

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
13 September 2007 (13.09.2007)

PCT

(10) International Publication Number
WO 2007/103585 A3

(51) International Patent Classification:
A61N 1/30 (2006.01) A61N 1/00 (2006.01)

(21) International Application Number:
PCT/US2007/006135

(22) International Filing Date: 9 March 2007 (09.03.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/767,201 9 March 2006 (09.03.2006) US
60/861,568 28 November 2006 (28.11.2006) US
60/872,265 1 December 2006 (01.12.2006) US

(71) Applicant (for all designated States except US):
SYNAPSE BIOMEDICAL, INC. [US/US]; 300 Artino
Street, Obelin, OH 44074 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **IGNAGNI, An-
thony, R.** [US/US]; 300 Artino Street, Oberlin, OH (US).
ONDERS, Raymond, P. [US/US]; 300 Artino Street,
Shaker Heights, OH (US).

(74) Agents: **LIMBACH, Douglas** et al.; Shay Law Group,
LLP, 2755 Campus Drive, Suite 210, San Mateo, CA 94403
(US).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, 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, 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, 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, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL,
PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM,
GA, GN, GQ, GW, 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 receipt of
amendments

(88) Date of publication of the international search report:
3 January 2008

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

(54) Title: VENTILATOR ASSIST SYSTEM AND METHOD TO IMPROVE RESPIRATORY FUNCTION

(57) Abstract: Systems and methods are provided to improve respiratory function. Systems include an external electrical stimulator coupled to electrodes that stimulates diaphragm contraction and may optionally include a positive pressure mechanical ventilator. The system further includes an electrode suitable for temporary implantation. Electrical stimulation is provided to specific portions of the diaphragm, such as one hemidiaphragm preferentially over another. By preferentially contracting one hemidiaphragm, a specific portion of a lung may be expanded such as a posterior portion. By the provision of the negative intrathoracic pressure from diaphragm contraction, greater expansion of specific portion of lung is achieved in relationship to air pressure within the lung. Supplementation of stimulated diaphragm contraction with positive pressure driven air flow from a PPMV directs the air flow to specific portions of the lung. Such portion may include a posterior portion of a lung, and may cause a clearing of atelectasis in that portion.



WO 2007/103585 A3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 07/06135

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A61N 1/30, A61N 1/00 (2007.10)

USPC - 604/21, 607/42

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): A61N 1/30, A61N 1/00 (2007.10)

USPC: 604/21, 607/42

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)
 WEST (PGPB, USPT, USOC, EPAB, JPAB; PLUR), Google Patents (<http://www.google.com/patents>); Free Patents Online (<http://www.freepatentsonline.com/>) and Google Scholar (<http://scholar.google.com/>). Search terms: electrode, implant, lead, insulate, insulated, stop, barb, "break-away needle."

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/0021102 A1 (IGNAGNI ET AL.) 27 January 2005 (27.01.2005): para. [0018]; para. [0032]; para. [0031]; para. [0023]; fig.2, element 230; fig. 2, element 210; para. [0027]; para. [0042]; para. [0033]	1, 2-3, 5-8 and 10
---		---
Y		4 and 9
Y	US 6,397,108 B1 (CAMPS ET AL.) 28 May 2002 (28.05.2002): col 7, ln 5-10; col 8, ln 5-7; col 8, ln 66-col 9, ln 4	4 and 9

 Further documents are listed in the continuation of Box C.

* 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 application or patent 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

05 October 2007 (05.10.2007)

Date of mailing of the international search report

15 NOV 2007

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:

Lee W. Young

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