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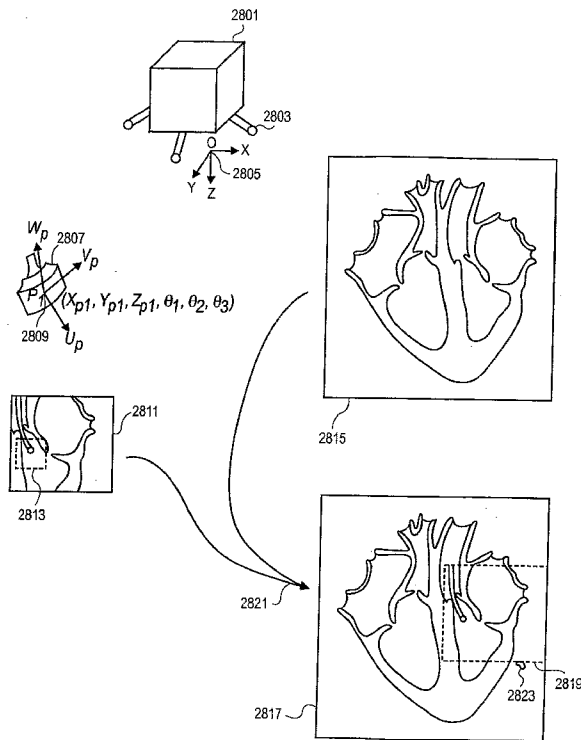
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[Continued on next page]

(54) Title: IMAGE-GUIDANCE IN MEDICAL IMAGE PROCESSING



(57) Abstract: Methods and apparatuses for the image guidance and documentation of medical procedures. One embodiment includes combining small field of view images into a recorded image of with a large field of view and aligning the small field of view real time image with the recorded image through correlation of imaging data. A location and orientation determination system may be used to track the imaging system and provide a starting set of image alignment parameters and/or provide change updates to a set of image alignment parameters, which is then further improved through correlating imaging data. The recorded image may be selected according to real time measurement of a cardiac parameter during an image guided cardiac procedure. Image manipulations planned based on the recorded image can be stored and applied to the real time information. The position of the medical device may be determined and recorded through manipulating a cursor in a 3-D image space shown in two non-parallel views.

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FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, 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).

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.

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

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2006/044508

A. CLASSIFICATION OF SUBJECT MATTER

INV. G06T7/00 G06T17/40 G06F19/00 G09B23/28

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)

G06T A61B G09B G06F

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)

EPO-Internal, WPI Data, INSPEC, COMPENDEX, EMBASE, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/231789 A1 (WILLIS N PARKER [US] ET AL) 18 December 2003 (2003-12-18)	1-10,12, 17-19, 23-26, 30-32, 36,37, 42,43, 51-53, 55,56
Y	abstract figure 4 paragraphs [0003] - [0011], [0042] - [0050], [0070] - [0097] ----- -/--	11,54, 57,61

Further documents are listed in the continuation of Box C.

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
- *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.
- *Z* document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2006/044508

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 97/29682 A (BIOSENSE INC [US]; BEN HAIM SHLOMO [IL]; FENSTER MAIER [IL]) 21 August 1997 (1997-08-21) page 3, line 23 - page 4, line 36 page 6, lines 6-14 page 8, lines 30-39 page 14, lines 5-8	11,54, 57,61
X	----- JOSEPH M ROSEN ET AL: "From planning to performing surgery" IEEE ENGINEERING IN MEDICINE AND BIOLOGY MAGAZINE, IEEE SERVICE CENTER, PISACATAWAY, NJ, US, vol. 15, no. 2, March 1996 (1996-03), pages 16-22, XP011084680 ISSN: 0739-5175 sections "1. Generic Models", "2. Patient Specific Models", "DataFusion"	13-16, 27-29, 39-41
X	----- US 5 797 849 A (VESELY IVAN [US] ET AL) 25 August 1998 (1998-08-25) cited in the application column 3, lines 24-35 column 16, lines 11-21 column 19, lines 51-57 column 23, lines 34-41	13-16, 27-29, 39-41
X	----- US 2005/107688 A1 (STROMMER GERA [IL]) 19 May 2005 (2005-05-19) figures 2A,2B paragraphs [0008], [0082], [0086], [0166], [0173]	13,15, 16,27, 29,39,41

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2006/044508

Box 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.: 58 - 60, 62
because they relate to subject matter not required to be searched by this Authority, namely:
Claims 58 and 60 are directed to aspects of medical diagnosis and claims 59, 60 and 62 relate to medical treatment. Consequently, they belong to matter listed under Rule 39.1 (IV) PCT and shall not be searched under A. 17(2) PCT.
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 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 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.:
1-19, 23-32, 36-43, 51-62
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.:

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: 1-12,17-19,23-26,30-32,36-38,42,43,51-62

align intra-operative image with pre-operative mosaic by correlation, partly receive initial parameters from an imaging probe or (ultrasound) transducer

2. claims: 13-16,27-29,39-41

display an image of an anatomy after application of intra-operatively acquired manipulation data

3. claims: 20-22,33-35,44-46

interactively display a cursor in a three-dimensional anatomic image in at least two non-parallel views

4. claims: 47-50

display two recorded images from two image sets being updated at different frequencies and each having a real time image overlaid thereon

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2006/044508

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2003231789 A1	18-12-2003	AU 2003234685 A1	31-12-2003
		CA 2486718 A1	24-12-2003
		EP 1514214 A2	16-03-2005
		JP 2005529701 T	06-10-2005
		WO 03107251 A2	24-12-2003
WO 9729682 A	21-08-1997	AU 1616897 A	02-09-1997
US 5797849 A	25-08-1998	AT 195024 T	15-08-2000
		AU 5140496 A	23-10-1996
		CA 2215508 A1	10-10-1996
		WO 9631753 A2	10-10-1996
		DE 69609529 D1	31-08-2000
		DE 69609529 T2	29-03-2001
		EP 0879426 A2	25-11-1998
		JP 11503629 T	30-03-1999
		US 5515853 A	14-05-1996
		US 5830144 A	03-11-1998
		US 5795298 A	18-08-1998
		US 5868673 A	09-02-1999
		US 5817022 A	06-10-1998
US 5779638 A	14-07-1998		
US 2005107688 A1	19-05-2005	NONE	