



(51) International Patent Classification:

A61F 9/007 (2006.01) A61B 1/00 (2006.01)
A61B 34/10 (2016.01) A61B 90/00 (2016.01)
A61B 34/20 (2016.01) A61B 17/00 (2006.01)
G06T 19/00 (2011.01) A61B 34/00 (2016.01)
G06T 7/10 (2017.01)

(21) International Application Number:

PCT/US2020/017425

(22) International Filing Date:

10 February 2020 (10.02.2020)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/803,418 08 February 2019 (08.02.2019) US

(71) Applicant: **THE BOARD OF TRUSTEES OF THE UNIVERSITY OF ILLINOIS** [US/US]; 352 Henry Administration Building, 506 South Wright Street, Urbana, IL 61801 (US).

(72) Inventors: **LEIDERMAN, Yannek, I.**; 840 S. Wood Street, Chicago, IL 60612 (US). **LUCIANO, Cristian, J.**; 840 S. Wood Street, Chicago, IL 60612 (US).

(74) Agent: **PROTAS, Jeremy, D.**; Marshall, Gerstein & Borun LLP, 233 S. Wacker Drive, 6300 Willis Tower, Chicago, IL 60606-6357 (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, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, 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).

(54) Title: IMAGE-GUIDED SURGERY SYSTEM

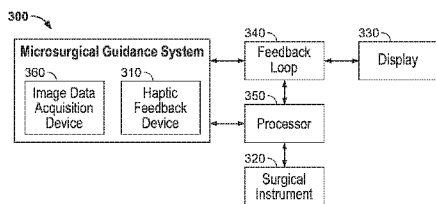


FIG. 3

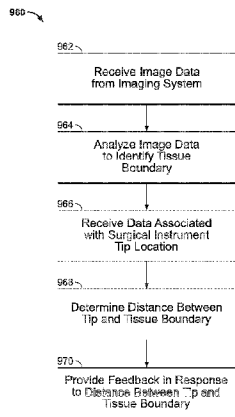


FIG. 2B

(57) Abstract: An image-guided surgical system includes a processor, a display communicatively coupled to the processor, and an imaging system communicatively coupled to the processor. A memory device, communicatively coupled to the processor, stores instructions, executable by the processor, to cause the processor to receive, from the imaging system, real-time image data of an ophthalmological surgical field during an ophthalmological surgical procedure, and analyze the image data in real-time to identify an ocular tissue boundary present in the image data of the ophthalmological surgical field. The instructions cause the processor to provide real-time visual, auditory, and/or haptic feedback in response to the identified ocular tissue boundary.



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:

24 September 2020 (24.09.2020)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2020/017425

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.: 17
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery and therapy
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.:
1-16, 18, 19, 22, 23

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.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2020/017425

A. CLASSIFICATION OF SUBJECT MATTER			
INV.	A61F9/007	A61B34/10	A61B34/20
	A61B1/00	A61B90/00	G06T19/00
ADD.	A61B17/00	A61B34/00	G06T7/10
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) A61F A61B 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 practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2014/121268 A1 (CLEVELAND CLINIC FOUNDATION [US]) 7 August 2014 (2014-08-07) paragraphs [0004], [0024] - [0035], [0045] - [0047]; claims 1,5,8-10,14; figures 1,2,9,11	1-5, 7-10,14, 15,22,23 11-13
Y	-----	
X	US 2011/106102 A1 (BALICKI MARCIN A [US] ET AL) 5 May 2011 (2011-05-05) paragraphs [0024] - [0028], [0032], [0033], [0049] - [0051]; figures 2,3,8	1,6,14, 22
X	US 2012/022546 A1 (HUBSCHMAN JEAN-PIERRE [US] ET AL) 26 January 2012 (2012-01-26) paragraphs [0002], [0051], [0059] - [0062]; claims 1-6; figures 1,2	1,14,22
	----- -/--	

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"&" document member of the same patent family
"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	

Date of the actual completion of the international search	Date of mailing of the international search report
8 June 2020	06/08/2020

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 Kajzar, Anna
--	--

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2020/017425

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 2017/181808 A1 (PANESCU DORIN [US] ET AL) 29 June 2017 (2017-06-29)	15,16, 18,19
Y	paragraphs [0086], [0122], [0123], [0136] - [0138], [0150] - [0153], [0159], [0173]; claims 1,6,9 -----	11-13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2020/017425

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2014121268 A1	07-08-2014	EP 2950763 A1 US 2014221822 A1 WO 2014121268 A1	09-12-2015 07-08-2014 07-08-2014

US 2011106102 A1	05-05-2011	NONE	

US 2012022546 A1	26-01-2012	US 2012022546 A1 US 2015141801 A1	26-01-2012 21-05-2015

US 2017181808 A1	29-06-2017	CN 106535812 A CN 110897590 A EP 3125809 A1 JP 2017510409 A KR 20160138233 A US 2017181808 A1 US 2020022769 A1 WO 2015149044 A1	22-03-2017 24-03-2020 08-02-2017 13-04-2017 02-12-2016 29-06-2017 23-01-2020 01-10-2015

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-16, 18, 19, 22, 23

a microsurgical guidance system with a real time feedback mechanism

2. claims: 20, 21

a system / method for microsurgical guidance wherein the tissue image is processed targeting tissue boundaries while excluding internal structure of the tissue
