

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
29 January 2009 (29.01.2009)

(10) International Publication Number
WO 2009/014917 A3

- (51) International Patent Classification:
B25J 5/00 (2006.01) A61B 17/00 (2006.01)
- (21) International Application Number:
PCT/US2008/069822
- (22) International Filing Date:
11 July 2008 (11.07.2008)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:

60/949,390	12 July 2007 (12.07.2007)	US
60/949,391	12 July 2007 (12.07.2007)	US
60/990,076	26 November 2007 (26.11.2007)	US
61/025,346	1 February 2008 (01.02.2008)	US

Seward, Nebraska 68434 (US). **PLATT, Stephen** [US/US]; 1726 Branched Oak Road, Garland, Nebraska 68360 (US). **HAWKS, Jeff** [US/US]; 6510 Applewood Drive, Lincoln, Nebraska 68516-1953 (US).

(74) Agents: **SOLBERG, Sean** et al.; Faegre & Benson LLP, 2200 Wells Fargo Center, 90 South Seventh Street, Minneapolis, Minnesota 55402 (US).

(71) Applicant (for all designated States except US): **BOARD OF REGENTS OF THE UNIVERSITY OF NEBRASKA** [US/US]; Varner Hall, 3835 Holdrege Street, Lincoln, Nebraska 68583 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, 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, ME, 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, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(72) Inventors; and
(75) Inventors/Applicants (for US only): **FARRITOR, Shane** [US/US]; 6137 Blackstone Road, Lincoln, Nebraska 68526 (US). **RENTSCHLER, Mark** [US/US]; 1302 South 51st Avenue, Omaha, Nebraska 68106 (US). **LEHMAN, Amy** [US/US]; 1752 Karol Kay Boulevard,

(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, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI

[Continued on next page]

(54) Title: METHODS AND SYSTEMS OF ACTUATION IN ROBOTIC DEVICES

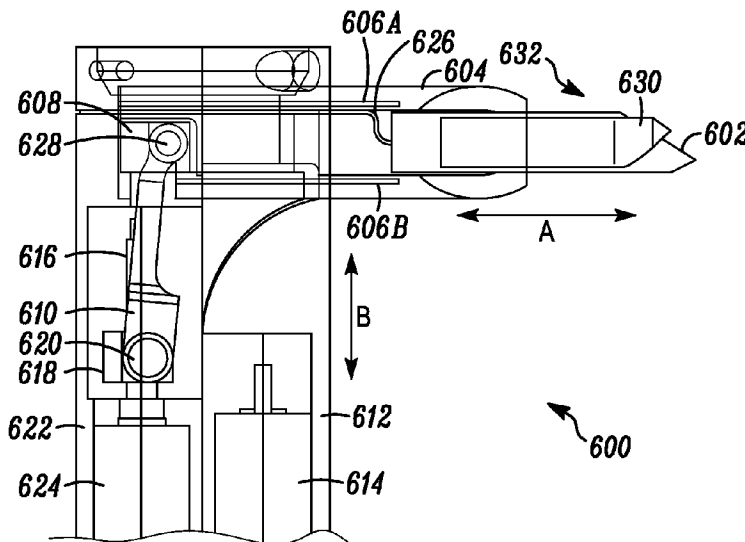


FIG. 24A

(57) Abstract: The embodiments disclosed herein relate to various medical device components, including components that can be incorporated into robotic and/or in vivo medical devices. Certain embodiments include various actuation system embodiments, including fluid actuation systems, drive train actuation systems, and motorless actuation systems. Additional embodiments include a reversibly lockable tube that can provide access for a medical device to a patient's cavity and further provides a reversible rigidity or stability during operation of the device. Further embodiments include various operational components for medical devices, including medical device arm mechanisms that have both axial and rotational movement while maintaining a relatively compact structure. medical device winch components, medical device biopsy/stapler/clamp mechanisms, and medical device adjustable focus mechanisms.

WO 2009/014917 A3



(BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(88) Date of publication of the international search report:
30 December 2009

Published:

— *with international search report (Art. 21(3))*

(15) Information about Correction:

Previous Correction:
see Notice of 19 March 2009

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 08/69822

A. CLASSIFICATION OF SUBJECT MATTER
 IPC(8) - B25J 5/00 (2009.01); A61B 17/00 (2009.01)
 USPC - 318/568.12; 606/207
 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)
 USPC: 318/568.12; 606/207

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
 USPC: 318/568.21,568.11; 606/207, 206; 600/101,104,109 (text searched-see terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 PubWest (PGPB, USPT, USOC, EPAB, and JPAB); Google Scholar
 Search Terms: jaw\$, cutting, piercing, end effector, fixed, stationary, immobile, flexible, and shape memory

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2006/0258954 A1 (TIMBERLAKE et al.) 16 November 2006 (16.11.2006), Fig 12a-13C, para[0102]-[0109]	1 and 5-7 ----- 2-4
Y	US 7,105,000 B2 (MCBRAYER) 12 September 2006 (12.09.2006), Fig 1, 12-15, and 21, col 2, ln 26-53 and col 6, ln 20-40)	2-4

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	"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 but 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 27 July 2009 (27.07.2009)	Date of mailing of the international search report 05 AUG 2009
--	--

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
---	--

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 08/69822

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 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 No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Please see Supplemental 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 additional fees, this Authority did not invite payment of additional fees.
- 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.:
1-7

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 08/69822

Continued from: Box III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-7, drawn to a biopsy component comprising a substantially fixed jaw component and a mobile jaw component adjacent to the substantially fixed jaw component.

Group II, claims 8-14, drawn to an arm device comprising an extendable, rotational arm.

Group III, claims 15-20, drawn to a medical device comprising a body, a first winch component, and a second winch component.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical feature of Group I is a biopsy component comprising a substantially fixed jaw component and a mobile jaw component. The special technical feature of Group I is not present in Group II or Group III.

The special technical feature of Group II is an arm device comprising an extendable, rotational arm. The special technical feature of Group II is not present in Group I or Group III.

The special technical feature of Group III is a medical device comprising a body, a first winch component, and a second winch component. The special technical feature of Group III is not present in Group I or Group II.

Accordingly, the inventions listed as Groups I - III lack unity of invention under PCT Rule 13 because they do not share a same or corresponding special technical feature.