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(54) Title: END EFFECTOR WITH REDUNDANT CLOSING MECHANISMS

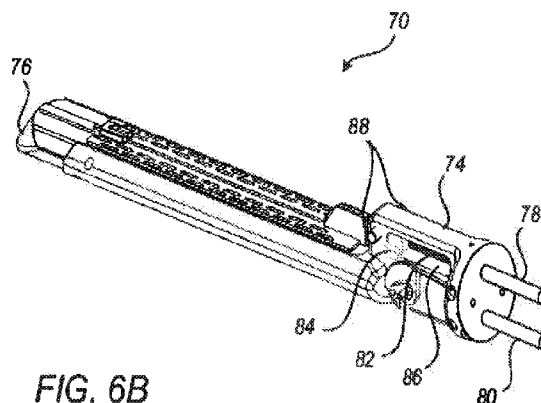


FIG. 6B

(57) Abstract: End effectors with redundant closing mechanisms, and related tools and methods are disclosed. The disclosed end effectors may be particularly beneficial when used for minimally invasive surgery. An example surgical tool (170) comprises an elongate shaft (174) having a proximal end and a distal end, a tool body (176) disposed at the distal end of the shaft, a jaw (178) movable relative to the tool body between a clamped configuration and an open configuration, a first actuation mechanism coupled with the jaw and operable to vary the position of the jaw relative to the tool body between the clamped configuration and the open configuration, and a second actuation mechanism coupled with the jaw. The second actuation mechanism has a first configuration where the jaw is held in the clamped configuration and a second configuration where the position of the jaw relative to the tool body is unconstrained by the second actuation mechanism.



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INTERNATIONAL SEARCH REPORT

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B. FIELDS SEARCHED				
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C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	US 2002/143346 A1 (MCGUCKIN, JR.) 3 October 2002 (2002-10-03)	4-6,9, 10,13		
Y	paragraphs [0004], [0031], [0032], [0034] - [0036], [0040], [0041]; claims 1,6,9,14,16; figures 1-18 -----	7,8,11, 12		
Y	US 2008/257935 A1 (VIOLA) 23 October 2008 (2008-10-23) paragraphs [0042] - [0044], [0062], [0063] -----	7,8		
Y	US 2009/090764 A1 (VIOLA) 9 April 2009 (2009-04-09) paragraphs [0055], [0056], [0064]; figures 1-7,12,18-26 ----- -/--	11,12		
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.				
* Special categories of cited documents : <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> "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 </td> <td style="width: 50%; border: none; vertical-align: top;"> "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 </td> </tr> </table>			"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
"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			
28 April 2011	06/07/2011			
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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>US 5 887 778 A (MAURER) 30 March 1999 (1999-03-30) column 5, lines 54,64,65 column 6, lines 6,11 column 9, lines 44,45,49,50; figures 5,6 -----</p>	4
A	<p>US 2009/095790 A1 (WHITMAN) 16 April 2009 (2009-04-16) paragraphs [0059], [0064], [0076], [0094] - [0096], [0111], [0114], [0125], [0126], [0143], [0154], [0155], [0159], [0161] paragraphs [0168], [0170]; figures 1-10,17,18 -----</p>	4-7, 11-13
A	<p>US 2006/048787 A1 (MANZO) 9 March 2006 (2006-03-09) paragraph [0066]; figures 14E,14G -----</p>	7,8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2010/056601

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.: 1-3
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 39.1(iv) PCT: method for treatment of the human or animal body by surgery
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:

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 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.:

4-13

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 4-13

A surgical tool comprising:

- an elongate shaft having a proximal end and a distal end;
- a tool body disposed at the distal end of the shaft;
- a jaw movable relative to the tool body between a clamped and an open configurations;
- a first actuation mechanism coupled with the jaw and operable to vary the position of the jaw between the clamped and the open configurations; and
- a second actuation mechanism coupled with the jaw, having a first configuration in which the jaw is held in the clamped configuration and a second configuration in which the position of the jaw relative to the tool body is unconstrained.

Problem solved:

Improving the actuation of the movable jaw of a minimally invasive surgical tool.

2. claims: 14-20

A robotic tool for mounting on a manipulator having a first drive, the tool comprising:

- a proximal tool chassis releasably mountable to the manipulator;
- a drive motor adjacently coupled with the tool chassis;
- a distal end effector comprising a movable jaw;
- an instrument shaft having a proximal end adjacent the chassis, and a distal end adjacent the end effector;
- a first actuation mechanism coupling the first drive to the end effector when the chassis is mounted to the manipulator so as to articulate the end effector between an open and a clamped configurations; and
- a second actuation mechanism coupling the drive motor to the end effector so as to articulate the end effector into the clamped configuration from the open configuration.

Problem solved:

Improving the actuation of the distal end effector of a robotic tool.

3. claims: 21-25

A surgical instrument comprising:

- an end effector comprising a movable jaw;
- a first jaw actuation mechanism coupled to the movable jaw; and
- a second jaw actuation mechanism coupled to the movable jaw;

wherein:

- the first jaw actuation mechanism moves the jaw from an

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

open to a closed position independently of the second jaw actuation mechanism; and
-- the second jaw actuation mechanism moves the jaw from the open to the closed position independently of the first jaw actuation mechanism.

Problem solved:

Independently applying two different clamping forces to the movable jaw of a surgical instrument end effector.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2010/056601

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