



(51) International Patent Classification:

A61B 5/00 (2006.01) G06T 7/00 (2006.01)
A61M 25/00 (2006.01) A61B 19/00 (2006.01)
A61F 2/82 (2006.01)

(21) International Application Number:

PCT/US2010/049887

(22) International Filing Date:

22 September 2010 (22.09.2010)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

61/244,992 23 September 2009 (23.09.2009) US
61/334,834 14 May 2010 (14.05.2010) US

(71) Applicant (for all designated States except US): **LIGHT-LAB IMAGING, INC.** [US/US]; One Technology Park Drive, Westford, MA 01886 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **SCHMITT, Joseph, M.** [US/US]; 102 Brookside Drive, Andover, MA 01810 (US). **FRIEDMAN, Joel, M.** [US/US]; 93 Cross Street, Andover, MA 01810 (US). **PETROFF, Christopher** [US/US]; 227 Riverbend Drive, Groton, MA 01450 (US). **ELBASIONY, Amr** [US/US]; 8 Fletcher Street, Chelmsford, MA 01824 (US).

(74) Agents: **FAJKOWSKI, James, E.** et al.; K&I Gates LLP, State Street Financial Center, One Lincoln Street, Boston, MA 02111-2950 (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, 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, 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, PE, PG, PH, PL, PT, RO, RS, RU, 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, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ,

[Continued on next page]

(54) Title: LUMEN MORPHOLOGY AND VASCULAR RESISTANCE MEASUREMENTS DATA COLLECTION SYSTEMS, APPARATUS AND METHODS

STENT DIA = 2 mm, LENGTH = 8mm, CNTR POS = 21.3 mm, Q_{un} = 2.2 ml/s

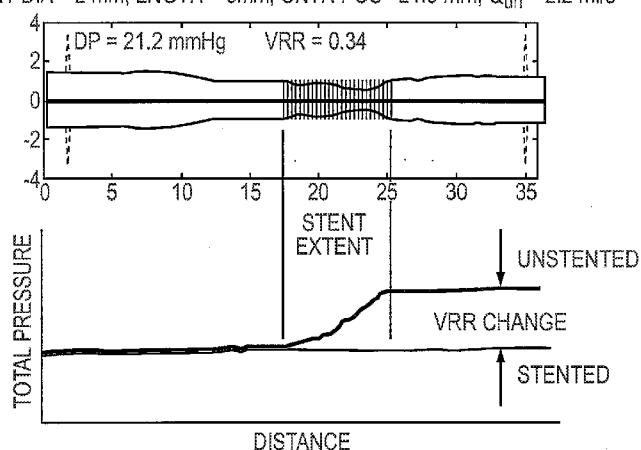


FIG. 23

(57) Abstract: A method and apparatus of automatically locating in an image of a blood vessel the lumen boundary at a position in the vessel and from that measuring the diameter of the vessel. From the diameter of the vessel and estimated blood flow rate, a number of clinically significant physiological parameters are then determined and various user displays of interest generated. One use of these images and parameters is to aid the clinician in the placement of a stent. The system, in one embodiment, uses these measurements to allow the clinician to simulate the placement of a stent and to determine the effect of the placement. In addition, from these patient parameters various patient treatments are then performed.



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

Published:

— *with international search report (Art. 21(3))*

(88) Date of publication of the international search report:

9 August 2012

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2010/049887

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61B5/00 A61M25/00 A61F2/82 G06T7/00
ADD. A61B19/00

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 A61M A61F G06T

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)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2 062 526 A1 (TERUMO CORP [JP]) 27 May 2009 (2009-05-27) paragraphs [0002], [0009] - [0010], [0024], [0031] - [0032], [0039], [0049], [0058] - [0060]; claims; figures -----	24-30
X	US 2007/135707 A1 (REDEL THOMAS [DE] ET AL) 14 June 2007 (2007-06-14) paragraphs [0001], [0002], [0011] - [0015], [0022] - [0027], [0035]; claims; figures -----	29,30
A	US 2006/135870 A1 (WEBLER WILLIAM E [US]) 22 June 2006 (2006-06-22) paragraphs [0001], [0019] - [0021], [0060] - [0062], [0102], [0150], [0167]; claims; figures -----	15-19, 24-28
A	US 2006/135870 A1 (WEBLER WILLIAM E [US]) 22 June 2006 (2006-06-22) paragraphs [0001], [0019] - [0021], [0060] - [0062], [0102], [0150], [0167]; claims; figures ----- -/-	24-30

☒ 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

17 May 2011

Date of mailing of the international search report

09/06/2011

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/US2010/049887

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SIHAN K ET AL: "A novel approach to quantitative analysis of intravascular optical coherence tomography imaging", COMPUTERS IN CARDIOLOGY, 2008, IEEE, PISCATAWAY, NJ, USA, 14 September 2008 (2008-09-14), pages 1089-1092, XP031406748, ISBN: 978-1-4244-3706-1	5-14,26
A	the whole document	24,25, 27-30
A	----- US 2008/075375 A1 (UNAL GOZDE [US] ET AL) 27 March 2008 (2008-03-27) paragraphs [0002], [0003], [0008], [0046], [0077] - [0078]; claims; figures	24-30
A	----- US 2008/228086 A1 (ILEGBUSI OLUSEGUN JOHNSON [US] ET AL) 18 September 2008 (2008-09-18) paragraphs [0005] - [0007], [0033], [0035] - [0039], [0044], [0048], [0049] - [0050], [0053], [0055]; claims; figures	24,25, 27,28
A,P	----- SIHAN ET AL: "Fully automated three-dimensional quantitative analysis of intracoronary optical coherence tomography:method and validation", CATHETERIZATION AND CARDIOVASCULAR INTERVENTIONS, vol. 74, 1 December 2009 (2009-12-01), pages 1058-1065, XP002616648, DOI: 10.1002/ccd the whole document	24-30
X	----- MAKOTO OHTA ET AL: "Rheological Changes After Stenting of a Cerebral Aneurysm: A Finite Element Modeling Approach", CARDIOVASCULAR AND INTERVENTIONAL RADIOLOGY, SPRINGER-VERLAG, NE, vol. 28, no. 6, 1 December 2005 (2005-12-01), pages 768-772, XP019365417, ISSN: 1432-086X the whole document	29,30

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2010/049887

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2062526 A1	27-05-2009	JP 2009128074 A US 2009143686 A1	11-06-2009 04-06-2009
US 2007135707 A1	14-06-2007	CN 1977773 A	13-06-2007
US 2006135870 A1	22-06-2006	EP 1833363 A2 JP 2008523954 T WO 2006068927 A2	19-09-2007 10-07-2008 29-06-2006
US 2008075375 A1	27-03-2008	NONE	
US 2008228086 A1	18-09-2008	US 2011051212 A1	03-03-2011

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2010/049887

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.: 1-4, 20-23, 31
because they relate to subject matter not required to be searched by this Authority, namely:
Claims 1-4, 20-23, 31 are directed to various invasive methods, employing an intravascular catheter for different measurements and hence are methods for treatment of the human or animal body by surgery (Rule 39.1(iv) PCT). The method of stent placement is also therapeutic.
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: 24, 25, 27, 28(completely); 15-19(partially)

directed to a computer based system for determining the stent length to be used to treat a stenotic lesion from vascular resistance ratio.

2. claims: 5-14, 26(completely); 15-19(partially)

directed to a computer based system for identifying the luminal border of a vessel from missing contour data.

3. claims: 29, 30

directed to a computer based system for optimizing the stent placement simulation.
