

9-19-2017

Multidispensor cartesian robotic printer

Michael J. Yost

Thomas Trusk

Ying Mei

Michael Chappell

Boylan Walter

Follow this and additional works at: https://tigerprints.clemson.edu/clemson_patents

Recommended Citation

Yost, Michael J.; Trusk, Thomas; Mei, Ying; Chappell, Michael; and Walter, Boylan, "Multidispensor cartesian robotic printer" (2017). *Clemson Patents*. 593.

https://tigerprints.clemson.edu/clemson_patents/593

This Patent is brought to you for free and open access by TigerPrints. It has been accepted for inclusion in Clemson Patents by an authorized administrator of TigerPrints. For more information, please contact kokeefe@clemson.edu.

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

(10) **Patent No.:** **US 9,764,515 B2**
(45) **Date of Patent:** **Sep. 19, 2017**

(54) **MULTIDISPENSOR CARTESIAN ROBOTIC PRINTER**

(71) Applicants: **MUSC Foundation for Research Development**, Charleston, SC (US); **Izumi International, Inc.**, Greenville, SC (US); **Clemson University**, Clemson, SC (US)

(72) Inventors: **Michael J. Yost**, Mt. Pleasant, SC (US); **Thomas Trusk**, Summerville, SC (US); **Ying Mei**, Mt. Pleasant, SC (US); **Michael Chappell**, Simpsonville, SC (US); **Walter Boylan**, Liberty, SC (US)

(73) Assignees: **MUSC Foundation for Research Development**, Charleston, SC (US); **Izumi International, Inc.**, Greenville, SC (US); **Clemson University**, Clemson, SC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 260 days.

(21) Appl. No.: **14/702,112**

(22) Filed: **May 1, 2015**

(65) **Prior Publication Data**
US 2015/0375453 A1 Dec. 31, 2015

Related U.S. Application Data

(60) Provisional application No. 61/987,355, filed on May 1, 2014.

(51) **Int. Cl.**
B29C 67/00 (2017.01)
B33Y 30/00 (2015.01)
(Continued)

(52) **U.S. Cl.**
CPC **B29C 67/0059** (2013.01); **B29C 67/0088** (2013.01); **B29K 2005/00** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC .. B29C 67/0059; B29C 67/0088; B33Y 30/00
See application file for complete search history.

(56) **References Cited**
U.S. PATENT DOCUMENTS
8,241,905 B2 8/2012 Forgacs et al.
8,931,880 B2* 1/2015 Murphy B41J 3/407 347/20
(Continued)

OTHER PUBLICATIONS
Billiet, T., et al., "A review of trends and limitations in hydrogel-rapid prototyping for tissue engineering," vol. 33, No. 26, 2012, pp. 6020-6041.
(Continued)

Primary Examiner — James Sanders
(74) *Attorney, Agent, or Firm* — Meunier Carlin & Curfman LLP

(57) **ABSTRACT**
Disclosed are systems, compositions, and methods for three-dimensional (3D) printing. An example system includes a plurality of dispensers configured to deposit materials from their tips and a printing surface for receiving the materials. The system includes a position sensing detector configured to detect positions of the tips of the dispensers and the location and dimensions of the printing surface. The system includes a robotic positioning device configured to drive the dispensers. The system also includes a control unit configured to receive and map in a 3D space the positions of the tips of the dispensers and the position and dimensions of the printing surface. The control unit is further configured to control the robotic positioning device to drive the dispensers relative to the printing surface in the 3D space, and to independently deposit materials on the printing surface, or on material deposited on the printing surface.

19 Claims, 26 Drawing Sheets

