



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

(10) **Patent No.:** **US 9,510,732 B2**
(45) **Date of Patent:** **Dec. 6, 2016**

(54) **METHODS AND APPARATUS FOR EFFICIENT PURGING**

(75) Inventors: **David Miller**, Cupertino, CA (US); **Vahid Saadat**, Atherton, CA (US); **Zachary J. Malchano**, San Francisco, CA (US); **Ruey-Feng Peh**, Mountain View, CA (US); **Aseem K. Thakur**, Sunnyvale, CA (US); **Chris A. Rothe**, San Mateo, CA (US); **Edmund Tam**, Mountain View, CA (US)

(73) Assignee: **Intuitive Surgical Operations, 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 597 days.

(21) Appl. No.: **12/499,681**

(22) Filed: **Jul. 8, 2009**

(65) **Prior Publication Data**
US 2010/0010311 A1 Jan. 14, 2010

Related U.S. Application Data

(63) Continuation-in-part of application No. 11/259,498, filed on Oct. 25, 2005, now Pat. No. 7,860,555.

(60) Provisional application No. 61/079,414, filed on Jul. 9, 2008.

(51) **Int. Cl.**
A61B 1/00 (2006.01)
A61B 1/04 (2006.01)

(52) **U.S. Cl.**
CPC **A61B 1/00089** (2013.01); **A61B 1/0008** (2013.01); **A61B 1/00165** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

623,022 A	4/1899	Johnson	
2,305,462 A	12/1942	Wolf	
2,453,862 A	11/1948	Salisbury	
3,559,651 A *	2/1971	Moss	604/349

(Continued)

FOREIGN PATENT DOCUMENTS

DE	2853466 A1	6/1979
DE	10028155 A1	12/2000

(Continued)

OTHER PUBLICATIONS

European Patent Application No. 06734083.6 filed Jan. 30, 2006 in the name of Voyage Medical, Inc., Office Action mailed Nov. 12, 2010.

(Continued)

Primary Examiner — Thomas J Sweet
Assistant Examiner — Alexandra Newton

(57) **ABSTRACT**

Methods and apparatus for efficient purging from an imaging hood are described which facilitate the visualization of tissue regions through a clear fluid. Such a system may include an imaging hood having one or more layers covering the distal opening and defines one or more apertures which control the infusion and controlled retention of the clearing fluid into the hood. In this manner, the amount of clearing fluid may be limited and the clarity of the imaging of the underlying tissue through the fluid within the hood may be maintained for relatively longer periods of time by inhibiting, delaying, or preventing the infusion of surrounding blood into the viewing field. The aperture size may be controlled to decrease or increase through selective inflation of the membrane or other mechanisms.

8 Claims, 14 Drawing Sheets

