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**Tierney et al.**

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

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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. .

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(List continued on next page.)

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

FOREIGN PATENT DOCUMENTS

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) .

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**Related U.S. Application Data**

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(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**

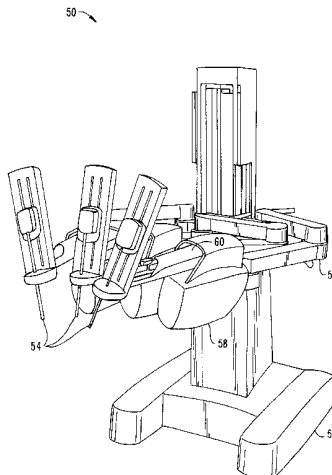
4,281,447	8/1981	Miller et al. .
4,332,066	6/1982	Hailey et al. .
4,486,928	12/1984	Tucker et al. .
4,500,065	2/1985	Hennekes et al. .
4,512,709	4/1985	Hennekes et al. .
4,706,372	11/1987	Ferrero et al. .
4,710,093	12/1987	Zimmer et al. .
4,793,053	12/1988	Zuccaro et al. .
4,809,747	3/1989	Choly et al. .
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. .

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(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

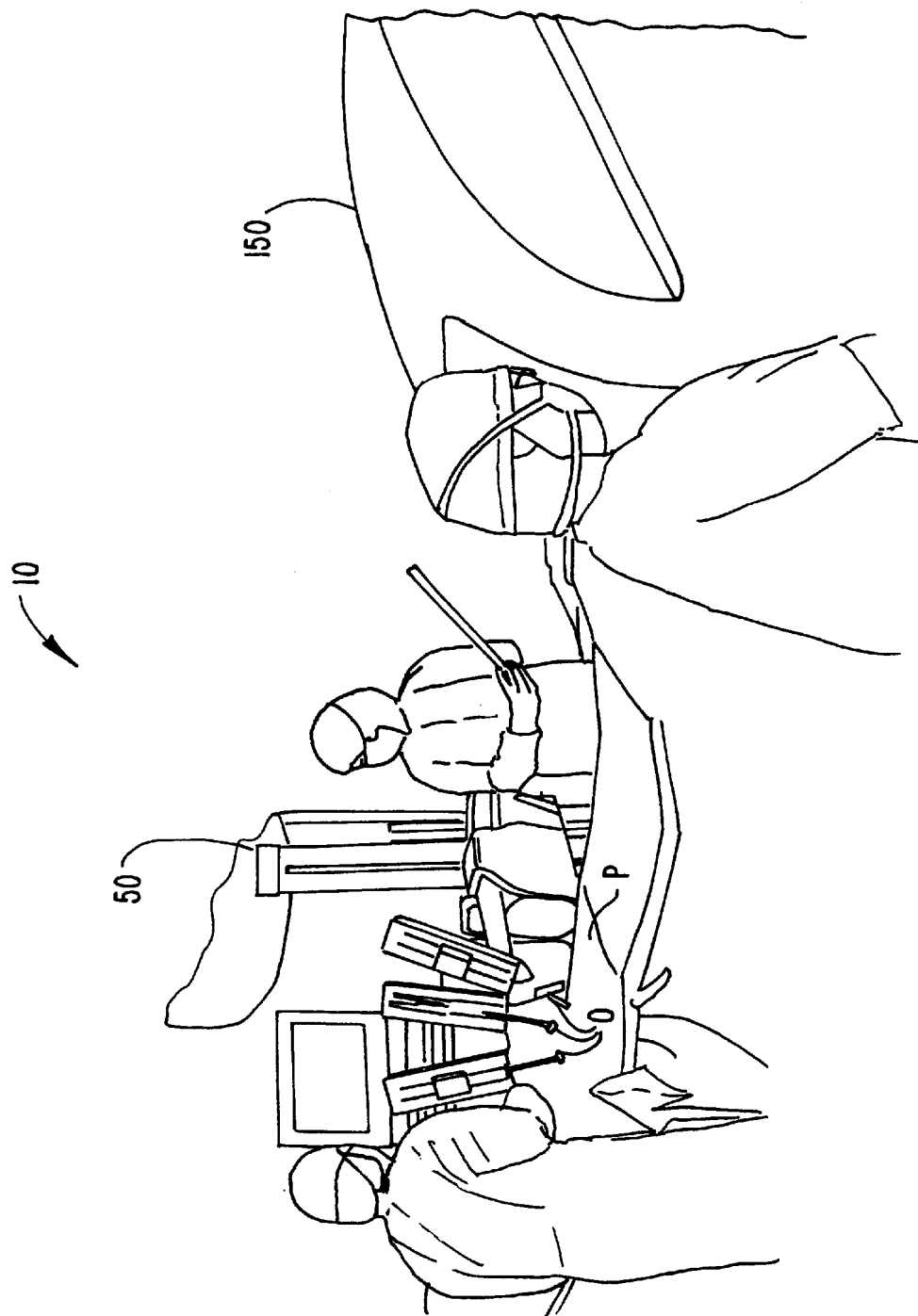


FIG. 1.

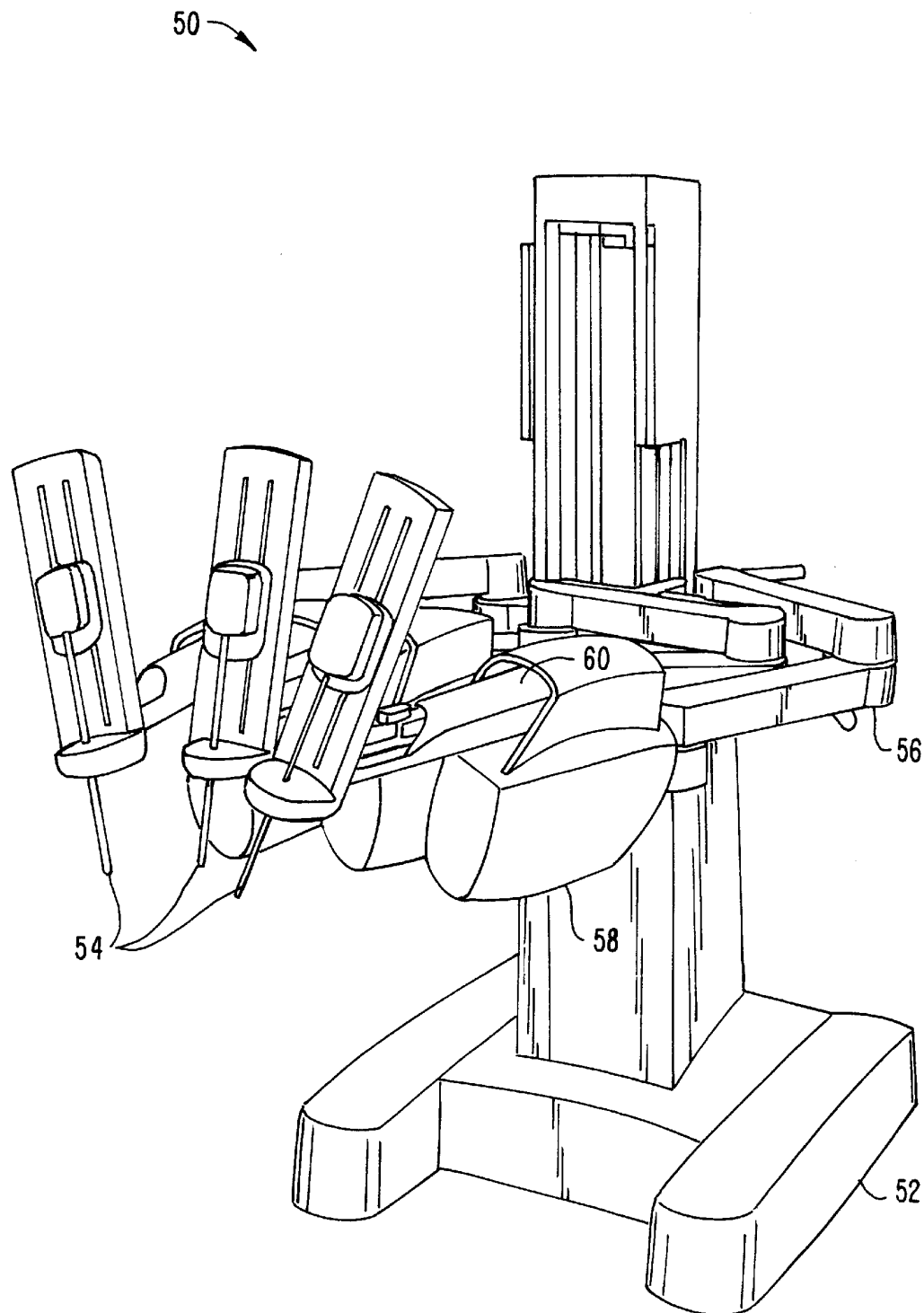


FIG. 2.

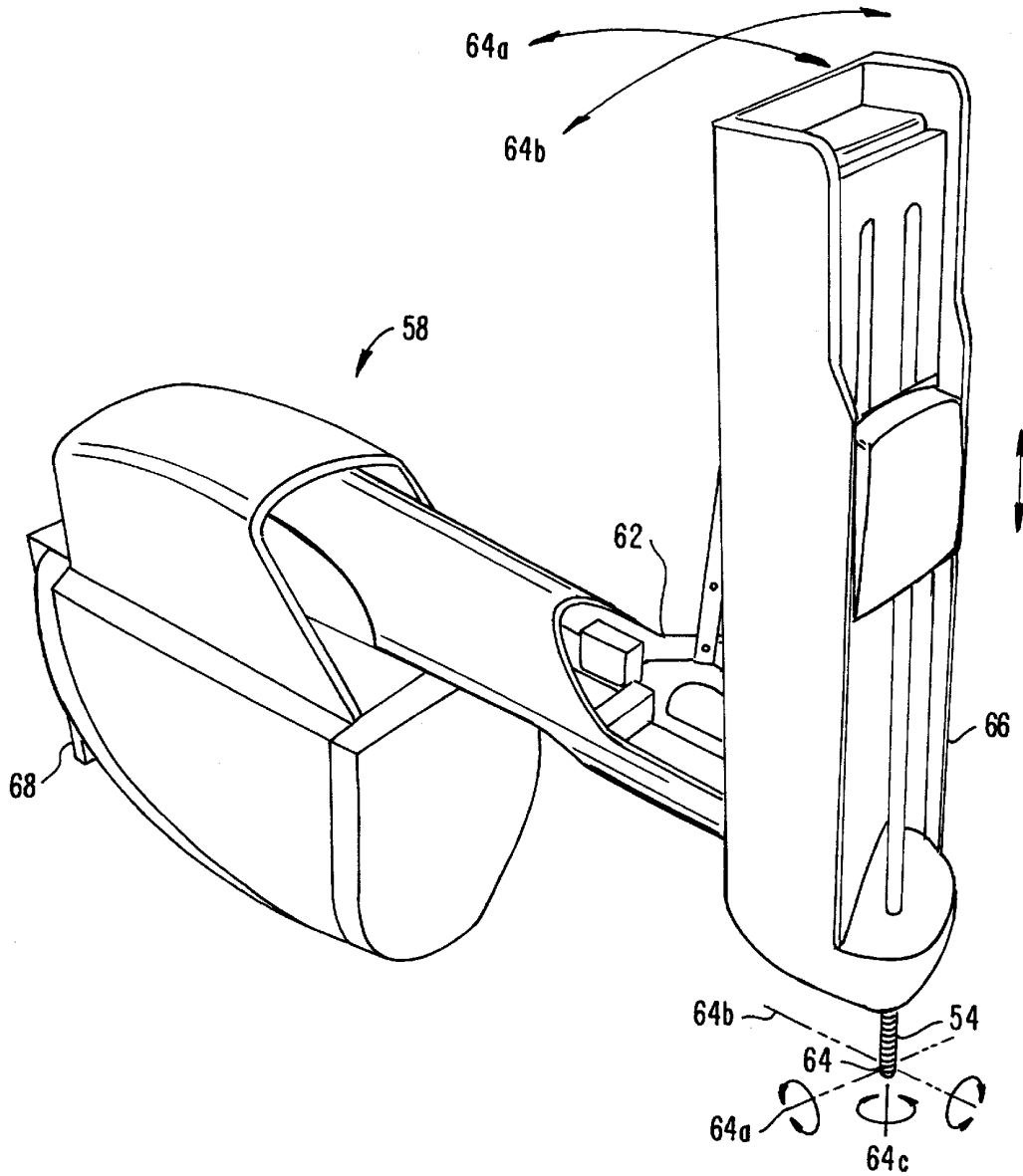


FIG. 2A.

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