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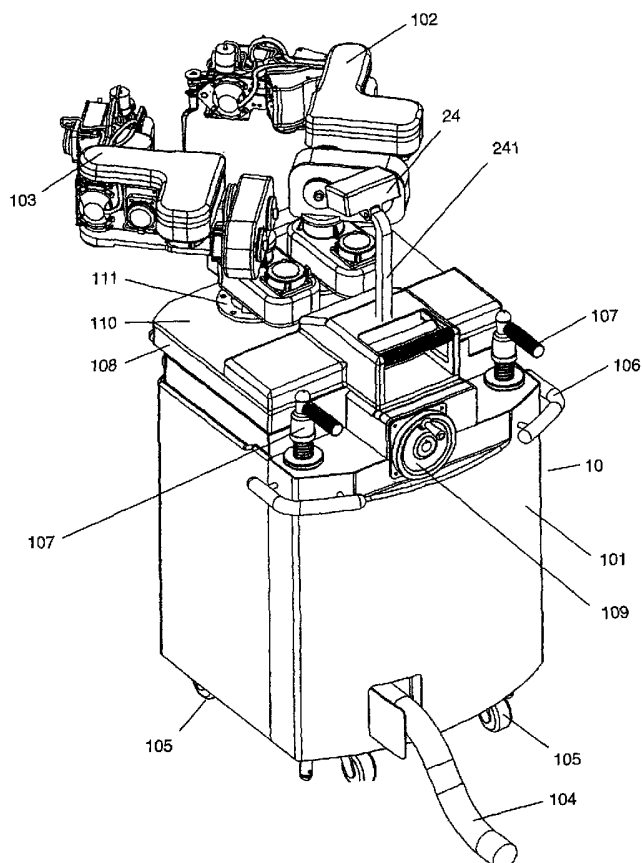
Garnette, R. [CA/CA]; 1403-29th Street, Calgary, Alberta T2N 2T9 (CA). **LOUW, Deon, F.** [CA/CA]; 1403-29th Street, Calgary, Alberta T2N 2T9 (CA). **MCBETH, Paul, Bradley** [CA/CA]; 19 Patterson Place S.W., Calgary, Alberta T3H 2C2 (CA). **FIELDING, Tim** [CA/CA]; 103 Sainstbury Crescent, Brampton, Ontario L6R 2W4 (CA). **GREGORIS, Dennis, John** [CA/CA]; 6 Garswell Place, Toronto, Ontario M9R 3K7 (CA).

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[Continued on next page]

(54) Title: MICROSURGICAL ROBOT SYSTEM



(57) Abstract: A surgical robot system has two movable arms (102, 103) carried on a wheeled base having six degrees of freedom each and an end effector which can be rolled about its axis and an actuator which can slide along the axis for operating different tools. Each end effector includes optical force sensors. A microscope provided for viewing the part of the patient. The position of the tool tip can be digitized relative to fiducial MRI visible markers. The control system has a pair of hand-controllers (19) simultaneously manipulated by an operator to control movement of the arms providing force feedback. The image from the microscope is displayed on a monitor in 2D (17) and stereoscopically on a microscope viewer. A second MRI display (16) shows the real-time location of the tool. The robot is MRI compatible and configured to operate within a closed magnet bore. The arms are driven by piezoelectric motors.



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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/CA 03/01201

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A61B19/00

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

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)

EP0-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 93/13916 A (STANFORD RES INST INT) 22 July 1993 (1993-07-22) page 2, line 34 - page 4, line 10 page 5, line 29 - page 6, line 15 page 21, line 19 - line 29; figure 1 -----	1-3
Y	WO 99/58055 A (SMITH WAYNE ;KLEIN GEORGE (CA); SONOMETRICS CORP (CA); VESELY IVAN) 18 November 1999 (1999-11-18) page 20, line 6 - page 23, line 8 -----	1-3
X	US 5 624 398 A (SLACK JR THEODORE C ET AL) 29 April 1997 (1997-04-29) column 3, line 43 - line 45; figures 1A,B column 1, line 16 - line 18 sentence 21 - sentence 24 column 14, line 8 - line 18 ----- -/--	1,2

☒ Further documents are listed in the continuation of box C.☒ 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

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"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

10 February 2004

Date of mailing of the international search report

01.06.2004

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International Application No

PCT/CA 03/01201

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 408 409 A (MITTELSTADT BRENT D ET AL) 18 April 1995 (1995-04-18) column 4, line 7 - column 5, line 16 column 6, line 64 - column 7, line 12 -----	1-3
A	US 6 244 809 B1 (WILSON JEFF ET AL) 12 June 2001 (2001-06-12) column 2, line 38 - line 62 column 7, line 58 - line 67; figure 1 -----	1-3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA 03/01201

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.:

1-3

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: 1-3

The robot system of claim 1 provided with a registration system, providing fiducial markers visible in generating the image and providing input of the position of the tool relative to the fiducial markers.

2. claims: 4-19

The robot system of claim 1 with mechanical details in the construction of the movable arms (degrees of freedom, MRI compatibility, piezoelectric motor, surgical tools)

3. claim: 20

The robot system of claim 1 having safety means which block movements of the robot

4. claim: 21

The robot system of claim 1 having a two channel microscope viewing system for viewing stereoscopic images.

5. claims: 22-24

The robot system of claim 1 having 3 force sensors for the different degrees of freedom of the surgical tool.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/CA 03/01201

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International Application No

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