US009636188B2

(12) **United States Patent**
Gattani et al.

(10) **Patent No.: US 9,636,188 B2**
(45) **Date of Patent: May 2, 2017**

(54) **SYSTEM AND METHOD FOR 3-D TRACKING OF SURGICAL INSTRUMENT IN RELATION TO PATIENT BODY**

(75) Inventors: **Abhishek Gattani**, San Jose, CA (US); **Salmaan Hameed**, San Jose, CA (US)

(73) Assignee: **STRYKER CORPORATION**, Kalamazoo, MI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 2795 days.

(21) Appl. No.: **11/388,756**

(22) Filed: **Mar. 24, 2006**

(65) **Prior Publication Data**

US 2007/0225550 A1 Sep. 27, 2007

(51) **Int. Cl.**

A61B 34/20	(2016.01)
A61B 90/00	(2016.01)
A61B 90/10	(2016.01)
A61B 34/10	(2016.01)

(52) **U.S. Cl.**

CPC ***A61B 90/36*** (2016.02); ***A61B 34/20*** (2016.02); *A61B 34/10* (2016.02); *A61B 90/10* (2016.02); *A61B 90/361* (2016.02); *A61B 2034/102* (2016.02); *A61B 2034/2051* (2016.02); *A61B 2090/363* (2016.02); *A61B 2090/364* (2016.02); *A61B 2090/371* (2016.02); *A61B 2090/376* (2016.02); *A61B 2090/3983* (2016.02)

(58) **Field of Classification Search**

CPC A61B 2034/102; A61B 2034/2051; A61B 2090/363; A61B 2090/364; A61B 2090/371; A61B 2090/376; A61B 2090/3983; A61B 34/10; A61B 34/20; A61B 90/10; A61B 90/36; A61B 90/361

USPC 600/407, 409, 424; 601/1–3

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,016,439	A *	1/2000	Acker	600/411
6,233,476	B1 *	5/2001	Strommer et al.	600/424
6,754,596	B2	6/2004	Ashe	
2002/0049375	A1	4/2002	Strommer et al.	
2002/0082498	A1 *	6/2002	Wendt et al.	600/411
2004/0215071	A1 *	10/2004	Frank et al.	600/407

(Continued)

FOREIGN PATENT DOCUMENTS

EP	1 415 609 A1	5/2004
EP	1 519 140 A1	3/2005

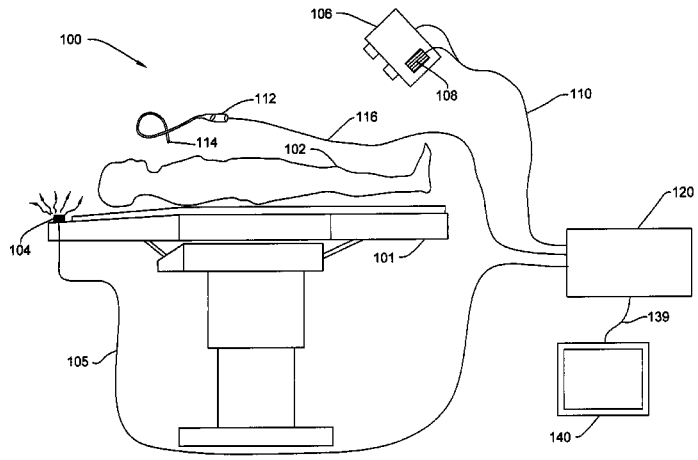
(Continued)

OTHER PUBLICATIONS

International Search Report dated Jan. 2, 2008.

Primary Examiner — Patricia Park
Assistant Examiner — Vani Gupta
(74) *Attorney, Agent, or Firm* — Flynn, Thiel, Boutell & Tanis, P.C.

(57) **ABSTRACT**

A system and method for tracking the three-dimensional position and orientation of a surgical instrument as the instrument is being utilized within the interior of a patient body. A stereoscopic camera system generates a stereoscopic image of the patient body which is subsequently rendered on a display device. A wireless signal transmitted by an electromagnetic field generator is received by a sensor on the surgical instrument. Utilizing this sensor data, a processor calculates the position and orientation of the surgical instrument and then superimposes upon the rendered stereoscopic image of the patient body a graphical representation indicative of the position and orientation of the surgical instrument.

29 Claims, 12 Drawing Sheets