PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : **A61B 7/00**	**A3**	**(11) International Publication Number:** **WO 98/14116** **(43) International Publication Date:** 9 April 1998 (09.04.98)

(21) International Application Number: PCT/IL97/00318

(22) International Filing Date: 30 September 1997 (30.09.97)

(30) Priority Data:
08/729,651 4 October 1996 (04.10.96) US

(71) Applicant *(for all designated States except US)*: KARMEL MEDICAL ACOUSTIC TECHNOLOGIES LTD. [IL/IL]; P.O. Box 393, 39554 Tirat Hacarmel (IL).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: GAVRIELI, Noam [IL/IL]; Sinai Avenue 11A, 34331 Haifa (IL).

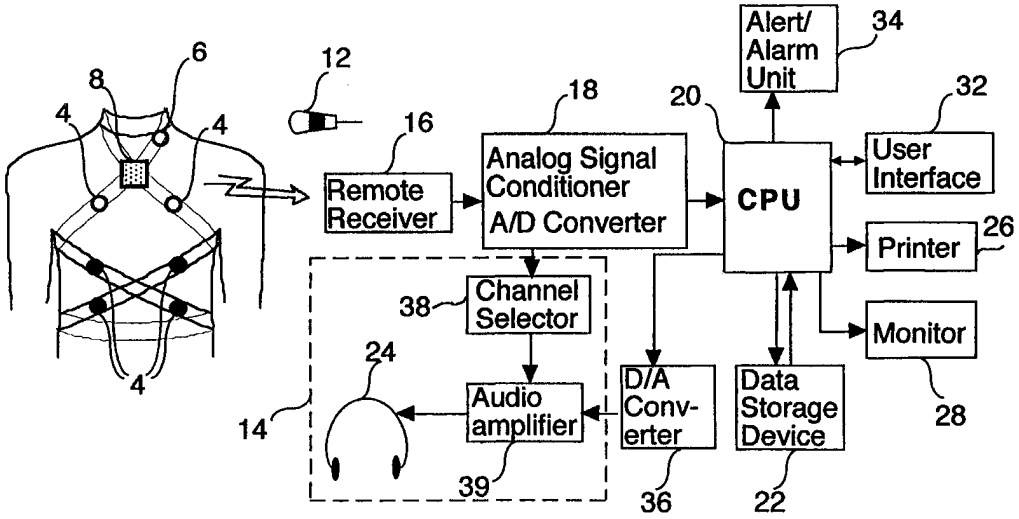
(74) Agents: FENSTER, Paul et al.; Fenster & Company, P.O. Box 2741, 49127 Petach Tikva (IL).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(88) Date of publication of the international search report:
6 August 1998 (06.08.98)

(54) Title: A PHONOPNEUMOGRAPH SYSTEM



(57) Abstract

A method of analyzing breath sounds produced by a respiratory system, the method comprising: measuring breath sounds produced by the respiratory system; tentatively identifying a signal as being caused by a breath sound of a given type if it meets a first criteria characteristic of the breath sound of the given type; and confirming said identification if a tentatively identified signal meets a second criteria characteristic of the breath sound of the given type.

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			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

INTERNATIONAL SEARCH REPORT

	national Application No
	PCT/IL 97/00318

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61B7/00

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 G01H G01V G01N

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	ROSQVIST ET AL.: "Tool kit for lung sound analysis" MEDICAL & BIOLOGICAL ENGINEERING & COMPUTING, vol. 33, no. 2, March 1995, STEVENAGE, GB, pages 190-195, XP000504664 see page 190, right-hand column, line 37 - page 194, right-hand column, line 12 see figure 12	1,43,54
A		2-6,25, 32,40, 44-46, 51-53, 55-58, 71,72, 75-79, 86,91, 94,96

-/--

[X] Further documents are listed in the continuation of box C.

[X] 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

Date of the actual completion of the international search	Date of mailing of the international search report
10 June 1998	19.06.98

Name and mailing address of the ISA	Authorized officer
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	Chen, A

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	COHEN ET AL.: "Analysis and automatic classification of breath sounds" IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, vol. 31, no. 9, September 1984, NEW YORK, US, pages 585-590, XP002057861 see page 585, right-hand column, line 44 - page 589, right-hand column, line 18 see figures	1,43,54
A		2-4,40, 44-46, 55,56, 71, 77-80, 82,85,86

X	WO 91 03981 A (MURPHY) 4 April 1991 cited in the application see page 7, line 10 - page 12, line 10 see page 16, line 4 - page 21, line 5 see figures 1,5-7	1,43
A		2-5,8, 10-12, 14,24, 26,46, 47,50, 51,54, 56,57, 68,71, 72,75,77

X	COHEN: "Signal processing methods for upper airway and pulmonary dysfuntion diagnosis" IEEE ENGINEERING IN MEDICINE & BIOLOGY, vol. 9, no. 1, March 1990, NEW YORK, US, pages 72-75, XP000117155 see the whole document	1,43,54
A		6,8, 11-13, 25,26, 32,33, 44-53, 56,57, 67,69, 71, 73-75, 77,79

	-/--	

INTERNATIONAL SEARCH REPORT

national Application No
PCT/IL 97/00318

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 240 392 A (DONNELLY ET AL.) 31 July 1991 see page 2, line 1 - page 7, line 30	54,75,85
A		1,43,44, 52,55, 56,58, 71, 77-82,86

A	WO 96 19142 A (SNAP LABORATORIES L. L. C.) 27 June 1996 see page 6, line 11 - page 12, line 17 see page 23, line 20 - page 28, line 20 see figures 1-4	1,35,43, 49,54, 56,57, 71,75, 77-82,84

A	US 4 672 977 A (KROLL) 16 June 1987 see column 2, line 35 - column 3, line 44 see column 5, line 53 - column 7, line 37 see figures 1,5	89,90

A	WODICKA ET AL.: "Bilateral asymmetry of repiratory acousitc transmission" MEDICAL & BIOLOGICAL ENGINEERING & COMPUTING, vol. 32, no. 5, September 1994, STEVENAGE, GB, pages 489-494, XP000469338 see page 490, left-hand column, line 21 - page 491, left-hand column, line 18 see figure 1	89

A	US 4 173 897 A (FÖRSTERMANN ET AL.) 13 November 1979 see column 3, line 36 - column 5, line 49 see column 7, line 61 - column 9, line 18 see figure	90

A	US 4 240 281 A (LATHER ET AL.) 23 December 1980 see column 6, line 31 - column 10, line 39 see figure 1	90

5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL 97/00318

Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 II Observations where unity of invention is lacking (Continuation of item 2 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 fee, this Authority did not invite payment of any additional fee.

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.

☒ 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: 1-88,91-98

   Detection and analysis of breath sounds produced by the respiratory system.

2. Claims: 89, 90

   Verification system for an arrangement of multiple sound sensors.

INTERNATIONAL SEARCH REPORT

Information on patent family members

In ational Application No
PCT/IL 97/00318

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9103981 A	04-04-1991	US 5165417 A	24-11-1992
		AT 133323 T	15-02-1996
		AU 6342790 A	18-04-1991
		CA 2065737 A,C	13-03-1991
		DE 69025065 D	07-03-1996
		DE 69025065 T	30-05-1996
		EP 0491781 A	01-07-1992
GB 2240392 A	31-07-1991	NONE	
WO 9619142 A	27-06-1996	AU 4643796 A	10-07-1996
US 4672977 A	16-06-1987	NONE	
US 4173897 A	13-11-1979	DE 2632680 A	19-01-1978
		CA 1113180 A	24-11-1981
		FR 2358699 A	10-02-1978
		GB 1577471 A	22-10-1980
		JP 53114483 A	05-10-1978
US 4240281 A	23-12-1980	DE 2753472 A	31-05-1979
		CA 1128622 A	27-07-1982
		FR 2410277 A	22-06-1979
		GB 2008755 A,B	06-06-1979
		JP 54083882 A	04-07-1979