(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 December 2003 (18.12.2003)

PCT

(10) International Publication Number
WO 2003/103484 A3

(51) International Patent Classification[7]: A61B 5/04, 5/0488, G06F 17/00

(21) International Application Number: PCT/IL2003/000475

(22) International Filing Date: 4 June 2003 (04.06.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/385,610 5 June 2002 (05.06.2002) US

(71) Applicant *(for all designated States except US)*: **NERVE-TRACK LTD.** [IL/IL]; MEYTAG TECHNOLOGY INCUBATOR LTD., P.O.Box 12, 12900 Katzrin (IL).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **ATSMON, Alon** [IL/IL]; 17 Shimon Hatarsi Street, 62492 Tel Aviv (IL).

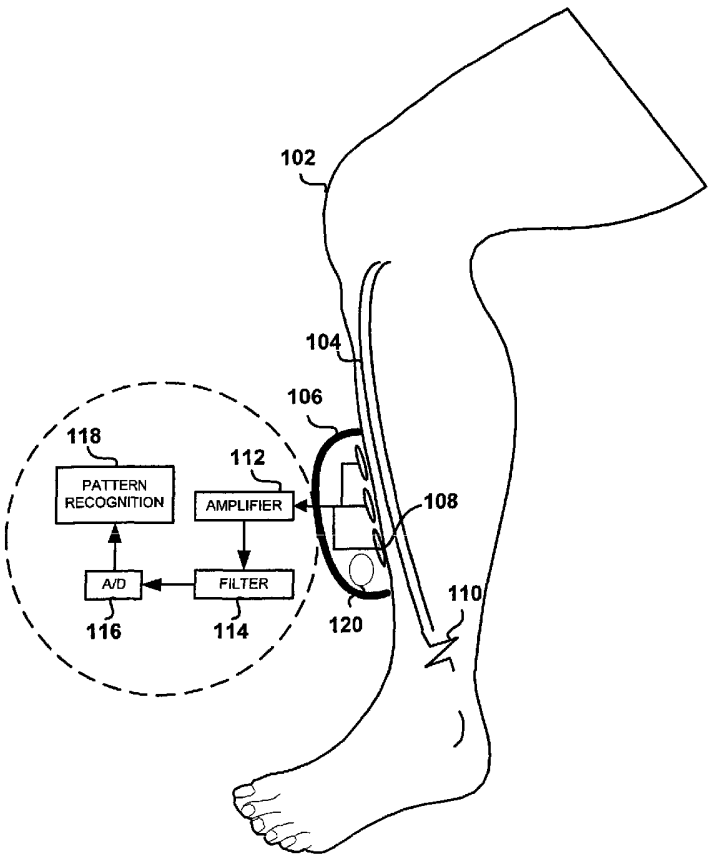
(74) Agents: **AGMON, Jonathan** et al.; Soroker-Agmon, Advocates and Patent Attorneys, Nolton House, 14 Shenkar Street, 46725 Herzliya Pituach (IL).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR MEASURING NERVE SIGNALS IN NERVE FIBERS



(57) Abstract: A method and apparatus for measuring in the non-stimulated activity of a plurality of sensory nerve fibers in a predetermined nerve conduction velocity range by at least two sensors in proximity to the nerve fiber, the sensors are spaced apart such that the measurements can be correlated. The correlation between the two measured signals is correlated in a time difference reflecting a predetermined velocity range and then summing all the correlation value points measured and calculated.

WO 2003/103484 A3

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(88) Date of publication of the international search report:
1 April 2004

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

Interi ıl Application No
PCT/IL 03/00475

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B5/04 A61B5/0488 G06F17/00

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 7 A61B G06F

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, PAJ, WPI Data, INSPEC, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FIORE L ET AL: "Cross-correlation-based evaluations of the impulse transmission in a nerve: simulation and experimental studies" JOURNAL OF NEUROSCIENCE METHODS, APRIL 1989, NETHERLANDS, vol. 27, no. 3, pages 235-243, XP008023268 ISSN: 0165-0270	1,2,5-9, 13,19,23
Y	pages 235-236; figure 1 pages 241-242	10-12

Y	WO 01/060445 A (NEURODAN AS ;HAUGLAND MORTEN (DK); SINKJAER THOMAS (DK)) 23 August 2001 (2001-08-23) page 28, line 21 - page 33, line 9; figure 11	10-12

	-/--	

[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
17 October 2003	24 02 2004
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 Kronberger, R

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

INTERNATIONAL SEARCH REPORT

Inter al Application No
PCT/IL 03/00475

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GOZANI S N ET AL: "Optimal Discrimination and Classification of Neuronal Action Potential Waveforms from Multiunit, Multichannel Recordings Using Software-Based linear Filters" IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, IEEE INC. NEW YORK, US, vol. 41, no. 4, 1 April 1994 (1994-04-01), pages 358-372, XP002090498 ISSN: 0018-9294	1,3
A	page 365 - page 368; figure 5	13

A	YAAR I ET AL: "MUSCLE FIBER CONDUCTION VELOCITY DIP ANALYSIS VERSUS CROSS CORRELATION TECHNIQUES" ELECTROMYOGRAPHY AND CLINICAL NEUROPHYSIOLOGY, vol. 31, no. 8, 1991, pages 473-482, XP008023198 ISSN: 0301-150X pages 473-475	1,13

A	SCHOONHOVEN R ET AL: "MODELS AND ANALYSIS OF COMPOUND NERVE ACTION POTENTIALS" CRITICAL REVIEWS IN BIOMEDICAL ENGINEERING, vol. 19, no. 1, 1991, pages 47-111, XP008023253 ISSN: 0278-940X figures 1,6,27	17

A	SCHALOW G ET AL: "Classification of human peripheral nerve fibre groups by conduction velocity and nerve fibre diameter is preserved following spinal cord lesion" JOURNAL OF THE AUTONOMIC NERVOUS SYSTEM, vol. 52, no. 2-3, 1995, pages 125-150, XP002257967 ISSN: 0165-1838 Section 3.7 abstract; figures 2,3,7,8	5,14-16

A	SHAO XUESI M ET AL: "Measure and statistical test for cross-correlation between paired neuronal spike trains with small sample size" JOURNAL OF NEUROSCIENCE METHODS, vol. 70, no. 2, 1996, pages 141-152, XP002257968 ISSN: 0165-0270 1. Introduction	4,24-27

INTERNATIONAL SEARCH REPORT

Ir...ional application No.
PCT/IL 03/00475

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.:

1-12, 13-21, 23-27

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: 1-12, 13-21,23-27

An apparatus / a method for measuring a non-stimulated activity of a plurality of sensory nerve fibers with at least two sensors for measuring signals passing through the nerve by correlating between the two measured signals.

---

2. claims: 22, 28-33

An apparatus / a method for measuring a non-stimulated activity of a plurality of sensory nerve fibers with at least two sensors for measuring signals passing through the nerve by correlating between a measured signal and a template.

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter al Application No
PCT/IL 03/00475

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0160445 A	23-08-2001	AU 3361901 A	27-08-2001
		WO 0160445 A2	23-08-2001
		EP 1257318 A2	20-11-2002
		US 2003144710 A1	31-07-2003