

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
24 March 2011 (24.03.2011)

(10) International Publication Number  
**WO 2011/034699 A3**

(51) International Patent Classification:  
A61B 5/00 (2006.01)

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(21) International Application Number:  
PCT/US2010/046674

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(22) International Filing Date:  
25 August 2010 (25.08.2010)

(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.

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
12/563,852 21 September 2009 (21.09.2009) US

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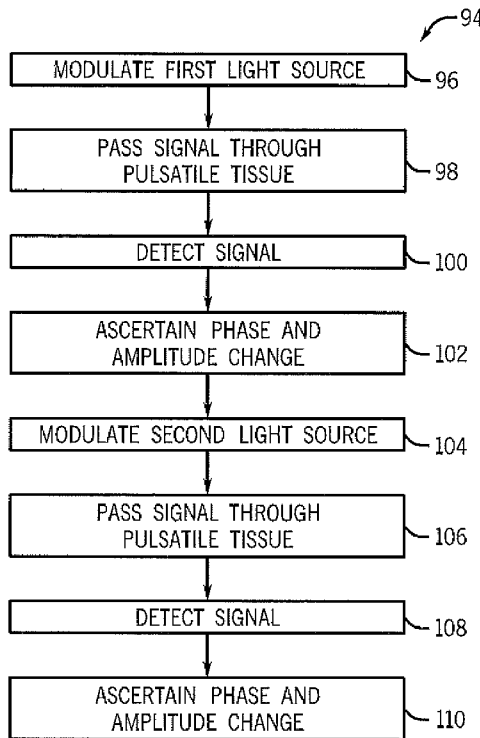
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,

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[Continued on next page]

(54) Title: TIME-DIVISION MULTIPLEXING IN A MULTI-WAVELENGTH PHOTON DENSITY WAVE SYSTEM

FIG. 7



(57) Abstract: Multi-wavelength photon density wave medical systems, methods, and devices are provided. In one embodiment, a multi-wavelength system may include a sensor, a sensor cable, and a patient monitor. The sensor may have an emitter output and a detector input configured to pass a multi-wavelength photon density wave input signal into a patient and receive a resulting multi-wavelength photon density wave output signal. The sensor cable may couple to the sensor using two optical cables for transmitting and receiving the multi-wavelength photon density wave signals. The patient monitor may couple to the sensor cable and generate several time-division multiplexed single-wavelength input signals by modulating one or more light sources at a frequency sufficient to produce resolvable photon density waves. By combining the several time-division multiplexed single-wavelength input signals into one of the optical cables of the sensor cable, the patient monitor may generate the multi-wavelength photon density wave input signal.



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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).

— 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))

**Published:**

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

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

7 July 2011

INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2010/046674

A. CLASSIFICATION OF SUBJECT MATTER  
INV. A61B5/00  
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 practical, 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	US 2008/220512 A1 (KOH SEUNGUG [US] ET AL) 11 September 2008 (2008-09-11)	1-8, 17-20
Y	paragraph [0009] paragraph [0054] - paragraph [0070] -----	9,10
Y	US 2002/147400 A1 (CHANCE BRITTON [US]) 10 October 2002 (2002-10-10) paragraph [0059] - paragraph [0082] paragraphs [0098], [ 116], [ 120] -----	9,10
A	US 6 122 042 A (WUNDERMAN IRWIN [US] ET AL) 19 September 2000 (2000-09-19) the whole document -----	1-10, 17-20

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.
- "&" document member of the same patent family

Date of the actual completion of the international search  27 January 2011	Date of mailing of the international search report  26/04/2011
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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  Rapp, Alexander
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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2010/046674

## 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.:  
1-10, 17-20

### 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: 1-10, 17-20

Invention I relates to a system comprising a patient monitor, a sensor, and a sensor cable. The system comprises as potential special technical feature certain methods for time-division multiplexing of photon density wave signals thereby solving the technical problem of better separating signals of different wavelengths.

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2. claims: 11-16

Invention II relates to a patient monitor comprising as potential special technical feature a fiber coupler in order to reduce the complexity of the patient monitor.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2010/046674

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008220512	A1	11-09-2008	NONE
US 2002147400	A1	10-10-2002	US 2008161697 A1 03-07-2008
US 6122042	A	19-09-2000	NONE