



US007691098B2

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

(10) **Patent No.:** **US 7,691,098 B2**
(45) **Date of Patent:** **Apr. 6, 2010**

- (54) **PLATFORM LINK WRIST MECHANISM**
- (75) Inventors: **Daniel T. Wallace**, Redwood City, CA (US); **S. Christopher Anderson**, Northampton, MA (US); **Scott Manzo**, Shelton, CT (US)
- (73) Assignee: **Intuitive Surgical, Inc.**, Sunnyvale, CA (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 755 days.

(58) **Field of Classification Search** 606/1, 606/39, 51, 53, 120, 151, 190, 205, 210, 606/237; 623/24
See application file for complete search history.

- (56) **References Cited**
U.S. PATENT DOCUMENTS

4,806,068	A *	2/1989	Kohli et al.	414/735
4,919,112	A	4/1990	Siegmund	
4,919,382	A *	4/1990	Forman	248/178.1
5,053,687	A *	10/1991	Merlet	318/568.2
5,383,888	A *	1/1995	Zvenyatsky et al.	606/206

(21) Appl. No.: **11/436,988**

(Continued)

(22) Filed: **May 18, 2006**

OTHER PUBLICATIONS

(65) **Prior Publication Data**
US 2007/0156119 A1 Jul. 5, 2007

Vertut, Jean and Coiffet, Philippe Coiffet; "Robot Technology; vol. 3A Teleoperation and Robotics Evolution and Development"; 1986; Prentice-Hall, Inc; Englewood Cliffs, N.J.

Related U.S. Application Data

Primary Examiner—Henry M Johnson, III
Assistant Examiner—Jeffrey B Lipitz

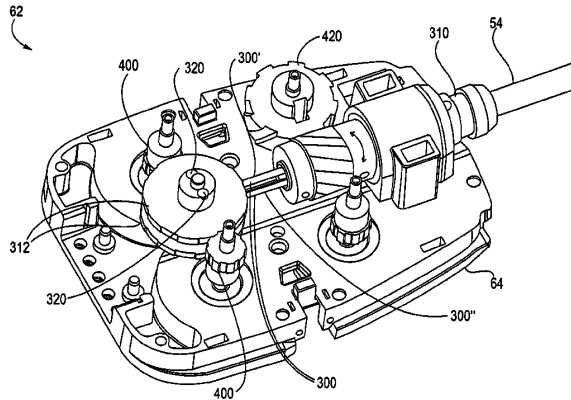
- (63) Continuation of application No. 10/758,050, filed on Jan. 14, 2004, now Pat. No. 7,066,926, which is a continuation of application No. 10/186,176, filed on Jun. 28, 2002, now Pat. No. 6,699,235.
- (60) Provisional application No. 60/301,967, filed on Jun. 29, 2001, provisional application No. 60/327,702, filed on Oct. 5, 2001.

(57) **ABSTRACT**

The present invention provides a robotic surgical tool for use in a robotic surgical system to perform a surgical operation. The robotic surgical tool includes a wrist mechanism disposed near the distal end of a shaft which connects with an end effector. The wrist mechanism includes a distal member configured to support the end effector, and a plurality of rods extending generally along an axial direction within the shaft and movable generally along this axial direction to adjust the orientation of the distal member with respect to the shaft. Advancement or retraction of a first rod generally along the axial direction tips the base through a first angle. The addition of a second angle allows the distal member to direct the end effector in essentially a compound angle. The robotic surgical tool may also include provisions for roll movement.

- (51) **Int. Cl.**
G05G 11/00 (2006.01)
G05G 9/00 (2006.01)
B25J 9/06 (2006.01)
B25J 11/00 (2006.01)
A61B 17/28 (2006.01)
A61B 19/00 (2006.01)
A61B 17/00 (2006.01)
- (52) **U.S. Cl.** **606/1**; 74/490.06; 74/490.01; 606/914; 606/206; 606/139; 606/130; 606/142; 606/205

14 Claims, 24 Drawing Sheets



US 7,691,098 B2

Page 2

U.S. PATENT DOCUMENTS									
		6,418,811	B1 *	7/2002	Rosheim 74/490.06				
		6,425,177	B1	7/2002	Akeel				
5,699,695	A *	12/1997	Canfield et al.	74/490.06	6,516,681	B1 *	2/2003	Pierrot et al.	74/490.01
5,740,699	A	4/1998	Ballantyne et al.		6,658,962	B1 *	12/2003	Rosheim 74/490.05	
5,792,135	A *	8/1998	Madhani et al.	606/1	7,273,488	B2 *	9/2007	Nakamura et al.	606/205
6,331,181	B1 *	12/2001	Tierney et al.	606/130	2004/0111113	A1 *	6/2004	Nakamura et al.	606/205
6,394,998	B1 *	5/2002	Wallace et al.	606/1					

* cited by examiner

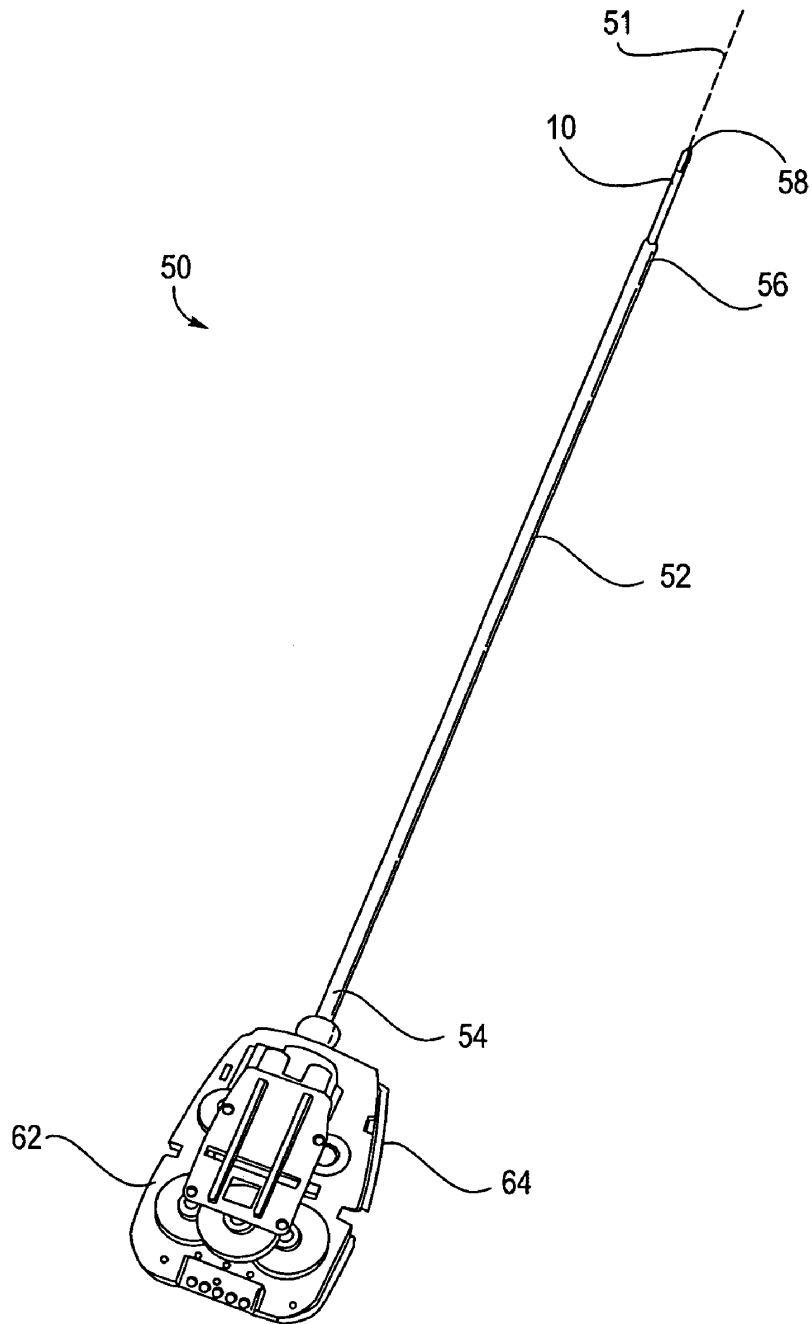


Fig. 1

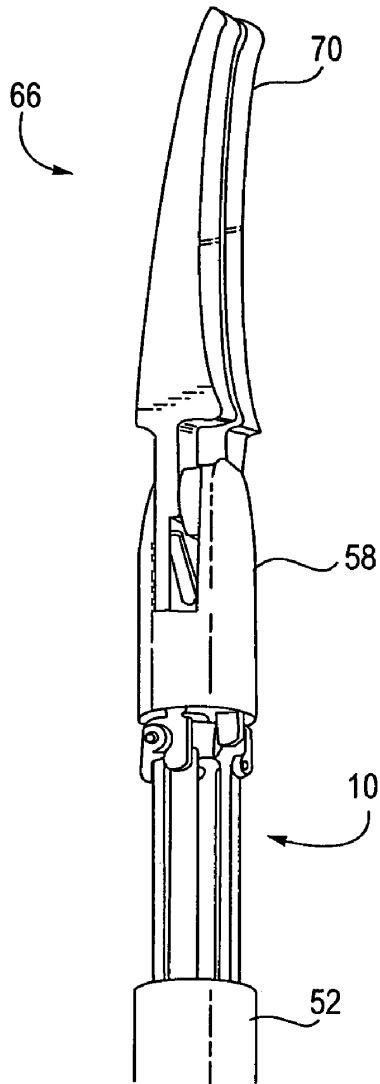


Fig. 2A

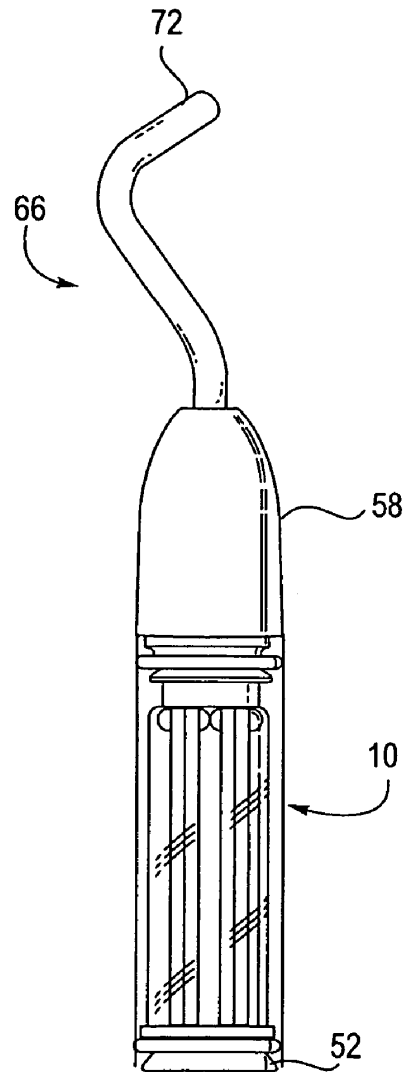


Fig. 2B

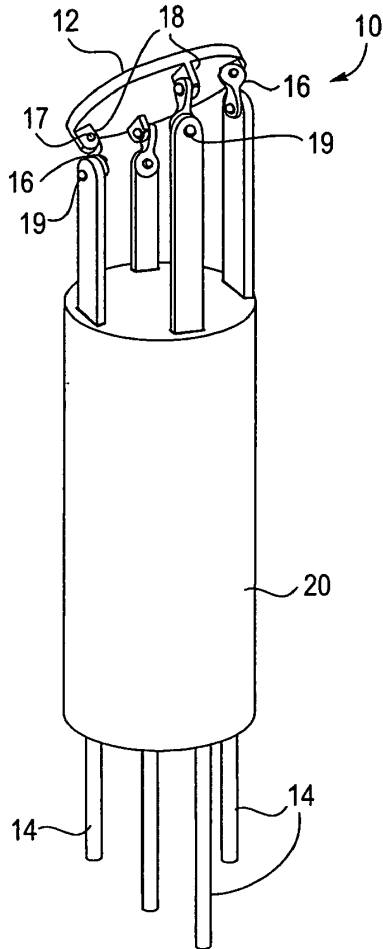


Fig. 3

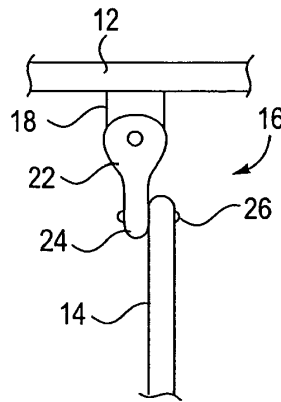


Fig. 3C

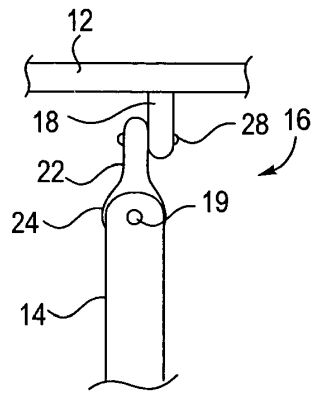


Fig. 3D

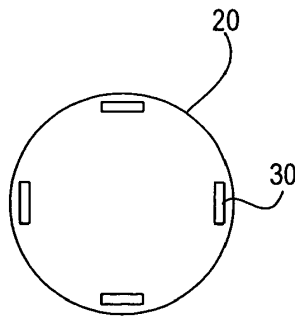


Fig. 3A

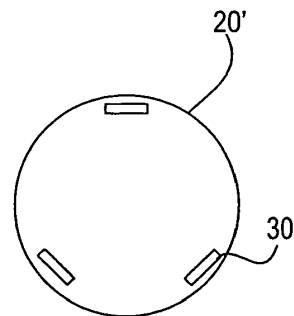


Fig. 3B

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.