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(54) Title: SURGICAL INSTRUMENT WITH DETECTION SENSORS

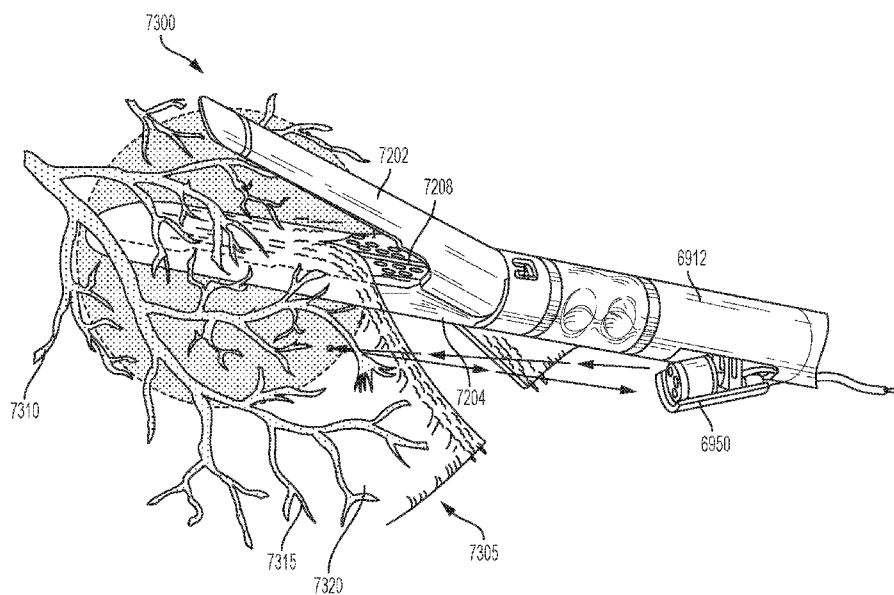


FIG. 108

(57) Abstract: Aspects of the present disclosure are presented for a surgical instrument having one or more sensors at or a near an end effector and configured to aid in the detection of tissues and other materials and structures at a surgical site. The detections may then be used to aid in the placement of the end effector and to confirm which objects to operate on, or alternatively, to avoid. Examples of sensors include laser sensors used to employ Doppler shift principles to detect movement of objects at the surgical site, such as blood cells; resistance sensors to detect the presence of metal; monochromatic light sources that allow for different levels of absorption from different types of substances present at the surgical site, and near infrared spectrometers with small form factors.



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).

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))*

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:

15 March 2018 (15.03.2018)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/026334

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.: 3-8, 14, 15, 18, 19(completely); 1, 2, 16, 17(partially)
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:
see FURTHER INFORMATION sheet PCT/ISA/210
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.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2017/026334

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B17/072
ADD. A61B17/00

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

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	US 5 769 791 A (BENARON DAVID A [US] ET AL) 23 June 1998 (1998-06-23) column 5, line 24 - line 62 column 9, line 7 - column 23, line 16 figures 1-6 -----	1,2, 9-12,16, 17
X	US 2015/066000 A1 (AN ANDREW [US] ET AL) 5 March 2015 (2015-03-05) paragraph [0075] - paragraph [0119] figures 4,5,9,10 -----	1,2,13, 16,17
X	US 2015/257629 A1 (SHAHINIAN HRAYR KARNIG [US]) 17 September 2015 (2015-09-17) paragraph [0035] - paragraph [0046] figure 1 ----- -/--	1,2,16, 17



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

30 January 2018

Date of mailing of the international search report

12/02/2018

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2017/026334

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 2008/125634 A1 (RYAN S ERIC [US] ET AL) 29 May 2008 (2008-05-29) paragraph [0061] - paragraph [0068] figure 1 -----	20
X	US 2016/073909 A1 (ZAND JASON MATTHEW [US] ET AL) 17 March 2016 (2016-03-17) paragraph [0053] - paragraph [0058] figure 1 -----	20
X	US 2014/288386 A1 (ZAND JASON M [US] ET AL) 25 September 2014 (2014-09-25) paragraph [0068] - paragraph [0074] figures 1a,1b -----	20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2017/026334

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5769791	A	23-06-1998	US 5769791 A 23-06-1998
		US 5772597 A	30-06-1998
		US 5785658 A	28-07-1998
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		US 2014288386 A1	25-09-2014
		US 2016310055 A1	27-10-2016
		WO 2014153428 A1	25-09-2014

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-19

Surgical instrument comprising a sensor apparatus to transmit sensor signals onto and receive sensor data of patient tissue

2. claim: 20

Computer readable medium comprising instructions to cause a processor to determine a physical or chemical composition of patient tissue

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 3-8, 14, 15, 18, 19(completely); 1, 2, 16, 17(partially)

Several of the claims define an invention which is not disclosed in a manner sufficiently clear and complete to be carried out by a person skilled in the art (Art. 5 PCT) or lack clarity and/or support (Art. 6 PCT) to such an extent that a meaningful search is impossible.

The applicant did not reply to the informal clarification request dated 20-07-2017 explaining the deficiencies and asking him to indicate on which subject-matter complying with Art. 5 and 6 PCT the search is to be based. As a consequence, it was impossible to carry out a meaningful search on claims 3-8, 14, 15, 18 and 19 for lack of compliance with Art. 5 & 6 PCT as explained above. The remaining claims were only searched in so far as they relate to a sensor apparatus as defined by the features of any of claims 9 or 13.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guidelines C-IV, 7.2), should the problems which led to the Article 17(2) declaration be overcome.