



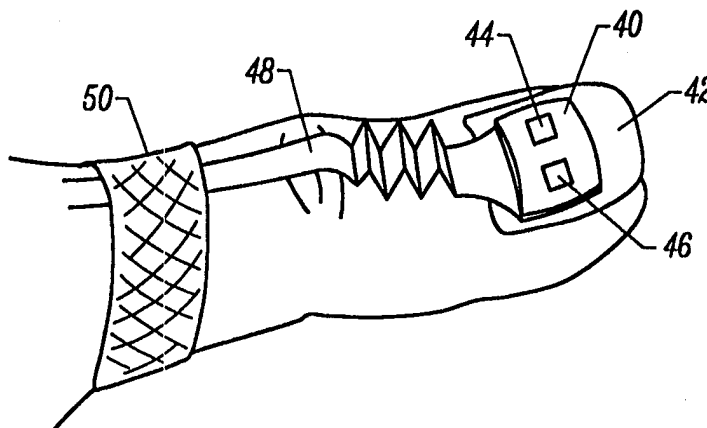
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : A61B 5/00	A3	(11) International Publication Number: WO 98/15224 (43) International Publication Date: 16 April 1998 (16.04.98)
(21) International Application Number: PCT/US97/17818 (22) International Filing Date: 2 October 1997 (02.10.97) (30) Priority Data: 08/722,443 10 October 1996 (10.10.96) US (71) Applicant: NELLCOR PURITAN BENNETT INCORPORATED [US/US]; 4280 Hacienda Drive, Pleasanton, CA 94588 (US). (72) Inventors: CHIN, Rodney; 6645 Armour Drive, Oakland, CA 94611 (US). MANNHEIMER, Paul; 4119 Sugar Maple Drive, Danville, CA 94506 (US). FLEWELLING, Ross; 15 Orinda Vista Drive, Oakland, CA 94605 (US). (74) Agent: KOVACH, Dennis, E.; Nellcor Puritan Bennett Incorporated, Legal Dept., 4280 Hacienda Drive, Pleasanton, CA 94588 (US).		(81) Designated States: AU, CA, JP, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> (88) Date of publication of the international search report: 25 June 1998 (25.06.98)

(54) Title: MOTION COMPATIBLE SENSOR FOR NON-INVASIVE OPTICAL BLOOD ANALYSIS

(57) Abstract

A non-invasive optical sensor (40) which uses the motion signal to calculate the physiological characteristic being measured. For pulse oximetry, a least squares or a ratio-of-ratios technique can be applied to the motion signal itself. This is made possible by selecting a site on the patient where variations in motion produce signals of two wavelengths which are sufficiently correlated. In particular, it has been determined that a sensor (40) placed on a nail, in particular a thumbnail (42), exhibits the characteristics of having the red and infrared signals correlated when used for pulse oximetry, and the resulting signals correlate to arterial oxygen saturation.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 97/17818

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61B5/00

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)

IPC 6 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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 4 883 055 A (MERRICK) 28 November 1989 see the whole document ----- -/--	1, 46, 57, 62 3, 5, 13, 17, 42-44, 47-49, 54-56, 63

Further documents are listed in the continuation of box C.

Patent family members are listed in 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

3

Date of the actual completion of the international search <p style="text-align: center; font-size: 1.2em;">20 March 1998</p>	Date of mailing of the international search report <p style="text-align: center; font-size: 1.2em;">30/03/1998</p>
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer <p style="text-align: center; font-size: 1.2em;">Chen, A</p>

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 97/17818

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>US 5 111 817 A (CLARK ET AL.) 12 May 1992</p> <p>see column 4, line 27 - line 47 see column 5, line 11 - column 6, line 27 see column 8, line 50 - column 9, line 38 see column 10, line 18 - column 13, line 16 see column 14, line 14 - column 15, line 45 see column 19, line 63 - column 20, line 9 see figures 1-2A</p>	<p>1, 40, 46, 62</p>
A	<p>---</p>	<p>2, 5, 6, 9, 11, 13, 17, 45, 47, 49, 50, 54, 55</p>
X	<p>---</p> <p>"Sensor für die Durchführung medizinischer Messungen, insbesondere pulsoximetrischer Messungen, am menschlichen Finger" RESEARCH DISCLOSURE, no. 380, December 1995, EMSWORTH, GB, pages 831-832, XP000549843 see the whole document</p>	<p>18</p>
A	<p>---</p>	<p>1, 4, 6, 8, 19, 20, 23, 29, 30, 35, 37, 39, 63</p>
A	<p>---</p> <p>WO 92 21281 A (SUSI) 10 December 1992 see page 13, line 15 - page 15, line 16 see figure 3</p>	<p>21, 22</p>
A	<p>---</p> <p>WO 92 16142 A (VITAL SIGNALS, INC.) 1 October 1992 see page 22, line 27 - page 23, line 20 see figure 8</p>	<p>25, 28</p>
A	<p>---</p> <p>TAKATANI ET AL.: "A noninvasive reflectance pulse oximeter sensor" PROCEEDINGS OF THE ANNUAL INTERNATIONAL CONFERENCE OF THE IEEE ENGINEERING IN MEDICINE AND BIOLOGY SOCIETY, vol. 13, no. 4/5, 31 October 1991 - 3 November 1991, US, pages 1610-1611, XP000348115 see the whole document</p>	<p>25, 29, 33, 34</p>
	<p>---</p> <p>-/--</p>	

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 97/17818

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	WO 96 39926 A (MASIMO CORPORATION) 19 December 1996 see page 6, line 17 - page 7, line 15 see page 10, line 22 - page 11, line 13 see page 15, line 13 - page 17, line 30 see page 19, line 4 - page 20, line 18 see figures 1,2,8,10-12A -----	1,46,62

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No PCT/US 97/17818

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4883055 A	28-11-89	NONE	
US 5111817 A	12-05-92	US 5423322 A	13-06-95
WO 9221281 A	10-12-92	EP 0587718 A	23-03-94
WO 9216142 A	01-10-92	AU 664175 B AU 1569192 A CA 2105681 A EP 0576560 A JP 6505903 T US 5638818 A	09-11-95 21-10-92 22-09-92 05-01-94 07-07-94 17-06-97
WO 9639926 A	19-12-96	US 5638816 A AU 5973096 A	17-06-97 30-12-96