

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
2 April 2009 (02.04.2009)

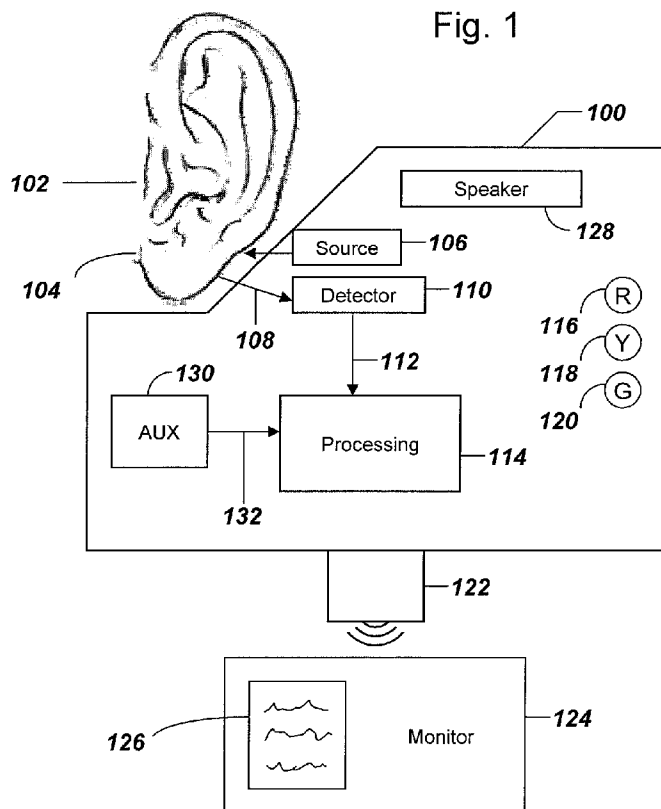
PCT

(10) International Publication Number  
**WO 2009/043028 A3**

- (51) International Patent Classification:  
A61B 5/02 (2006.01)
- (21) International Application Number:  
PCT/US2008/078160
- (22) International Filing Date:  
29 September 2008 (29.09.2008)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
60/995,723 28 September 2007 (28.09.2007) US
- (71) Applicant (for all designated States except US): **TIAX LLC** [US/US]; 15 Acorn Park, Cambridge, Massachusetts 02140 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **FRICKE, John Robert** [US/US]; 77 Hill Street, Lexington, Massachusetts 02421 (US). **WIGGINS, Matthew Corbin** [US/US]; 67 Prairie Street, Concord, Massachusetts 01742 (US).
- (74) Agents: **ROHLICEK, J. Robin et al.**; Occhiuti Rohlicek & Tsao LLP, 10 Fawcett Street, Cambridge, Massachusetts 02138 (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, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, 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, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL,

[Continued on next page]

(54) Title: MEASUREMENT OF PHYSIOLOGICAL SIGNALS



(57) Abstract: A system includes an optical sensor and a signal processing module. The optical sensor is configured to be positioned on an area of skin of a patient. The optical sensor includes a light source for illuminating a capillary bed in the area of skin and a photodetector. The photodetector is configured to receive an optical signal from the capillary bed resulting from the illumination and to convert the optical signal into an electrical signal, the optical signal characterizing a fluctuation in a level of blood in the capillary bed. The signal processing module is configured to process the electric signal using a nonstationary frequency estimation method to obtain a processed signal related to at least one of a heart rate and a respiration rate of the patient. Another aspect relates to obtaining a quantity related to the blood pressure of the patient.

WO 2009/043028 A3



NO, PL, PT, RO, SE, SI, SK, 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*

**Published:**

— *with international search report*

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

14 May 2009

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2008/078160

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A61B 5/02 (2009.01)

USPC - 600/310

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)

IPC(8) - A61B 5/02 (2009.01)

USPC - 128/920, 600/310

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)

PatBase, Google Patents

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 7,179,228 B2 (BANET) 20 February 2007 (20.02.2007) entire document	20-21, 23, 26-29
--		-----
Y		1-19, 22, 24
Y	US 5,533,511 A (KASPARI et al) 09 July 1996 (09.07.1996) entire document	1-19
Y	US 2001/0056236 A1 (ANGELSEN) 27 December 2001 (27.12.2001) entire document	17-18, 22
Y	US 3,363,621 A (WHITMORE) 16 January 1968 (16.01.1968) entire document	24
Y	US 2007/0219453 A1 (KREMLIOVSKY et al) 20 September 2007 (20.09.2007) entire document	3, 15, 17
Y	US 4,296,754 A (HENNIG et al) 27 October 1981 (20.10.1981) entire document	6

Further documents are listed in the continuation of Box C.

* 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

24 February 2009

Date of mailing of the international search report

06 MAR 2009

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents  
P.O. Box 1450, Alexandria, Virginia 22313-1450  
Facsimile No. 571-273-3201

Authorized officer:

Blaine R. Copenheaver

PCT Helpdesk: 571-272-4300  
PCT OSP: 571-272-7774