



US006331181B1

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

(10) **Patent No.:** **US 6,331,181 B1**  
(45) **Date of Patent:** **Dec. 18, 2001**

(54) **SURGICAL ROBOTIC TOOLS, DATA ARCHITECTURE, AND USE**

(75) Inventors: **Michael J. Tierney**, Pleasanton; **Thomas G. Cooper**, Menlo Park; **Chris A. Julian**, Los Gatos; **Stephen J. Blumenkranz**, Redwood City; **Gary S. Guthart**, Foster City; **Robert G. Younge**, Portola Valley, all of CA (US)

4,996,975	3/1991	Nakamura .
5,018,266	5/1991	Hutchinson et al. .
5,078,140	1/1992	Kwoh .
5,143,453	9/1992	Weynant .
5,154,717	10/1992	Matsen, III et al. .
5,174,300	12/1992	Bales et al. .
5,217,003	6/1993	Wilk .
5,221,283	6/1993	Chang .
5,236,432	8/1993	Matsen, III et al. .
5,255,429	10/1993	Nishi et al. .

(73) Assignee: **Intuitive Surgical, Inc.**, Mountain View, CA (US)

(List continued on next page.)

**FOREIGN PATENT DOCUMENTS**

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

WO 93/13916	7/1993	(WO) .
WO 94/26167	11/1994	(WO) .
WO 95/16396	6/1995	(WO) .
WO 95/30964	11/1995	(WO) .
WO 96/39944	12/1996	(WO) .

(21) Appl. No.: **09/418,726**

(22) Filed: **Oct. 15, 1999**

**Related U.S. Application Data**

(60) Provisional application No. 60/111,713, filed on Dec. 8, 1998.

(51) **Int. Cl.**<sup>7</sup> ..... **A61B 19/00**

(52) **U.S. Cl.** ..... **606/130; 600/429**

(58) **Field of Search** ..... 606/130; 600/429

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

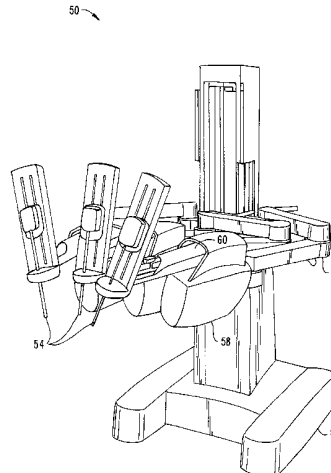
4,281,447	8/1981	Miller et al. .
4,332,066	6/1982	Hailey et al. .
4,486,928	12/1984	Tucker et al. .
4,500,065	2/1985	Hennekes et al. .
4,512,709	4/1985	Hennekes et al. .
4,706,372	11/1987	Ferrero et al. .
4,710,093	12/1987	Zimmer et al. .
4,793,053	12/1988	Zuccaro et al. .
4,809,747	3/1989	Choly et al. .
4,830,569	5/1989	Jannborg .
4,832,198	5/1989	Alikhan .
4,943,939	7/1990	Hoover .
4,979,949	12/1990	Matsen, III et al. .

*Primary Examiner*—Gene Mancene  
*Assistant Examiner*—Michael B. Priddy  
(74) *Attorney, Agent, or Firm*—Townsend and Townsend and Crew LLP

(57) **ABSTRACT**

Robotic surgical tools, systems, and methods for preparing for and performing robotic surgery include a memory mounted on the tool. The memory can perform a number of functions when the tool is loaded on the tool manipulator: first, the memory can provide a signal verifying that the tool is compatible with that particular robotic system. Secondly, the tool memory may identify the tool-type to the robotic system so that the robotic system can reconfigure its programming. Thirdly, the memory of the tool may indicate tool-specific information, including measured calibration offsets indicating misalignment of the tool drive system, tool life data, or the like. This information may be stored in a read only memory (ROM), or in a nonvolatile memory which can be written to only a single time. The invention further provides improved engagement structures for coupling robotic surgical tools with manipulator structures.

**28 Claims, 22 Drawing Sheets**



U.S. PATENT DOCUMENTS

5,257,998	11/1993	Ota et al. .	5,400,267	3/1995	Denen et al. .	
5,271,384	12/1993	McEwen et al. .	5,402,801	4/1995	Taylor .	
5,294,209	3/1994	Naka et al. .	5,403,319	* 4/1995	Matsen, III et al. ....	606/88
5,305,203	4/1994	Raab .	5,417,210	5/1995	Funda et al. .	
5,312,212	5/1994	Naumec .	5,427,097	6/1995	Depp .	
5,313,935	5/1994	Kortenbach et al. .	5,451,368	9/1995	Jacob .	
5,343,385	8/1994	Joskowicz et al. .	5,649,956	* 7/1997	Jensen et al. ....	606/205
5,354,314	10/1994	Hardy et al. .	5,697,939	* 12/1997	Kubota et al. ....	606/130
5,355,743	10/1994	Tesar .	5,762,458	* 6/1998	Wang et al. ....	414/1
5,359,993	11/1994	Slater et al. .	5,792,135	8/1998	Madhani et al. .	
5,372,147	12/1994	Lathrop, Jr. et al. .	5,800,423	9/1998	Jensen .	
5,397,323	3/1995	Taylor .	6,132,368	10/2000	Cooper .....	600/102
5,399,951	3/1995	Lavallee et al. .				

\* cited by examiner

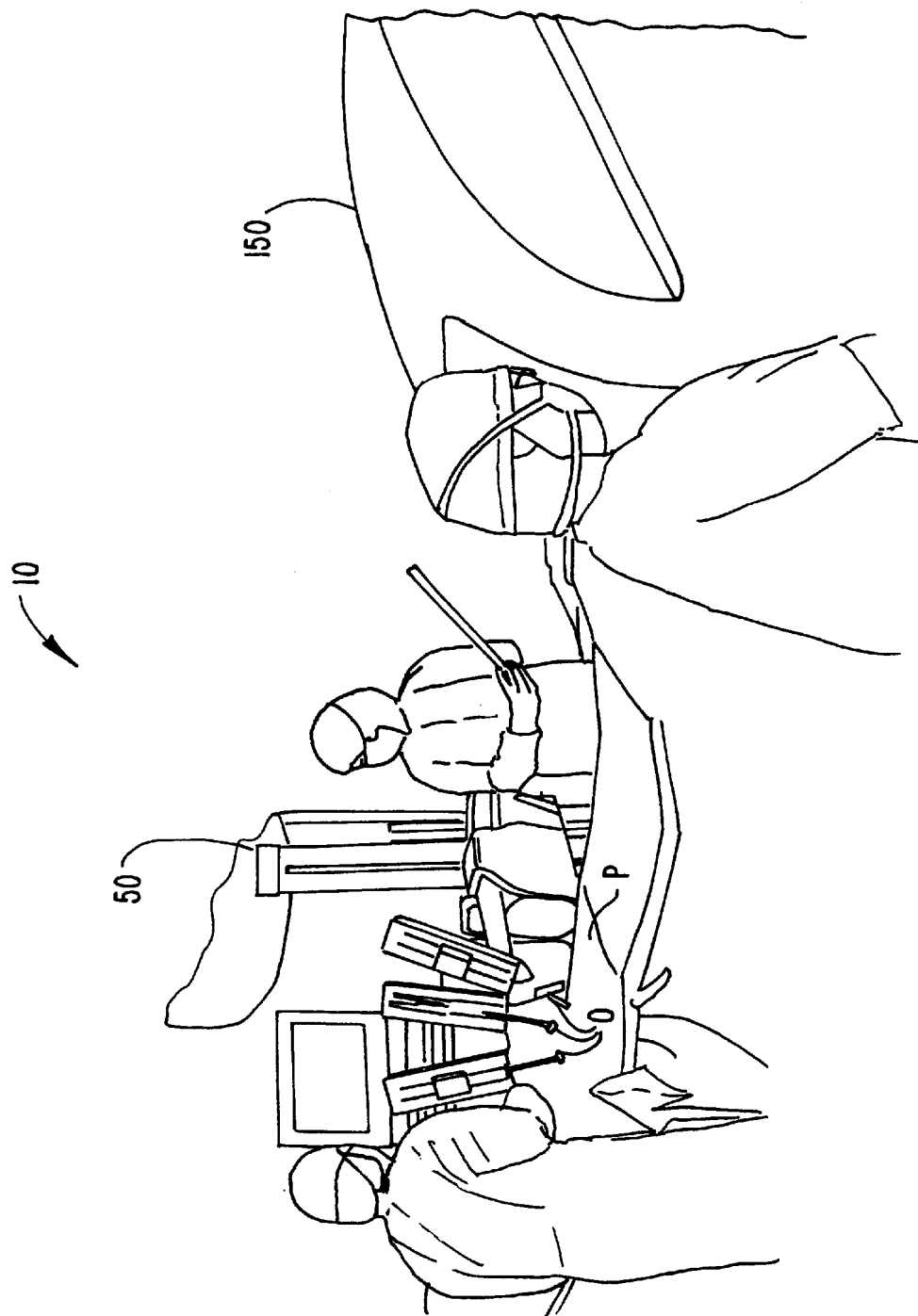


FIG. 1.

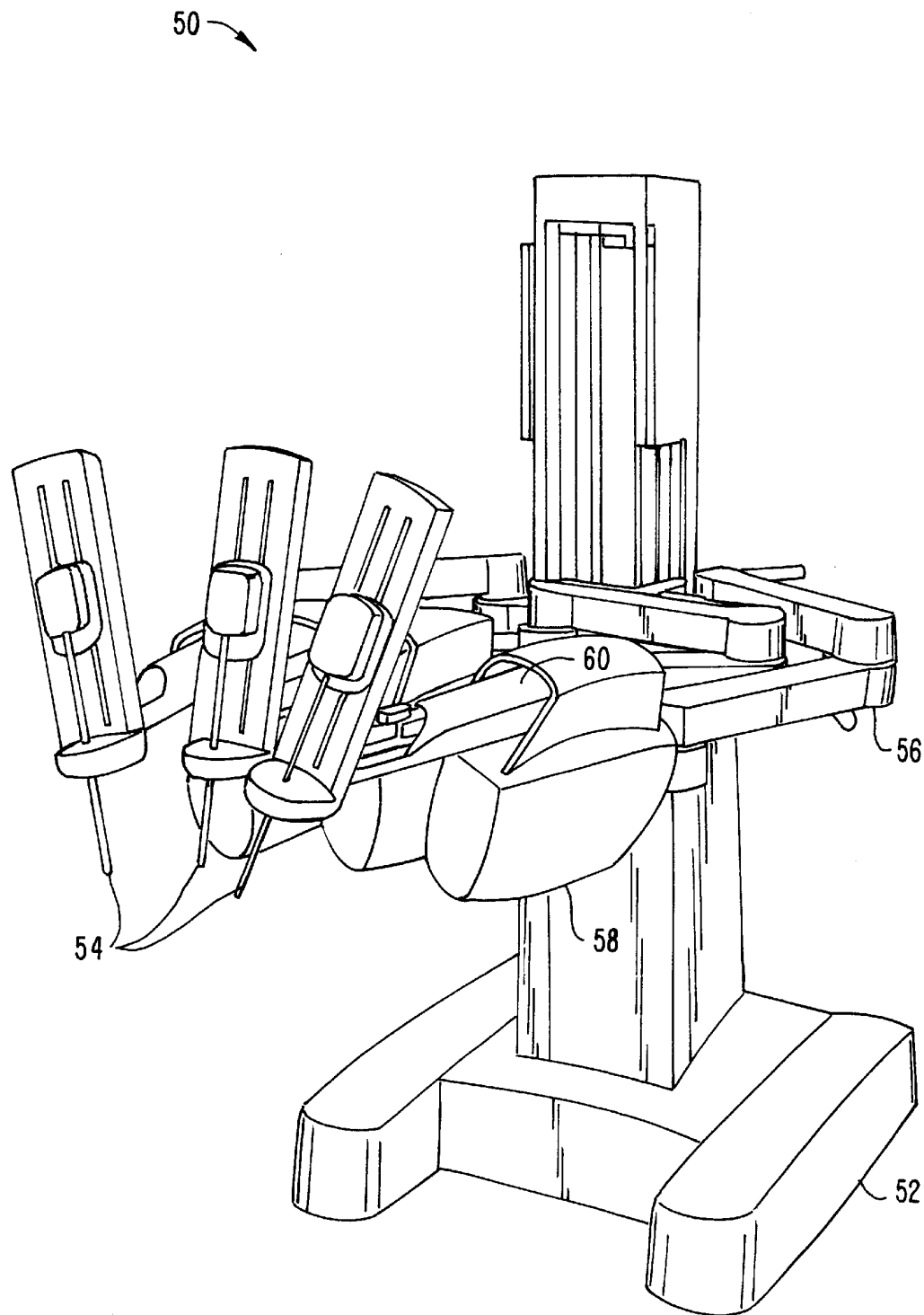


FIG. 2.

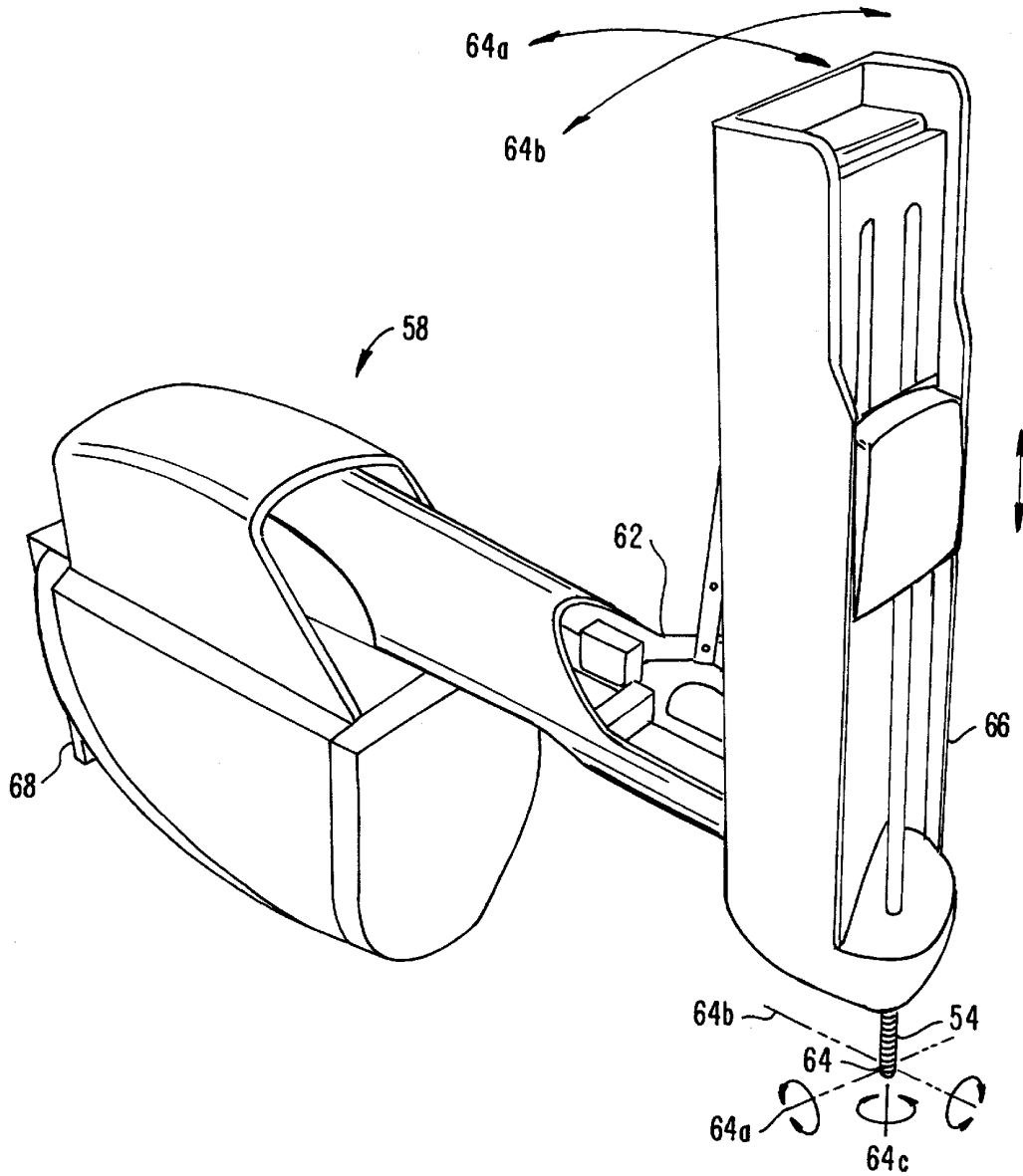


FIG. 2A.

# Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

## Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

## Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

## Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

## API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

## LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

## FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

## E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.