

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
25 March 2004 (25.03.2004)

PCT

(10) International Publication Number
WO 2004/023978 A3

(51) International Patent Classification⁷: **A61B 18/04**

(21) International Application Number:
PCT/US2003/028578

(22) International Filing Date:
12 September 2003 (12.09.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10/244,271 16 September 2002 (16.09.2002) US
10/635,170 6 August 2003 (06.08.2003) US

(71) Applicant: **TRANSURGICAL, INC.** [US/US]; 220 Belle Meade Road, Suite 2, Setauket, NY 11733 (US).

(72) Inventors: **LOPATH, Patrick, David**; 3611 University Drive, Suite 4J, Durham, NC 27707 (US). **HARHEN, Edward, Paul**; 67 Meeting House Road, Duxbury, MA 02332 (US).

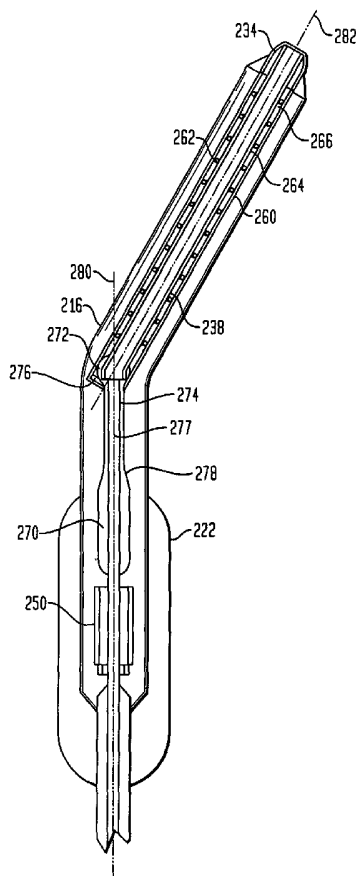
(74) Agents: **MILLET, Marcus, J.** et al.; Lerner, David, Littenberg, Krumholz & Mentlik, LLP, 600 South Avenue West, Westfield, NJ 07090 (US).

(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, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, 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: **BALLOON ALIGNMENT AND COLLAPSING SYSTEM**



(57) Abstract: A balloon catheter is provided with rigid engagement elements (260, 270) which move into engagement when the balloon (216) is inflated, so that the engaged elements stiffen the balloon in the inflated condition. When the balloon is deflated, the engagement elements are at least partially disengaged so that the balloon can flex. A stem (274) on one engagement element (270) may project into the adjacent engagement element (260) in the disengaged condition, so that the stem allows the engagement elements to pivot but constrains them to prevent kinking. A stretchable tube (238) may be provided to allow communication through the balloon, and a spring (262, 42) may be provided to elongate the balloon upon deflation.



Published:

— *with international search report*

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

29 July 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.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference TRANS53CIP	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/US03/28578	International filing date (<i>day/month/year</i>) 12 September 2003 (12.09.2003)	(Earliest) Priority Date (<i>day/month/year</i>) 16 September 2002 (16.09.2002)
Applicant TRANSURGICAL, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the Report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (See Box II).

4. With regard to the **title**,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 4



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.



None of the figures

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/28578

A. CLASSIFICATION OF SUBJECT MATTER		
IPC(7) : A61B 18/04		
US CL : 606/27		
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)		
U.S. : 606/27,195; 604/95-97,101-103,195; 128/658		
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)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,868,708 A (Hart et al.) 09 February 1999 (09.02.1999), See entire document.	1,2,7,44
---		-----
Y		3-6,8-43,45-53
Y	US 5,800,392 A (Racchini) 01 September 1998 (01.09.1998), See entire document.	3-6,8-43,45-53
Y	US 6,096,054 A (Wyzgala et al.) 01 August 2000 (01.08.2000), See entire document.	3-6,8-43,45-53
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents:		
"A"	document defining the general state of the art which is not considered to be of particular relevance	"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
"E"	earlier application or patent published on or after the international filing date	"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
"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)	"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
"O"	document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"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		Date of mailing of the international search report
23 February 2004 (23.02.2004)		10 MAR 2004
Name and mailing address of the ISA/US		Authorized officer
Mail Stop PCT, Attn: ISA/US		Sharon M. Greene for
Commissioner for Patents		Linda C Dvorak
P.O. Box 1450		Telephone No. 703 308 0858
Alexandria, Virginia 22313-1450		
Facsimile No. (703)305-3230		

PCT/US03/28578

AMENDED CLAIMS

[received by the International Bureau on 10 May 2004 (10.05.04);
original claims 7 and 52 amended; new claims 54 and 55 added]

direction when said balloon is deflated and shortened in the lengthwise direction when said balloon is inflated, said tube being formed from a material selected from the group consisting of expanded polymers.

5 3. Apparatus as claimed in claim 2 wherein said tube is formed from an expanded polytetrafluorethylene.

 4. Apparatus as claimed in claim 1 or claim 2 wherein said bore of said tube has a first interior diameter when the balloon is deflated and the tube is shortened and a
10 second interior diameter when the balloon is inflated and the tube is stretched, said first and second interior diameters differing from one another by less than about 20 percent of the first interior diameter.

 5. Apparatus as claimed in claim 1 or claim 2
15 further comprising a carrier catheter mechanically linked to said proximal end of said balloon, said carrier catheter having a bore communicating with the bore of said tube.

 6. Apparatus as claimed in claim 5 further comprising an elongated element extending through said
20 carrier catheter and said bore and projecting beyond said distal end of said balloon.

 7. Apparatus comprising:

 (a) a balloon having proximal and distal ends and a lengthwise direction between said ends, said balloon having
25 an inflated condition and a deflated condition, said balloon having a deflated length between said ends in the deflated condition and an inflated length in the inflated condition, said inflated length being less than said deflated length; and

30 (b) a plurality of engagement elements disposed at least partially within said balloon and movable with respect to one another in the lengthwise direction, said balloon urging said engagement elements into engagement with one another upon inflation of the balloon, said engagement elements being

49. A method as claimed in claim 48 wherein said stem projecting from said first engagement element remains disposed within said second engagement element during said deflating and withdrawing step.

5 50. A method as claimed in claim 45 wherein said step of urging the distal end of the balloon is performed by a spring disposed within the balloon.

51. A method as claimed in claim 50 wherein said spring twists the distal end of the balloon relative to the proximal
10 end during the deflating step.

52. A method as claimed in claim 45 further comprising the steps of providing a guide element extending through the carrier catheter, extending through a tube disposed within the balloon and extending beyond the balloon, stretching the tube
15 upon movement of the distal end of the balloon away from the proximal end and foreshortening the tube upon inflation of the balloon.

53. A method as claimed in claim 44 wherein said step of performing a procedure includes directing energy from a
20 transducer disposed within the balloon to a wall of the balloon and reflecting the energy towards a target region of the subject at the wall of the balloon.

54. Apparatus as claimed in claim 7 wherein said plurality of engagement elements form a structure which substantially
25 reinforces said balloon against lateral displacement when said balloon is in said inflated condition and said engagement elements are engaged with one another, said plurality of engagement elements permitting flexing of said balloon in lateral directions transverse to said lengthwise direction when
30 said balloon is in said deflated condition.

55. A method as claimed in claim 44 wherein, when said balloon is in said inflated condition said engagement elements substantially reinforce said balloon against displacement in lateral direction transverse to said lengthwise direction, and
35 said engagement elements allow flexing of said balloon in said lateral directions when said balloon is in said deflated condition.