



US009408565B2

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

(10) **Patent No.:** **US 9,408,565 B2**
(45) **Date of Patent:** ***Aug. 9, 2016**

(54) **APPARATUS FOR DETECTING TUMOR CELLS**

B01L 2200/0668; B01L 2300/0636; B01L 3/502761; C12Q 1/68; G01N 15/1056; G01N 33/5091

(75) Inventors: **Chris C. Yu**, Conneautville, PA (US); **Xuedong Du**, Shanghai (CN); **He Yu**, Honolulu, HI (US)

See application file for complete search history.

(73) Assignee: **SHANGHAI XINSHENPAI TECHNOLOGY CO., LTD.**, Shanghai (CN)

(56) **References Cited**

U.S. PATENT DOCUMENTS

2003/0232425 A1* 12/2003 Bachalo et al. 435/283.1
2004/0043494 A1* 3/2004 Amorese B01L 3/50853
436/37

(Continued)

FOREIGN PATENT DOCUMENTS

JP 2005524833 8/2005
JP 2008538282 10/2008
WO 2004029221 4/2004

OTHER PUBLICATIONS

International Search Report dated Mar. 4, 2013 issued in corresponding PCT Application No. PCT/US2012/036551, 7 pages.

(Continued)

Primary Examiner — Jennifer Wecker

(74) *Attorney, Agent, or Firm* — Weisun Rao; Greenberg Traurig, LLP

(57) **ABSTRACT**

Among others, the present invention provides apparatus for detecting circulating tumor cells, comprising a system delivery biological subject and a probing and detecting device, wherein the probing and detecting device includes a first micro-device and a first substrate supporting the first micro-device, the first micro-device contacts a biologic material to be detected and is capable of measuring at the microscopic level an electrical, magnetic, electromagnetic, thermal, optical, acoustical, biological, chemical, electro-mechanical, electro-chemical, electro-optical, electro-thermal, electro-chemical-mechanical, bio-chemical, bio-mechanical, bio-optical, bio-thermal, bio-physical, bio-electro-mechanical, bio-electro-chemical, bio-electro-optical, bio-electro-thermal, bio-mechanical-optical, bio-mechanical thermal, bio-thermal-optical, bio-electro-chemical-optical, bio-electro-mechanical-optical, bio-electro-thermal-optical, bio-electro-chemical-mechanical, physical or mechanical property, or a combination thereof, of the biologic subject.

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

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **14/110,759**

(22) PCT Filed: **May 4, 2012**

(86) PCT No.: **PCT/US2012/036551**

§ 371 (c)(1),
(2), (4) Date: **Oct. 9, 2013**

(87) PCT Pub. No.: **WO2012/151501**

PCT Pub. Date: **Nov. 8, 2012**

(65) **Prior Publication Data**

US 2014/0030799 A1 Jan. 30, 2014

Related U.S. Application Data

(60) Provisional application No. 61/482,900, filed on May 5, 2011.

(51) **Int. Cl.**

G01N 33/50 (2006.01)
G01N 33/53 (2006.01)

(Continued)

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

CPC **A61B 5/14546** (2013.01); **A61B 5/07** (2013.01); **A61B 5/1451** (2013.01);

(Continued)

(58) **Field of Classification Search**

CPC **A61B 5/14546**; **B01L 2200/0652**;

48 Claims, 68 Drawing Sheets

