-2009

JP 2012061131	A	29-03-2012	JP 5552982 B2	16-07-2014
			JP 2012061131 A	29-03-2012

US 4722347	A	02-02-1988	NONE	

US 2014352440	A1	04-12-2014	CN 105264543 A	20-01-2016
			EP 3005227 A1	13-04-2016
			JP 2016522650 A	28-07-2016
			KR 20160016958 A	15-02-2016
			TW 201510555 A	16-03-2015
			US 2014352440 A1	04-12-2014
			WO 2014197504 A1	11-12-2014

US 2005154299	A1	14-07-2005	NONE	

US 2002067359	A1	06-06-2002	EP 1370888 A2	17-12-2003
			JP 2004530463 A	07-10-2004
			TW 537885 B	21-06-2003
			US 2002067359 A1	06-06-2002
			WO 02068992 A2	06-09-2002

WO 2005053664	A2	16-06-2005	EP 1695113 A2	30-08-2006
			EP 2267481 A1	29-12-2010
			EP 2267482 A1	29-12-2010
			EP 2857861 A2	08-04-2015
			US 2005251035 A1	10-11-2005
			US 2014071789 A1	13-03-2014
			WO 2005053664 A2	16-06-2005

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/065926

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.:

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: 1-4, 6, 8, 9, 17, 19-24

various aspects of the focusing layer of an ultrasound cardiovascular measuring device

2. claims: 5, 7, 14-16, 18, 25

processing steps of the control system of an ultrasound cardiovascular measuring device

3. claim: 10

materials of the various components

4. claims: 11-13

aspects related to design of an ultrasound cardiovascular measuring device
