

UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

PATENT NO. : 9,168,698 B2  
APPLICATION NO. : 14/065516  
DATED : October 27, 2015  
INVENTOR(S) : Aljosa Kemperle, Filipp Gelman and Peter Joseph Schmehl

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In Column 13, Line 27, Claim 15, delete "and optical sensor" and insert -- an optical sensor --.

Signed and Sealed this  
Third Day of May, 2016



Michelle K. Lee  
*Director of the United States Patent and Trademark Office*

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Patent No.: 9,168,698  
Issued: October 27, 2015  
Serial No.: 14/065,516  
Filing Date: October 29, 2013  
In re: KEMPERLE, Aljosa, *et al.*  
Art Unit: 1743  
Examiner: NGUYEN, Thukhanh T.  
Conf. No.: 9906

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Attention: Certificate of Corrections Branch  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**CERTIFICATE OF CORRECTION COMMUNICATION**

Dear Examiner:

For the above identified patent, the applicant request a certificate of correction for the item specified on the Certificate of Correction form submitted herewith.

The applicant respectfully requests a published Certificate of Correction for this issued patent.

The applicant submits herewith the fee of \$100 as stated in 37 C.F.R. § 1.20(a). The applicant hereby authorizes the Patent Office to charge any deficiencies or credit any overpayments associated with this filing to Deposit Account No. 50-4262.

Please direct any inquiry regarding this matter to the undersigned at (617) 916-2658.

Respectfully submitted  
STRATEGIC PATENTS, P.C.

/Robert Mazzaresse/  
Robert A. Mazzaresse  
Reg. No. 42,852  
Tel.: (617)-916-2658

November 12, 2015

## UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

Page 1 of 1

PATENT NO. : 9,168,698

APPLICATION NO.: 14/065,516

ISSUE DATE : October 27, 2015

INVENTOR(S) : Aljosa Kemperle, Filipp Gelman, Peter Joseph Schmehl

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In Column 13, Line 27, Claim 15, delete "and optical sensor" and insert -- an optical sensor --.

**MAILING ADDRESS OF SENDER (Please do not use customer number below):**

Robert Mazzaresse  
P.O. Box 920629  
Needham, MA 02492

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

| Electronic Patent Application Fee Transmittal      |                 |  |               |                             |
|--|-----------------|--|---------------|-----------------------------|
| <b>Application Number:</b>                         |                 | 14065516                                       |               |                             |
| <b>Filing Date:</b>                                |                 | 29-Oct-2013                                    |               |                             |
| <b>Title of Invention:</b>                         |                 | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |               |                             |
| <b>First Named Inventor/Applicant Name:</b>        |                 | Aljosa Kemperle                                |               |                             |
| <b>Filer:</b>                                      |                 | Robert A. Mazzaresse/Paula Ng                  |               |                             |
| <b>Attorney Docket Number:</b>                     |                 | MBOT-0051-P01                                  |               |                             |
| Filed as Large Entity                              |                 |  |               |                             |
| <b>Filing Fees for Utility under 35 USC 111(a)</b> |                 |  |               |                             |
| <b>Description</b>                                 | <b>Fee Code</b> | <b>Quantity</b>                                | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                               |                 |  |               |                             |
| <b>Pages:</b>                                      |                 |  |               |                             |
| <b>Claims:</b>                                     |                 |  |               |                             |
| <b>Miscellaneous-Filing:</b>                       |                 |  |               |                             |
| <b>Petition:</b>                                   |                 |  |               |                             |
| <b>Patent-Appeals-and-Interference:</b>            |                 |  |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>           |                 |  |               |                             |
| Certificate of Correction                          | 1811            | 1  | 100           | 100                         |

| Description        | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|--------------------|----------|----------|--------|----------------------|
| Extension-of-Time: |          |          |        |                      |
| Miscellaneous:     |          |          |        |                      |
| Total in USD (\$)  |          |          |        | 100                  |

| Electronic Acknowledgement Receipt          |  |
|---|--|
| <b>EFS ID:</b>                              | 24064968                                       |
| <b>Application Number:</b>                  | 14065516                                       |
| <b>International Application Number:</b>    |  |
| <b>Confirmation Number:</b>                 | 9906   |
| <b>Title of Invention:</b>                  | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |
| <b>First Named Inventor/Applicant Name:</b> | Aljosa Kemperle                                |
| <b>Customer Number:</b>                     | 43520  |
| <b>Filer:</b>                               | Robert A. Mazzaresse/Paula Ng                  |
| <b>Filer Authorized By:</b>                 | Robert A. Mazzaresse                           |
| <b>Attorney Docket Number:</b>              | MBOT-0051-P01                                  |
| <b>Receipt Date:</b>                        | 12-NOV-2015                                    |
| <b>Filing Date:</b>                         | 29-OCT-2013                                    |
| <b>Time Stamp:</b>                          | 15:30:40                                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                    |

### Payment information:

|  |             |
|--|-------------|
| Submitted with Payment   | yes         |
| Payment Type   | Credit Card |
| Payment was successfully received in RAM   | \$100       |
| RAM confirmation Number  | 2079        |
| Deposit Account  | 504262      |
| Authorized User  | NG, PAULA   |
| <p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)</p> <p>Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)</p> |             |

| <b>File Listing:</b>  |                                       |  |  |                  |                  |
|---|---------------------------------------|--|--|------------------|------------------|
| Document Number   | Document Description                  | File Name                                  | File Size(Bytes)/<br>Message Digest                | Multi Part /.zip | Pages (if appl.) |
| 1   | Request for Certificate of Correction | MBOT-0051-P01_111215_Comm-Cert_of_Corr.pdf | 68534<br>ab9816bd50096e3cab2817a4740d1f528273ff6c  | no               | 1                |
| <b>Warnings:</b>  |                                       |  |  |                  |                  |
| <b>Information:</b>   |                                       |  |  |                  |                  |
| 2   | Request for Certificate of Correction | MBOT-0051-P01_111215_CertofCorr.pdf        | 164394<br>a0914ccda5123a8dad6c2208f8f59d3a5d9f0b44 | no               | 2                |
| <b>Warnings:</b>  |                                       |  |  |                  |                  |
| <b>Information:</b>   |                                       |  |  |                  |                  |
| 3   | Fee Worksheet (SB06)                  | fee-info.pdf                               | 30649<br>e27fc399f3d25e13f204583131e303c7c01f7086  | no               | 2                |
| <b>Warnings:</b>  |                                       |  |  |                  |                  |
| <b>Information:</b>   |                                       |  |  |                  |                  |
| <b>Total Files Size (in bytes):</b>   |                                       |  | 263577   |                  |                  |
| <p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/>         If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/>         If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/>         If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                                       |  |  |                  |                  |





## UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
[www.uspto.gov](http://www.uspto.gov)

| APPLICATION NO. | ISSUE DATE | PATENT NO. | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|------------|------------|---------------------|------------------|
| 14/065,516      | 10/27/2015 | 9168698    | MBOT-0051-P01       | 9906             |

43520 7590 10/07/2015  
STRATEGIC PATENTS P.C.  
P.O. BOX 920629  
NEEDHAM, MA 02492

### ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

#### **Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)** (application filed on or after May 29, 2000)

The Patent Term Adjustment is 101 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

**APPLICANT(s)** (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

MakerBot Industries, LLC, Brooklyn, NY;  
Aljosa Kemperle, Brooklyn, NY;  
Filipp Gelman, Staten Island, NY;  
Peter Joseph Schmehl, New York, NY;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit [SelectUSA.gov](http://SelectUSA.gov).

# **PART B - FEE(S) TRANSMITTAL**

Complete and send this form, together with applicable fee(s), to: **Mail Stop ISSUE FEE**  
**Commissioner for Patents**  
**P.O. Box 1450**  
**Alexandria, Virginia 22313-1450**  
 or **Fax (571)-273-2885**

**INSTRUCTIONS:** This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

43520 7590 07/22/2015  
**STRATEGIC PATENTS P.C.**  
**P.O. BOX 920629**  
**NEEDHAM, MA 02492**

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

## **Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

|                                     |                    |
|-------------------------------------|--------------------|
| Robert A. Mazzaresse                | (Depositor's name) |
| /Robert Mazzaresse, Reg.No. 42,852/ | (Signature)        |
| September 23, 2015                  | (Date)             |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 14/065,516      | 10/29/2013  | Aljosa Kemperle      | MBOT-0051-P01       | 9906             |

TITLE OF INVENTION: THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | UNDISCOUNTED  | \$960         | \$0                 | \$0                  | \$960            | 10/22/2015 |

| EXAMINER           | ART UNIT | CLASS-SUBCLASS |
|--------------------|----------|----------------|
| NGUYEN, THUKHANH T | 1743     | 264-075000     |

|   |   |
|---|---|
| 1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).<br><input type="checkbox"/> Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.<br><input type="checkbox"/> "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required. | 2. For printing on the patent front page, list<br>(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,<br>(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. |
|---|---|

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: **MakerBot Industries, LLC**

(B) RESIDENCE: (CITY and STATE OR COUNTRY): **Brooklyn, NY**

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

|   |  |
|---|--|
| 4a. The following fee(s) are submitted:<br><input checked="" type="checkbox"/> Issue Fee<br><input type="checkbox"/> Publication Fee (No small entity discount permitted)<br><input type="checkbox"/> Advance Order - # of Copies _____ | 4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)<br><input type="checkbox"/> A check is enclosed.<br><input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached.<br><input checked="" type="checkbox"/> The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number <b>50-4262</b> (enclose an extra copy of this form). |
|---|--|

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

**NOTE:** Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

**NOTE:** If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

**NOTE:** Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature: /Robert Mazzaresse/ Date: September 23, 2015  
 Typed or printed name: Robert A. Mazzaresse Registration No. 42,852

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Serial No.: 14/065,516  
Filing Date: October 29, 2013  
In re: KEMPERLE, Aljosa, *et al.*  
Art Unit: 1743  
Examiner: NGUYEN, Thukhanh T  
Conf. No.: 9906

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**ISSUE FEE COMMUNICATION**

Mail Stop Issue Fee  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Examiner:

For the above identified application, the applicant submits herewith the Issue Fee Transmittal Form (PTO-85B) and the application issue fee. The application issue fee is paid by EFS Web.

The applicant hereby authorizes the Patent Office to charge any deficiencies or credit any overpayments associated with this filing to Deposit Account No. 50-4262.

Please direct any inquiry regarding this matter to the below signed attorney.

Respectfully Submitted,

STRATEGIC PATENTS, P.C.

/Robert Mazzaresse/

Robert A. Mazzaresse  
Reg. No. 42,852  
(617) 916-2658  
Customer Number 43,520

September 23, 2015

| Electronic Patent Application Fee Transmittal      |                 |  |               |                             |
|--|-----------------|--|---------------|-----------------------------|
| <b>Application Number:</b>                         |                 | 14065516                                       |               |                             |
| <b>Filing Date:</b>                                |                 | 29-Oct-2013                                    |               |                             |
| <b>Title of Invention:</b>                         |                 | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |               |                             |
| <b>First Named Inventor/Applicant Name:</b>        |                 | Aljosa Kemperle                                |               |                             |
| <b>Filer:</b>                                      |                 | Robert A. Mazzaresse/Paula Ng                  |               |                             |
| <b>Attorney Docket Number:</b>                     |                 | MBOT-0051-P01                                  |               |                             |
| Filed as Large Entity                              |                 |  |               |                             |
| <b>Filing Fees for Utility under 35 USC 111(a)</b> |                 |  |               |                             |
| <b>Description</b>                                 | <b>Fee Code</b> | <b>Quantity</b>                                | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                               |                 |  |               |                             |
| <b>Pages:</b>                                      |                 |  |               |                             |
| <b>Claims:</b>                                     |                 |  |               |                             |
| <b>Miscellaneous-Filing:</b>                       |                 |  |               |                             |
| <b>Petition:</b>                                   |                 |  |               |                             |
| <b>Patent-Appeals-and-Interference:</b>            |                 |  |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>           |                 |  |               |                             |
| Utility Appl Issue Fee                             | 1501            | 1  | 960           | 960                         |

| Description        | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|--------------------|----------|----------|--------|----------------------|
| Extension-of-Time: |          |          |        |                      |
| Miscellaneous:     |          |          |        |                      |
| Total in USD (\$)  |          |          |        | 960                  |

| Electronic Acknowledgement Receipt          |  |
|---|--|
| <b>EFS ID:</b>                              | 23575799                                       |
| <b>Application Number:</b>                  | 14065516                                       |
| <b>International Application Number:</b>    |  |
| <b>Confirmation Number:</b>                 | 9906   |
| <b>Title of Invention:</b>                  | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |
| <b>First Named Inventor/Applicant Name:</b> | Aljosa Kemperle                                |
| <b>Customer Number:</b>                     | 43520  |
| <b>Filer:</b>                               | Robert A. Mazzaresse/Paula Ng                  |
| <b>Filer Authorized By:</b>                 | Robert A. Mazzaresse                           |
| <b>Attorney Docket Number:</b>              | MBOT-0051-P01                                  |
| <b>Receipt Date:</b>                        | 23-SEP-2015                                    |
| <b>Filing Date:</b>                         | 29-OCT-2013                                    |
| <b>Time Stamp:</b>                          | 10:30:16                                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                    |

### Payment information:

|  |             |
|--|-------------|
| Submitted with Payment   | yes         |
| Payment Type   | Credit Card |
| Payment was successfully received in RAM   | \$ 960      |
| RAM confirmation Number  | 8027        |
| Deposit Account  | 504262      |
| Authorized User  | NG, PAULA   |
| <p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)</p> <p>Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)</p> |             |

| <b>File Listing:</b>  |                             |  |   |                  |                  |
|---|-----------------------------|--|---|------------------|------------------|
| Document Number   | Document Description        | File Name  | File Size(Bytes)/<br>Message Digest                 | Multi Part /.zip | Pages (if appl.) |
| 1   | Issue Fee Payment (PTO-85B) | MBOT-0051-P01_092315_IssueFeeTransmittal-PTO.pdf | 1501024<br>29ca095a5d9804b22acbd7710835218df0b094bf | no               | 1                |
| <b>Warnings:</b>  |                             |  |   |                  |                  |
| <b>Information:</b>   |                             |  |   |                  |                  |
| 2   | Transmittal Letter          | MBOT-0051-P01_092315_IssueFeeComm.pdf            | 67259<br>c3729d15eb4eb59f3b44a006ddf1627dac42611e   | no               | 1                |
| <b>Warnings:</b>  |                             |  |   |                  |                  |
| <b>Information:</b>   |                             |  |   |                  |                  |
| 3   | Fee Worksheet (SB06)        | fee-info.pdf                                     | 30729<br>6c78917015052ca2182958ebc14adddb196767795  | no               | 2                |
| <b>Warnings:</b>  |                             |  |   |                  |                  |
| <b>Information:</b>   |                             |  |   |                  |                  |
| <b>Total Files Size (in bytes):</b>   |                             |  | 1599012   |                  |                  |
| <p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                             |  |   |                  |                  |



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
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## NOTICE OF ALLOWANCE AND FEE(S) DUE

43520 7590 07/22/2015  
STRATEGIC PATENTS P.C.  
P.O. BOX 920629  
NEEDHAM, MA 02492

EXAMINER

NGUYEN, THUKHANH T

ART UNIT

PAPER NUMBER

1743

DATE MAILED: 07/22/2015

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 14/065,516      | 10/29/2013  | Aljosa Kemperle      | MBOT-0051-P01       | 9906             |

TITLE OF INVENTION: THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | UNDISCOUNTED  | \$960         | \$0                 | \$0                  | \$960            | 10/22/2015 |

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

### HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.**



# **PART B - FEE(S) TRANSMITTAL**

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
or Fax (571)-273-2885**

**INSTRUCTIONS:** This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

43520 7590 07/22/2015  
STRATEGIC PATENTS P.C.  
P.O. BOX 920629  
NEEDHAM, MA 02492

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

## **Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

|                    |
|--------------------|
| (Depositor's name) |
| (Signature)        |
| (Date)             |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 14/065,516      | 10/29/2013  | Aljosa Kemperle      | MBOT-0051-P01       | 9906             |

TITLE OF INVENTION: THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | UNDISCOUNTED  | \$960         | \$0                 | \$0                  | \$960            | 10/22/2015 |

| EXAMINER           | ART UNIT | CLASS-SUBCLASS |
|--------------------|----------|----------------|
| NGUYEN, THUKHANH T | 1743     | 264-075000     |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 \_\_\_\_\_
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 \_\_\_\_\_
- 3 \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies \_\_\_\_\_

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number \_\_\_\_\_ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

**NOTE:** Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

**NOTE:** If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

**NOTE:** Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

**NOTE:** This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature \_\_\_\_\_ Date \_\_\_\_\_

Typed or printed name \_\_\_\_\_ Registration No. \_\_\_\_\_



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P.O. Box 1450  
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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 14/065,516      | 10/29/2013  | Aljosa Kemperle      | MBOT-0051-P01       | 9906             |

|                        |      |            |
|------------------------|------|------------|
| 43520                  | 7590 | 07/22/2015 |
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| P.O. BOX 920629        |      |            |
| NEEDHAM, MA 02492      |      |            |

|                    |  |
|--------------------|--|
| EXAMINER           |  |
| NGUYEN, THUKHANH T |  |

|          |              |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
| 1743     |              |

DATE MAILED: 07/22/2015

## **Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)** (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

## OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

### Privacy Act Statement

**The Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

|                               |  |  |   |
|-------------------------------|--|--|---|
| <b>Notice of Allowability</b> | <b>Application No.</b><br>14/065,516   | <b>Applicant(s)</b><br>KEMPERLE ET AL. |   |
|                               | <b>Examiner</b><br>THU KHANH T. NGUYEN | <b>Art Unit</b><br>1743                | <b>AIA (First Inventor to File) Status</b><br>Yes |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to amendment filed 7/9/2015.  
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_\_.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_\_; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 14-28. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a) ☐ All    b) ☐ Some    \*c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.  
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.

**Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

|  |  |
|--|--|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892)   | 5. <input type="checkbox"/> Examiner's Amendment/Comment                             |
| 2. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08),<br>Paper No./Mail Date _____    | 6. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| 3. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br>of Biological Material | 7. <input type="checkbox"/> Other _____.   |
| 4. <input type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date _____.                     |  |

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

*Allowable Subject Matter*

1. Claims 14-28 are allowed over the prior art of record.
2. The following is an examiner's statement of reasons for allowance:  
  
The prior art fails to teach or suggest an method comprising:
  - a. identifying build instructions for fabricating an object;
  - b. initiating a build using a three-dimensional printer comprising a fabrication tool and one or more sensors mechanically coupled to the fabrication tool, the one or more sensors configured to detect a current contact force between the fabrication tool and a separate structure;
  - c. detecting the current contact force based on a sensor signal from the one or more sensors; and
  - d. creating a control signal to control at least one component of the three-dimensional printer in response to the current contact force while depositing material during the build.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."


Any inquiry concerning this communication or earlier communications from the examiner should be directed to THU KHANH T. NGUYEN whose telephone number is (571)272-1136. The examiner can normally be reached on Monday-Friday, 7:30-3:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Del Sole can be reached on 571-272-1130. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Thu Khanh T. Nguyen/  
Patent Examiner, 1743

/JOSEPH S. DEL SOLE/  
Supervisory Patent Examiner, Art Unit 1743

|  |  |   |
|--|--|---|
| <b>Search Notes</b><br><br> | <b>Application/Control No.</b><br><br>14065516 | <b>Applicant(s)/Patent Under Reexamination</b><br><br>KEMPERLE ET AL. |
|  | <b>Examiner</b><br><br>THUKHANH T NGUYEN       | <b>Art Unit</b><br><br>1743   |

| CPC- SEARCHED                  |           |          |
|--------------------------------|-----------|----------|
| Symbol                         | Date      | Examiner |
| B 29C 67/0055; B 29K 2995/0073 | 7/16/2015 | TN       |

| CPC COMBINATION SETS - SEARCHED |      |          |
|---------------------------------|------|----------|
| Symbol                          | Date | Examiner |
|                                 |      |          |

| US CLASSIFICATION SEARCHED |                                     |           |          |
|----------------------------|-------------------------------------|-----------|----------|
| Class                      | Subclass                            | Date      | Examiner |
| 264                        | 129,176.1,40.1,40.7,308,113,401,497 | 7/16/2015 | TN       |
| 425                        | 145,150,375,112,113,174.4,185,186   | 7/16/2015 | TN       |
| 700                        | 118,119,120                         | 7/16/2015 | TN       |
| 226                        | 8,24,26,42,43,45                    | 7/16/2015 | TN       |

| SEARCH NOTES    |           |          |
|-----------------|-----------|----------|
| Search Notes    | Date      | Examiner |
| Inventor search | 7/16/2015 | TN       |

| INTERFERENCE SEARCH     |                                     |           |          |
|-------------------------|-------------------------------------|-----------|----------|
| US Class/<br>CPC Symbol | US Subclass / CPC Group             | Date      | Examiner |
| 264                     | 129,176.1,40.1,40.7,308,113,401,497 | 7/16/2015 | TN       |
| 425                     | 145,150,375,112,113,174.4,185,186   | 7/16/2015 | TN       |
| 700                     | 118,119,120                         | 7/16/2015 | TN       |
| 226                     | 8,24,26,42,43,45                    | 7/16/2015 | TN       |

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## BIB DATA SHEET

CONFIRMATION NO. 9906

| SERIAL NUMBER   | FILING or 371(c)<br>DATE  | CLASS  | GROUP ART UNIT                    | ATTORNEY DOCKET<br>NO.  |                               |                                    |
|---|---|--|-----------------------------------|---|-------------------------------|------------------------------------|
| 14/065,516  | 10/29/2013  | 264  | 1743                              | MBOT-0051-P01   |                               |                                    |
| <b>APPLICANTS</b><br>MakerBot Industries, LLC, Brooklyn, NY;<br><b>INVENTORS</b><br>Aljosa Kemperle, Brooklyn, NY;<br>Filipp Gelman, Staten Island, NY;<br>Peter Joseph Schmehl, New York, NY;<br><b>** CONTINUING DATA *****</b><br>This appln claims benefit of 61/719,874 10/29/2012<br><b>** FOREIGN APPLICATIONS *****</b><br><b>** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **</b><br>11/13/2013 |   |  |                                   |   |                               |                                    |
| Foreign Priority claimed <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>35 USC 119(a-d) conditions met <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Verified and /THUKHANH T<br>NGUYEN/<br>Acknowledged Examiner's Signature  |   | <input type="checkbox"/> Met after Allowance<br>Initials | <b>STATE OR<br/>COUNTRY</b><br>NY | <b>SHEETS<br/>DRAWINGS</b><br>5   | <b>TOTAL<br/>CLAIMS</b><br>25 | <b>INDEPENDENT<br/>CLAIMS</b><br>2 |
| <b>ADDRESS</b><br>STRATEGIC PATENTS P.C.<br>P.O. BOX 920629<br>NEEDHAM, MA 02492<br>UNITED STATES   |   |  |                                   |   |                               |                                    |
| <b>TITLE</b><br>THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION  |   |  |                                   |   |                               |                                    |
| <b>FILING FEE<br/>RECEIVED</b><br>2140  | FEES: Authority has been given in Paper<br>No. _____ to charge/credit DEPOSIT ACCOUNT<br>No. _____ for following: |  |                                   | <input type="checkbox"/> All Fees<br><input type="checkbox"/> 1.16 Fees (Filing)<br><input type="checkbox"/> 1.17 Fees (Processing Ext. of time)<br><input type="checkbox"/> 1.18 Fees (Issue)<br><input type="checkbox"/> Other _____<br><input type="checkbox"/> Credit |                               |                                    |




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| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>14065516 | <b>Applicant(s)/Patent Under Reexamination</b><br>KEMPERLE ET AL. |  |
|  | <b>Examiner</b><br>THUKHANH T NGUYEN       | <b>Art Unit</b><br>1743   |  |

| CPC    |  |      |  |       |      |            |
|--------|--|------|--|-------|------|------------|
| Symbol |  |      |  |       | Type | Version    |
| B29C   |  | 67   |  | 0055  | F    | 2013-01-01 |
| B29C   |  | 47   |  | 92    | I    | 2013-01-01 |
| B29C   |  | 67   |  | 0051  | I    | 2013-01-01 |
| B29C   |  | 67   |  | 0088  | I    | 2013-01-01 |
| B29C   |  | 47   |  | 0822  | I    | 2013-01-01 |
| B29C   |  | 47   |  | 0002  | A    | 2013-01-01 |
| B29C   |  | 47   |  | 025   | I    | 2013-01-01 |
| B29C   |  | 47   |  | 0864  | A    | 2013-01-01 |
| B29C   |  | 47   |  | 0866  | A    | 2013-01-01 |
| B29C   |  | 2947 |  | 9258  | A    | 2013-01-01 |
| B29C   |  | 2947 |  | 92704 | A    | 2013-01-01 |
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| CPC Combination Sets |  |      |     |         |         |
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| /THUKHANH T NGUYEN/<br>Examiner.Art Unit 1743                    | 7/15/2015<br>(Date)  | <b>Total Claims Allowed:</b><br>15 |                        |
| /JOSEPH S DEL SOLE/<br>Supervisory Patent Examiner.Art Unit 1743 | 07/16/2015<br>(Date) | O.G. Print Claim(s)<br>1           | O.G. Print Figure<br>1 |

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|--|--|---|
| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>14065516 | <b>Applicant(s)/Patent Under Reexamination</b><br>KEMPERLE ET AL. |
|  | <b>Examiner</b><br>THUKHANH T NGUYEN       | <b>Art Unit</b><br>1743   |

| US ORIGINAL CLASSIFICATION |                                   |     |          |     |     | INTERNATIONAL CLASSIFICATION |   |   |   |                  |             |  |  |  |  |  |  |  |  |
|----------------------------|-----------------------------------|-----|----------|-----|-----|------------------------------|---|---|---|------------------|-------------|--|--|--|--|--|--|--|--|
| CLASS                      |                                   |     | SUBCLASS |     |     | CLAIMED                      |   |   |   |                  | NON-CLAIMED |  |  |  |  |  |  |  |  |
| 264                        |                                   |     | 75       |     |     | B                            | 2 | 9 | C | 41 / 22 (2006.0) |             |  |  |  |  |  |  |  |  |
| CROSS REFERENCE(S)         |                                   |     |          |     |     | B                            | 2 | 9 | C | 41 / 52 (2006.0) |             |  |  |  |  |  |  |  |  |
|                            |                                   |     |          |     |     |                              |   |   |   |                  |             |  |  |  |  |  |  |  |  |
| CLASS                      | SUBCLASS (ONE SUBCLASS PER BLOCK) |     |          |     |     |                              |   |   |   |                  |             |  |  |  |  |  |  |  |  |
| 264                        | 245                               | 255 | 308      |     |     |                              |   |   |   |                  |             |  |  |  |  |  |  |  |  |
| 425                        | 132                               | 145 | 146      | 162 | 375 |                              |   |   |   |                  |             |  |  |  |  |  |  |  |  |
| 700                        | 119                               |     |          |     |     |                              |   |   |   |                  |             |  |  |  |  |  |  |  |  |
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| /THUKHANH T NGUYEN/<br>Examiner.Art Unit 1743<br><br>(Assistant Examiner)                  | 7/15/2015<br><br>(Date)  | <b>Total Claims Allowed:</b><br><br>15 |                            |
| /JOSEPH S DEL SOLE/<br>Supervisory Patent Examiner.Art Unit 1743<br><br>(Primary Examiner) | 07/16/2015<br><br>(Date) | O.G. Print Claim(s)<br><br>1           | O.G. Print Figure<br><br>1 |

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| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>14065516 | <b>Applicant(s)/Patent Under Reexamination</b><br>KEMPERLE ET AL. |
|  | <b>Examiner</b><br>THUKHANH T NGUYEN       | <b>Art Unit</b><br>1743   |

| <input checked="" type="checkbox"/> <b>Claims renumbered in the same order as presented by applicant</b> <input type="checkbox"/> <b>CPA</b> <input type="checkbox"/> <b>T.D.</b> <input type="checkbox"/> <b>R.1.47</b> |          |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|--|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|
| Final  | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original |
| 1  | 14       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 2  | 15       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 3  | 16       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 4  | 17       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 5  | 18       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 6  | 19       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 7  | 20       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 8  | 21       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 9  | 22       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 10   | 23       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 11   | 24       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 12   | 25       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 13   | 26       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 14   | 27       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 15   | 28       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
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| /THUKHANH T NGUYEN/<br>Examiner.Art Unit 1743<br><br>(Assistant Examiner)                  | 7/15/2015<br><br>(Date)  | <b>Total Claims Allowed:</b><br><br>15 |                            |
| /JOSEPH S DEL SOLE/<br>Supervisory Patent Examiner.Art Unit 1743<br><br>(Primary Examiner) | 07/16/2015<br><br>(Date) | O.G. Print Claim(s)<br><br>1           | O.G. Print Figure<br><br>1 |

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Serial No.: 14/065,516  
Filing Date: 29 OCT 2013  
In re: KEMPERLE, A.  
Art Unit: 1743  
Examiner: NGUYEN, T.  
Conf. No.: 9906

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Commissioner for Patents  
PO Box 1450  
Alexandria, Virginia 22313-1450

**AMENDMENT AND REMARKS**

Dear Examiner:

Please enter and consider the following Amendment and Remarks, which are responsive to the non-final Office Action mailed on April 9, 2015

**Amendments to the Claims** begin on page 2 of this paper.

**Remarks** begin on page 5 of this paper.

**Amendments to the Claims**

Please amend the claims according to the following claim listing, which replaces all prior versions and listings of the claims in this application:

1-13. (Canceled)

14. (Currently amended) A method comprising:

identifying build instructions for fabricating an object;

initiating a build using a three-dimensional printer comprising a fabrication tool and one or more sensors mechanically coupled to the fabrication tool, the one or more sensors configured to detect a current contact force between the fabrication tool and a separate structure;

detecting the current contact force based on a sensor signal from the one or more sensors; and

~~responsively~~ creating a control signal to control at least one component of the three-dimensional printer in response to the current contact force while depositing material during the build.

15. (Original) The method of claim 14, wherein the fabrication tool includes an extruder.

16. (Original) The method of claim 15, wherein the at least one component of the three-dimensional printer controls a feed rate for a build material used in the build.

17. (Original) The method of claim 15, wherein the at least one component of the three-dimensional printer controls a z-distance between the extruder and a build platform of the three-dimensional printer.

18. (Original) The method of claim 15 further comprising comparing the current contact force to an expected contact force.

19. (Original) The method of claim 18 further comprising adjusting at least one parameter of the three-dimensional printer to reduce a difference between the current contact force and the expected contact force.
20. (Original) The method of claim 18 further comprising terminating the build when a difference between the current contact force and the expected contact force indicates a fabrication error.
21. (Original) The method of claim 14 wherein the control signal includes a signal to the three-dimensional printer to change a distance between the fabrication tool and the separate structure.
22. (Original) The method of claim 15 wherein the control signal includes a signal to the three-dimensional printer to change a feed rate of build material extruded by the extruder.
23. (Original) The method of claim 15 further comprising detecting a planarity of the separate structure based upon a number of contact force measurements across a surface of the separate structure.
24. (Original) The method of claim 23 further comprising fabricating a layer on the surface of the separate structure that decreases one or more irregularities in the surface of the separate structure.
25. (Original) The method of claim 14, wherein the build instructions include at least one instruction for achieving a specified contact force between the fabrication tool and a separate structure, and wherein the control signal controls the at least one component of the three-dimensional printer to achieve the specified contact force.
26. (New) The method of claim 14 wherein the one or more sensors include a strain gauge.

27. (New) The method of claim 14 wherein the one or more sensors include a piezoelectric sensor.

28. (New) The method of claim 14 wherein the one or more sensors include at least one of a capacitive sensor, and optical sensor, an electromechanical sensor, an electromagnetic sensor, and an acoustical sensor.

**Remarks**

***Status of the Claims***

Claims 1-13 were previously withdrawn and are now canceled. Claim 14 is amended. New claims 26-28 are added. Claims 14-28 are presented for examination, with claim 14 being independent.

***Election/Restriction***

The applicant elects Invention II (claims 14-25) without traverse. The remaining claims have been canceled.

***Claim Rejections – 35 U.S.C. § 103***

Claim 1 stands rejected under 35 U.S.C. § 103(a) as obvious over U.S. Pat. No. 6,129,872 to Jang (“*Jang*”) in view of U.S. Pat. No. 7,625,198 to Lipson, et al. (“*Lipson*”).

The applicant has devised techniques for integrating a force sensor into a print head for a three-dimensional printer. This provides a variety of useful feedback control techniques

*Jang* is cited for its general teaching of three-dimensional printing, and the outstanding rejection properly concedes that *Jang* “fails to disclose the step of detecting contact force between the fabrication tool and a separate structure.”<sup>1</sup> Instead, *Lipson* is cited as teaching this feature. According to the outstanding rejection, this feature is more specifically disclosed at col. 22, ll. 31-51; however, this passage provides in its entirety:

The optical emitter/detector pairs (200A-B and 202A-B, respectively) function by detectors 202A-B returning a signal level which is higher when less infrared light is received from emitters 200A-B. Thus, when an object obstructs the optical axis of an emitter/detector pair, the signal will be larger than when no object is present, and the signal varies symmetrically as an object moves perpendicularly across the optical axis. This sensing arrangement easily detects small deposition tips, such as a syringe needle 68 with an outside diameter of 0.007”. The system control software monitors the analog output signals from the optical sensors, while commanding the positioning system to perform a search pattern. When tool tip 68 has been positioned at the center of both optical axes,

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<sup>1</sup> Office Action dated April 9, 2015, p. 5.



providing the X and Y coordinates of the tool tip, the Z-axis is elevated gradually, raising the sensor assembly toward tool tip 68 until a signal is detected by force sensor 204. Force sensor 204 is designed to detect very small changes in applied force with very little displacement, so detecting contact with the sensor requires very little force be applied to tool tip 68. When a threshold force is detected, the Z coordinate of tool tip 68 is identified.<sup>2</sup>

While this passage does mention a force sensor (204), there is no suggestion here to use a signal from the force sensor as feedback *during a build*. In the device of *Lipson*, the force sensor is simply used to detect a threshold force indicating a Z axis position of a newly loaded tool tip. This may be useful, but it is significantly different than the presently claimed use of a force sensor, which provides feedback to control print parameters during a build, i.e., while material is being extruded to fabricate an object. The claims have been amended to clarify this inventive concept, and to emphasize the step of creating a control signal to control at least one component of the three-dimensional printer in response to the current contact force while depositing material during the build.

None of the cited art teaches or suggests a control system for three-dimensional printing based on feedback from a contact force sensor, and none of the art of record can render the invention of claim 14 obvious, either alone or in combination. The remaining claims depend from claim 1 and are likewise believed to be in condition for allowance. The applicant respectfully requests reconsideration and withdrawal of the outstanding claim rejections under 35 U.S.C. § 103.

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<sup>2</sup> *Lipson*, col. 22, ll. 31-51.

***Conclusion***

In view of the foregoing, the applicant believes that the currently pending claims are in condition for allowance and respectfully requests a corresponding Notice of Allowance.

The applicant believes that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed.

Nothing in this paper should be construed as intent to concede any issue with regard to any claim, except as specifically stated in this paper. The amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

The Director is hereby authorized to charge any fees or to credit any overpayments associated with this filing to Deposit Account No. 50-4262. If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at (617) 916-2658.

Respectfully submitted  
STRATEGIC PATENTS, P.C.

/Robert Mazzaresse/  
Robert A. Mazzaresse  
Reg. No. 42,852  
Tel.: (617)-916-2658

July 9, 2015

| Electronic Acknowledgement Receipt          |  |
|---|--|
| <b>EFS ID:</b>                              | 22872590                                       |
| <b>Application Number:</b>                  | 14065516                                       |
| <b>International Application Number:</b>    |  |
| <b>Confirmation Number:</b>                 | 9906   |
| <b>Title of Invention:</b>                  | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |
| <b>First Named Inventor/Applicant Name:</b> | Aljosa Kemperle                                |
| <b>Customer Number:</b>                     | 43520  |
| <b>Filer:</b>                               | Robert A. Mazzaresse/Paula Ng                  |
| <b>Filer Authorized By:</b>                 | Robert A. Mazzaresse                           |
| <b>Attorney Docket Number:</b>              | MBOT-0051-P01                                  |
| <b>Receipt Date:</b>                        | 09-JUL-2015                                    |
| <b>Filing Date:</b>                         | 29-OCT-2013                                    |
| <b>Time Stamp:</b>                          | 15:47:59                                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                    |

### Payment information:

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| Submitted with Payment | no |
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### File Listing:

| Document Number | Document Description | File Name                           | File Size(Bytes)/<br>Message Digest                | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|-------------------------------------|--|------------------|------------------|
| 1               |                      | MBOT-0051-P01_070915_OAResponse.pdf | 132771<br>c41198bd4f0038d749ff3af0049c9e173950932d | yes              | 7                |

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|--|---|--------|-----|
|  | Multipart Description/PDF files in .zip description   |        |     |
|  | Document Description                                  | Start  | End |
|  | Amendment/Req. Reconsideration-After Non-Final Reject | 1      | 1   |
|  | Claims  | 2      | 4   |
|  | Applicant Arguments/Remarks Made in an Amendment      | 5      | 7   |
| Warnings:  |   |        |     |
| Information:   |   |        |     |
| Total Files Size (in bytes):   |   | 132771 |     |
| <p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |   |        |     |

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|  |  |   |                                  |   |       |                                    |               |                                       |  |          |
|--|--|---|----------------------------------|---|-------|------------------------------------|---------------|---------------------------------------|--|----------|
| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875  |  |   |                                  | Application or Docket Number<br><b>14/065,516</b> |       | Filing Date<br><b>10/29/2013</b>   |               | <input type="checkbox"/> To be Mailed |  |          |
| ENTITY: <input checked="" type="checkbox"/> LARGE <input type="checkbox"/> SMALL <input type="checkbox"/> MICRO  |  |   |                                  |   |       |                                    |               |                                       |  |          |
| <b>APPLICATION AS FILED – PART I</b>   |  |   |                                  |   |       |                                    |               |                                       |  |          |
|  |  | (Column 1)  |                                  | (Column 2)  |       |                                    |               |                                       |  |          |
| FOR  |  | NUMBER FILED  |                                  | NUMBER EXTRA                                      |       | RATE (\$)                          |               | FEE (\$)                              |  |          |
| <input type="checkbox"/> BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))  |  | N/A   |                                  | N/A   |       | N/A                                |               |                                       |  |          |
| <input type="checkbox"/> SEARCH FEE<br>(37 CFR 1.16(k), (i), or (m))   |  | N/A   |                                  | N/A   |       | N/A                                |               |                                       |  |          |
| <input type="checkbox"/> EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))  |  | N/A   |                                  | N/A   |       | N/A                                |               |                                       |  |          |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))   |  | minus 20 =  |                                  | *   |       | X \$ =                             |               |                                       |  |          |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))   |  | minus 3 =   |                                  | *   |       | X \$ =                             |               |                                       |  |          |
| <input type="checkbox"/> APPLICATION SIZE FEE<br>(37 CFR 1.16(s))  |  | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                  |   |       |                                    |               |                                       |  |          |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))   |  |   |                                  |   |       |                                    |               |                                       |  |          |
| * If the difference in column 1 is less than zero, enter "0" in column 2.  |  |   |                                  |   |       | TOTAL                              |               |                                       |  |          |
| <b>APPLICATION AS AMENDED – PART II</b>  |  |   |                                  |   |       |                                    |               |                                       |  |          |
|  |  | (Column 1)  |                                  | (Column 2)  |       | (Column 3)                         |               |                                       |  |          |
| AMENDMENT  | <b>07/09/2015</b>  |   | CLAIMS REMAINING AFTER AMENDMENT |   |       | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |                                       |  |          |
|  | Total (37 CFR 1.16(i))   |   | * 15                             |   | Minus | ** 25                              | = 0           |                                       |  |          |
|  | Independent (37 CFR 1.16(h))   |   | * 1                              |   | Minus | *** 3                              | = 0           |                                       |  |          |
|  | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |   |                                  |   |       |                                    |               |                                       |  |          |
|  | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |   |                                  |   |       |                                    |               |                                       |  |          |
|  |  |   |                                  |   |       |                                    |               |                                       |  |          |
|  |  |   |                                  |   |       |                                    |               | TOTAL ADD'L FEE                       |  | <b>0</b> |
|  |  | (Column 1)  |                                  | (Column 2)  |       | (Column 3)                         |               |                                       |  |          |
| AMENDMENT  |  |   | CLAIMS REMAINING AFTER AMENDMENT |   |       | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |                                       |  |          |
|  | Total (37 CFR 1.16(i))   |   | *                                |   | Minus | **                                 | =             |                                       |  |          |
|  | Independent (37 CFR 1.16(h))   |   | *                                |   | Minus | ***                                | =             |                                       |  |          |
|  | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |   |                                  |   |       |                                    |               |                                       |  |          |
|  | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |   |                                  |   |       |                                    |               |                                       |  |          |
|  |  |   |                                  |   |       |                                    |               |                                       |  |          |
|  |  |   |                                  |   |       |                                    |               | TOTAL ADD'L FEE                       |  |          |
| <p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p> |  |   |                                  |   |       |                                    |               |                                       |  |          |

LIE  
/MARSHA RICHARDS/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



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| APPLICATION NO.   | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.             | CONFIRMATION NO.            |
|---|-------------|----------------------|---------------------------------|-----------------------------|
| 14/065,516  | 10/29/2013  | Aljosa Kemperle      | MBOT-0051-P01                   | 9906                        |
| 43520 7590 04/09/2015<br>STRATEGIC PATENTS P.C.<br>P.O. BOX 920629<br>NEEDHAM, MA 02492 |             |                      | EXAMINER<br>NGUYEN, THUKHANH T  |                             |
|   |             |                      | ART UNIT<br>1743                | PAPER NUMBER                |
|   |             |                      | NOTIFICATION DATE<br>04/09/2015 | DELIVERY MODE<br>ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patents@stratpat.com

|                              |  |  |   |
|------------------------------|--|--|---|
| <b>Office Action Summary</b> | <b>Application No.</b><br>14/065,516   | <b>Applicant(s)</b><br>KEMPERLE ET AL. |   |
|                              | <b>Examiner</b><br>THU KHANH T. NGUYEN | <b>Art Unit</b><br>1743                | <b>AIA (First Inventor to File) Status</b><br>Yes |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 11/25/2014.  
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims\***

- 5) ☒ Claim(s) 1-25 is/are pending in the application.  
5a) Of the above claim(s) 1-13 is/are withdrawn from consideration.
- 6) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 7) ☒ Claim(s) 14-25 is/are rejected.
- 8) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 9) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

\* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).

**Application Papers**

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

- a) ☐ All    b) ☐ Some\*\* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\*\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)  
Paper No(s)/Mail Date 11/25/14; 5/30/14; 1/15/14
- 3) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_.
- 4) ☐ Other: \_\_\_\_.

- 1) The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

### **DETAILED ACTION**

#### ***Election/Restrictions***

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
  - I. Claims 1-13, drawn to a 3-D printer, classified in 425/135.
  - II. Claims 14-25, drawn to a method for forming a 3-D object, classified in 264/40.7.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another and materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus as claimed can be used to practice another and materially different process such as regular extrusion of a plastic material.
3. Restriction for examination purposes as indicated is proper because all these inventions listed in this action are independent or distinct for the reasons given above and there would be a serious search and/or examination burden if restriction were not required because one or more of the following reasons apply:

The claims are classified in different class/subclass and/or require different text and broadened classification searches and/or or require different patentability issue.



**Applicant is advised that the reply to this requirement to be complete must include (i) an election of an invention to be examined even though the requirement may be traversed (37 CFR 1.143) and (ii) identification of the claims encompassing the elected invention.**

The election of an invention may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable upon the elected invention.

Should applicant traverse on the ground that the inventions are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103 or pre-AIA 35 U.S.C. 103(a) of the other invention.

4. During a telephone conversation with Mr. Thomas Bassolino on March 26, 2015 a provisional election was made without traverse to prosecute the invention of group II, claims 14-25. Affirmation of this election must be made by applicant in replying to this Office action. Claims 1-13 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be corrected in compliance with 37 CFR 1.48(a) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. A request to correct inventorship under 37 CFR 1.48(a) must be accompanied by an application data sheet in accordance with 37 CFR 1.76 that identifies each inventor by his or her legal name and by the processing fee required under 37 CFR 1.17(i).

***Claim Rejections - 35 USC § 103***

6. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

7. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102 of this title, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 14-25 are rejected under 35 U.S.C. 103 as being unpatentable over Jang (6,129,872) in view of Lipson et al. (7,625,198).

Jang (US 6129872) teaches a method for forming a three-dimensional object comprising:

- Providing an extruder having a chamber 40 (interior chamber) and a filament feeding channel 59 that receives a body building material 20 in filament form (build

material) for extrusion (column 7, lines 36-67, figure 1, figure 2, figure 3), a dispensing nozzle 24 (nozzle) that extrudes the body building material 20 (build material) (column 7, lines 35-67), and a drive motor (motor) that drives the filament form (build material) through the chamber 40 (interior chamber) and out the nozzle 24 (nozzle) (column 7, lines 64-67, figure 1, figure 2, figure 3);

- providing an object-supporting platform 26 (build platform) (column 8, lines 22-26) that receives an object formed of the body building material 20 (build material) extruded from the nozzle 24 (nozzle) (column 10, lines 15-26);
- providing a motion devices (positioning assembly) that positions the supporting platform 26 (build platform) relative to the extruder (column 8, lines 22-32);
- providing a machine controller 150 (controller) coupled in a communicating relationship with the extruder and the motion devices (positioning assembly) (column 9, lines 64-67 - column 10, lines 1-5), wherein

the machine controller 150 (controller) is programmed (column 10, lines 1-15).

Jang further discloses that the drive motor can be controlled to regulate the advancing rate of the filament 20 in the feeding channel 59 so that the volumetric dispensing rate of the fluid can be closely controlled (column 7, lines 64-67, column 11, lines 3-9).

However, Jang fails to disclose the step of detecting contact force between the fabrication tool and a separate structure.

Lipson et al. discloses a method for fabricating a 3-D article, comprising the step of providing a force sensor (204) to detect very small change in applied force with very little

displacement, so that the actual position of the injecting tip (68) can be identified for better maneuver and control of the tip onto the subject (col. 22, lines 31-51).

It would have been obvious to one of ordinary skill in the art at the time the applicant's invention was made to modify Jang by providing a force sensor at the injecting tip of the nozzle as taught by Lipson et al so that actual position of the tip can be identified for better position control of the forming nozzle and the formation of the 3-D object.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to THU KHANH T. NGUYEN whose telephone number is (571)272-1136. The examiner can normally be reached on Monday-Friday, 7:30-3:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Del Sole can be reached on 571-272-1130. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Application/Control Number: 14/065,516  
Art Unit: 1743

Page 7

/Thu Khanh T. Nguyen/  
Patent Examiner, 1743

/JOSEPH S. DEL SOLE/  
Supervisory Patent Examiner, Art Unit 1743

|                                   |                                       |   |             |
|-----------------------------------|---------------------------------------|---|-------------|
| <b>Notice of References Cited</b> | Application/Control No.<br>14/065,516 | Applicant(s)/Patent Under<br>Reexamination<br>KEMPERLE ET AL. |             |
|                                   | Examiner<br>THU KHANH T. NGUYEN       | Art Unit<br>1743  | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * |   | Document Number<br>Country Code-Number-Kind Code | Date<br>MM-YYYY | Name          | Classification |
|---|---|--|-----------------|---------------|----------------|
| * | A | US-7,625,198                                     | 12-2009         | Lipson et al. | 425/174        |
| * | B | US-6,129,872                                     | 10-2000         | Jang, Justin  | 264/75         |
|   | C | US-  |                 |               |                |
|   | D | US-  |                 |               |                |
|   | E | US-  |                 |               |                |
|   | F | US-  |                 |               |                |
|   | G | US-  |                 |               |                |
|   | H | US-  |                 |               |                |
|   | I | US-  |                 |               |                |
|   | J | US-  |                 |               |                |
|   | K | US-  |                 |               |                |
|   | L | US-  |                 |               |                |
|   | M | US-  |                 |               |                |

**FOREIGN PATENT DOCUMENTS**

| * |   | Document Number<br>Country Code-Number-Kind Code | Date<br>MM-YYYY | Country | Name | Classification |
|---|---|--|-----------------|---------|------|----------------|
|   | N |  |                 |         |      |                |
|   | O |  |                 |         |      |                |
|   | P |  |                 |         |      |                |
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|   | R |  |                 |         |      |                |
|   | S |  |                 |         |      |                |
|   | T |  |                 |         |      |                |

**NON-PATENT DOCUMENTS**

| * |   | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|---|
|   | U |   |
|   | V |   |
|   | W |   |
|   | X |   |

\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Receipt date: 01/15/2014

14065516 - GAU: 1743

Doc code: IDS  
 Doc description: Information Disclosure Statement (IDS) Field

SUBSTITUTE PTO/SB/08 (01-10)  
 SPPC v1.5 011712

|   |                             |                 |
|---|-----------------------------|-----------------|
| <b>INFORMATION DISCLOSURE<br/>         STATEMENT BY APPLICANT</b><br>(Not for submission under 37 CFR 1.99) | <b>Application Number</b>   | 14/065,516      |
|   | <b>Filing Date</b>          | Oct 29, 2013    |
|   | <b>First Named Inventor</b> | Aljosa Kemperle |
|   | <b>Art Unit</b>             | 1742            |
|   | <b>Examiner Name</b>        | Unknown         |
| Sheet 1 of 2  | <b>Attorney Docket No.</b>  | MBOT-0051-P01   |

| U.S. PATENTS      |         |               |                        |              |   |   |
|-------------------|---------|---------------|------------------------|--------------|---|---|
| Examiner Initial* | Cite No | Patent Number | Kind Code <sup>1</sup> | Issue Date   | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|                   |         | US-6629011    |                        | Sep 30, 2003 | Calderon, Joseph L., et al.                     |   |

| U.S. PATENT APPLICATION PUBLICATIONS |         |                    |                        |                  |   |   |
|--------------------------------------|---------|--------------------|------------------------|------------------|---|---|
| Examiner Initial*                    | Cite No | Publication Number | Kind Code <sup>1</sup> | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |

| FOREIGN PATENT DOCUMENTS |         |                                      |                        |                        |                  |   |  |
|--------------------------|---------|--------------------------------------|------------------------|------------------------|------------------|---|--|
| Examiner Initial*        | Cite No | Foreign Document Number <sup>3</sup> | Cnty Code <sup>2</sup> | Kind Code <sup>4</sup> | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear |
|                          |         |                                      |                        |                        |                  |   | T <sup>5</sup>   |

| NON-PATENT LITERATURE DOCUMENTS |         |   |                |
|---------------------------------|---------|---|----------------|
| Examiner Initials*              | Cite No | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>5</sup> |

| EXAMINER SIGNATURE  |                   |                 |            |
|---|-------------------|-----------------|------------|
| Examiner Signature  | /Thukhanh Nguyen/ | Date Considered | 04/05/2015 |
| *EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.   |                   |                 |            |
| <sup>1</sup> See Kind Codes of USPTO Patent Documents at <a href="http://www.USPTO.GOV">www.USPTO.GOV</a> or MPEP 901.04. <sup>2</sup> Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>3</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>4</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>5</sup> Applicant is to place a check mark here if English language translation is attached. |                   |                 |            |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.N./

Receipt date: 05/30/2014

14065516 - GAU: 1743

Doc code: IDS  
Doc description: Information Disclosure Statement (IDS) FieldSUBSTITUTE PTO/SB/08 (01-10)  
SPPC v1.5 011712

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| <b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br>(Not for submission under 37 CFR 1.99) | <b>Application Number</b>   | 14/065,516      |
|  | <b>Filing Date</b>          | Oct 29, 2013    |
|  | <b>First Named Inventor</b> | Aljosa Kemperle |
|  | <b>Art Unit</b>             | 1742            |
|  | <b>Examiner Name</b>        | Not yet known   |
| Sheet 1 of 2   | <b>Attorney Docket No.</b>  | MBOT-0051-P01   |

| U.S. PATENTS      |         |               |                        |            |   |   |
|-------------------|---------|---------------|------------------------|------------|---|---|
| Examiner Initial* | Cite No | Patent Number | Kind Code <sup>1</sup> | Issue Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |

| U.S. PATENT APPLICATION PUBLICATIONS |         |                    |                        |                  |   |   |
|--------------------------------------|---------|--------------------|------------------------|------------------|---|---|
| Examiner Initial*                    | Cite No | Publication Number | Kind Code <sup>1</sup> | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |


| FOREIGN PATENT DOCUMENTS |         |                                      |                        |                        |                  |   |  |                |
|--------------------------|---------|--------------------------------------|------------------------|------------------------|------------------|---|--|----------------|
| Examiner Initial*        | Cite No | Foreign Document Number <sup>3</sup> | Cnty Code <sup>2</sup> | Kind Code <sup>4</sup> | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear | T <sup>5</sup> |

| NON-PATENT LITERATURE DOCUMENTS |         |  |                |
|---------------------------------|---------|--|----------------|
| Examiner Initials*              | Cite No | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.          | T <sup>5</sup> |
|                                 | NPL-81  | "Touch Sensor and Automated Calibration", by Assargadon - <a href="http://forums.reprap.org/read.php?1,8028">http://forums.reprap.org/read.php?1,8028</a> , NPL-81, Jan. 4, 2008 , 14 pages  |                |
|                                 | NPL-80  | "HydraRaptor", <a href="http://hydraraptor.blogspot.com/2011/04/auto-z-probe.html">http://hydraraptor.blogspot.com/2011/04/auto-z-probe.html</a> ,NPL-80, Apr. 4, 2011 , 12 pages  |                |
|                                 | NPL-79  | "Automated Bed Leveling With Our 3D Printer", by Brian Benchhoff - <a href="http://hackaday.com/2012/04/23/automated-bed-teveling-with-our-3d-printer/">http://hackaday.com/2012/04/23/automated-bed-teveling-with-our-3d-printer/</a> , NPL-79, Apr. 23, 2012 , 5 pages |                |

| EXAMINER SIGNATURE  |                   |                 |            |
|---|-------------------|-----------------|------------|
| Examiner Signature  | /Thukhanh Nguyen/ | Date Considered | 04/05/2015 |
| *EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant. |                   |                 |            |


ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.N./



|  |  |   |
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| <b><i>Index of Claims</i></b><br> | <b>Application/Control No.</b><br>14065516 | <b>Applicant(s)/Patent Under Reexamination</b><br>KEMPERLE ET AL. |
|  | <b>Examiner</b><br>THUKHANH T NGUYEN       | <b>Art Unit</b><br>1743   |

|   |                 |   |                   |   |                     |   |                 |
|---|-----------------|---|-------------------|---|---------------------|---|-----------------|
| ✓ | <b>Rejected</b> | - | <b>Cancelled</b>  | N | <b>Non-Elected</b>  | A | <b>Appeal</b>   |
| = | <b>Allowed</b>  | ÷ | <b>Restricted</b> | I | <b>Interference</b> | O | <b>Objected</b> |

| <input type="checkbox"/> Claims renumbered in the same order as presented by applicant |          |            | <input type="checkbox"/> CPA |  |  | <input type="checkbox"/> T.D. |  |  | <input type="checkbox"/> R.1.47 |  |  |
|--|----------|------------|------------------------------|--|--|-------------------------------|--|--|---------------------------------|--|--|
| CLAIM  |          | DATE       |                              |  |  |                               |  |  |                                 |  |  |
| Final  | Original | 04/05/2015 |                              |  |  |                               |  |  |                                 |  |  |
|  | 1        | N          |                              |  |  |                               |  |  |                                 |  |  |
|  | 2        | N          |                              |  |  |                               |  |  |                                 |  |  |
|  | 3        | N          |                              |  |  |                               |  |  |                                 |  |  |
|  | 4        | N          |                              |  |  |                               |  |  |                                 |  |  |
|  | 5        | N          |                              |  |  |                               |  |  |                                 |  |  |
|  | 6        | N          |                              |  |  |                               |  |  |                                 |  |  |
|  | 7        | N          |                              |  |  |                               |  |  |                                 |  |  |
|  | 8        | N          |                              |  |  |                               |  |  |                                 |  |  |
|  | 9        | N          |                              |  |  |                               |  |  |                                 |  |  |
|  | 10       | N          |                              |  |  |                               |  |  |                                 |  |  |
|  | 11       | N          |                              |  |  |                               |  |  |                                 |  |  |
|  | 12       | N          |                              |  |  |                               |  |  |                                 |  |  |
|  | 13       | N          |                              |  |  |                               |  |  |                                 |  |  |
|  | 14       | ✓          |                              |  |  |                               |  |  |                                 |  |  |
|  | 15       | ✓          |                              |  |  |                               |  |  |                                 |  |  |
|  | 16       | ✓          |                              |  |  |                               |  |  |                                 |  |  |
|  | 17       | ✓          |                              |  |  |                               |  |  |                                 |  |  |
|  | 18       | ✓          |                              |  |  |                               |  |  |                                 |  |  |
|  | 19       | ✓          |                              |  |  |                               |  |  |                                 |  |  |
|  | 20       | ✓          |                              |  |  |                               |  |  |                                 |  |  |
|  | 21       | ✓          |                              |  |  |                               |  |  |                                 |  |  |
|  | 22       | ✓          |                              |  |  |                               |  |  |                                 |  |  |
|  | 23       | ✓          |                              |  |  |                               |  |  |                                 |  |  |
|  | 24       | ✓          |                              |  |  |                               |  |  |                                 |  |  |
|  | 25       | ✓          |                              |  |  |                               |  |  |                                 |  |  |

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| <b>Search Notes</b><br><br> | <b>Application/Control No.</b><br><br>14064974 | <b>Applicant(s)/Patent Under Reexamination</b><br><br>DOUGLAS ET AL. |
|  | <b>Examiner</b><br><br>THUKHANH T NGUYEN       | <b>Art Unit</b><br><br>1743  |

| CPC- SEARCHED                  |          |          |
|--------------------------------|----------|----------|
| Symbol                         | Date     | Examiner |
| B 29C 67/0055; B 29K 2995/0073 | 4/2/2015 | TN       |

| CPC COMBINATION SETS - SEARCHED |      |          |
|---------------------------------|------|----------|
| Symbol                          | Date | Examiner |
|                                 |      |          |

| US CLASSIFICATION SEARCHED |                                     |          |          |
|----------------------------|-------------------------------------|----------|----------|
| Class                      | Subclass                            | Date     | Examiner |
| 264                        | 129,176.1,40.1,40.7,308,113,401,497 | 4/2/2015 | TN       |
| 425                        | 145,150,375,112,113,174.4,185,186   | 4/2/2015 | TN       |
| 700                        | 118,119,120                         | 4/2/2015 | TN       |
| 226                        | 8,24,26,42,43,45                    | 4/2/2015 | TN       |

| SEARCH NOTES |      |          |
|--------------|------|----------|
| Search Notes | Date | Examiner |
|              |      |          |

| INTERFERENCE SEARCH     |                         |      |          |
|-------------------------|-------------------------|------|----------|
| US Class/<br>CPC Symbol | US Subclass / CPC Group | Date | Examiner |
|                         |                         |      |          |

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Receipt date: 11/25/2014

14065516 - GAU: 1743

Doc code: IDS  
Doc description: Information Disclosure Statement (IDS) FieldSUBSTITUTE PTO/SB/08 (01-10)  
SPPC v1.5 011712

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|--|-----------------------------|------------------------|
| <b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br>(Not for submission under 37 CFR 1.99) | <b>Application Number</b>   | 14/065,516             |
|  | <b>Filing Date</b>          | Oct 29, 2013           |
|  | <b>First Named Inventor</b> | Aljosa Kemperle        |
|  | <b>Art Unit</b>             | 1742                   |
|  | <b>Examiner Name</b>        | JOHNSON, CHRISTINA ANN |
| Sheet 1 of 2   | <b>Attorney Docket No.</b>  | MBOT-0051-P01          |

| U.S. PATENTS      |         |               |                        |              |   |   |
|-------------------|---------|---------------|------------------------|--------------|---|---|
| Examiner Initial* | Cite No | Patent Number | Kind Code <sup>1</sup> | Issue Date   | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|                   |         | US-5303141    |                        | Apr 12, 1994 | Batchelder, John S., et al.                     |   |

| U.S. PATENT APPLICATION PUBLICATIONS |         |                    |                        |                  |   |   |
|--------------------------------------|---------|--------------------|------------------------|------------------|---|---|
| Examiner Initial*                    | Cite No | Publication Number | Kind Code <sup>1</sup> | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |

| FOREIGN PATENT DOCUMENTS |         |                                      |                        |                        |                  |   |  |                |
|--------------------------|---------|--------------------------------------|------------------------|------------------------|------------------|---|--|----------------|
| Examiner Initial*        | Cite No | Foreign Document Number <sup>3</sup> | Cnty Code <sup>2</sup> | Kind Code <sup>4</sup> | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear | T <sup>5</sup> |

| NON-PATENT LITERATURE DOCUMENTS |         |   |                |
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| Examiner Initials*              | Cite No | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>5</sup> |

| EXAMINER SIGNATURE  |                   |                 |            |
|---|-------------------|-----------------|------------|
| Examiner Signature  | /Thukhanh Nguyen/ | Date Considered | 04/05/2015 |
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.N./

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|---|-----------------------------|------------------------|
| <b>INFORMATION DISCLOSURE<br/>         STATEMENT BY APPLICANT</b><br>(Not for submission under 37 CFR 1.99) | <b>Application Number</b>   | 14/065,516             |
|   | <b>Filing Date</b>          | Oct 29, 2013           |
|   | <b>First Named Inventor</b> | Aljosa Kemperle        |
|   | <b>Art Unit</b>             | 1742                   |
|   | <b>Examiner Name</b>        | JOHNSON, CHRISTINA ANN |
| Sheet 1 of 2  | <b>Attorney Docket No.</b>  | MBOT-0051-P01          |

| U.S. PATENTS      |         |               |                        |              |   |   |
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| Examiner Initial* | Cite No | Patent Number | Kind Code <sup>1</sup> | Issue Date   | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|                   |         | US-5303141    |                        | Apr 12, 1994 | Batchelder, John S., et al.                     |   |

| U.S. PATENT APPLICATION PUBLICATIONS |         |                    |                        |                  |   |   |
|--------------------------------------|---------|--------------------|------------------------|------------------|---|---|
| Examiner Initial*                    | Cite No | Publication Number | Kind Code <sup>1</sup> | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |

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|---|-----------------------------|------------------------|
| <b>INFORMATION DISCLOSURE<br/>         STATEMENT BY APPLICANT</b><br>(Not for submission under 37 CFR 1.99) | <b>Application Number</b>   | 14/065,516             |
|   | <b>Filing Date</b>          | Oct 29, 2013           |
|   | <b>First Named Inventor</b> | Aljosa Kemperle        |
|   | <b>Art Unit</b>             | 1742                   |
|   | <b>Examiner Name</b>        | JOHNSON, CHRISTINA ANN |
| Sheet 2 of 2  | <b>Attorney Docket No.</b>  | MBOT-0051-P01          |

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☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e) (1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e) (2).

☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ Applicant believes that no fees are required with this filing. However, if an Office Action on the merits has been mailed, or a fee is otherwise required, the Commissioner is hereby authorized to charge any fees due under 37 C.F.R. §§1.16 or 1.17, or to credit any overpayments, to Deposit Account No. 50-4262 in order to have this information disclosure statement considered.

### SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

|            |                      |                     |            |
|------------|----------------------|---------------------|------------|
| Signature  | /Robert Mazzaresse/  | Date (YYYY-MM-DD)   | 2014-11-25 |
| Name/Print | Robert A. Mazzaresse | Registration Number | 42,852     |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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| <b>EFS ID:</b>                              | 20797199                                       |
| <b>Application Number:</b>                  | 14065516                                       |
| <b>International Application Number:</b>    |  |
| <b>Confirmation Number:</b>                 | 9906   |
| <b>Title of Invention:</b>                  | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |
| <b>First Named Inventor/Applicant Name:</b> | Aljosa Kemperle                                |
| <b>Customer Number:</b>                     | 43520  |
| <b>Filer:</b>                               | Robert A. Mazzaresse/Paula Ng                  |
| <b>Filer Authorized By:</b>                 | Robert A. Mazzaresse                           |
| <b>Attorney Docket Number:</b>              | MBOT-0051-P01                                  |
| <b>Receipt Date:</b>                        | 25-NOV-2014                                    |
| <b>Filing Date:</b>                         | 29-OCT-2013                                    |
| <b>Time Stamp:</b>                          | 14:53:38                                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                    |

### Payment information:

|                        |    |
|------------------------|----|
| Submitted with Payment | no |
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### File Listing:

| Document Number | Document Description                               | File Name                         | File Size(Bytes)/<br>Message Digest              | Multi Part /.zip | Pages (if appl.) |
|-----------------|--|-----------------------------------|--|------------------|------------------|
| 1               | Information Disclosure Statement (IDS) Form (SB08) | MBOT-0051-P01_112514_Form1449.pdf | 76366<br>d0fcfd288e31c0f3ef94ebd82b06ee7c28aa86f | no               | 2                |

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**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

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|   |                             |                 |
|---|-----------------------------|-----------------|
| <b>INFORMATION DISCLOSURE<br/>         STATEMENT BY APPLICANT</b><br>(Not for submission under 37 CFR 1.99) | <b>Application Number</b>   | 14/065,516      |
|   | <b>Filing Date</b>          | Oct 29, 2013    |
|   | <b>First Named Inventor</b> | Aljosa Kemperle |
|   | <b>Art Unit</b>             | 1742            |
|   | <b>Examiner Name</b>        | Not yet known   |
| Sheet 1 of 2  | <b>Attorney Docket No.</b>  | MBOT-0051-P01   |

| U.S. PATENTS      |         |               |                        |            |   |   |
|-------------------|---------|---------------|------------------------|------------|---|---|
| Examiner Initial* | Cite No | Patent Number | Kind Code <sup>1</sup> | Issue Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |

| U.S. PATENT APPLICATION PUBLICATIONS |         |                    |                        |                  |   |   |
|--------------------------------------|---------|--------------------|------------------------|------------------|---|---|
| Examiner Initial*                    | Cite No | Publication Number | Kind Code <sup>1</sup> | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |

| FOREIGN PATENT DOCUMENTS |         |                                      |                        |                        |                  |   |  |                |
|--------------------------|---------|--------------------------------------|------------------------|------------------------|------------------|---|--|----------------|
| Examiner Initial*        | Cite No | Foreign Document Number <sup>3</sup> | Cnty Code <sup>2</sup> | Kind Code <sup>4</sup> | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear | T <sup>5</sup> |

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| Examiner Initials*              | Cite No | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.          | T <sup>5</sup> |
|                                 | NPL-81  | "Touch Sensor and Automated Calibration", by Assargadon - <a href="http://forums.reprap.org/read.php?1,8028">http://forums.reprap.org/read.php?1,8028</a> , NPL-81, Jan. 4, 2008 , 14 pages  |                |
|                                 | NPL-80  | "HydraRaptor", <a href="http://hydraraptor.blogspot.com/2011/04/auto-z-probe.html">http://hydraraptor.blogspot.com/2011/04/auto-z-probe.html</a> ,NPL-80, Apr. 4, 2011 , 12 pages  |                |
|                                 | NPL-79  | "Automated Bed Leveling With Our 3D Printer", by Brian Benchhoff - <a href="http://hackaday.com/2012/04/23/automated-bed-teveling-with-our-3d-printer/">http://hackaday.com/2012/04/23/automated-bed-teveling-with-our-3d-printer/</a> , NPL-79, Apr. 23, 2012 , 5 pages |                |

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| <b>INFORMATION DISCLOSURE<br/>         STATEMENT BY APPLICANT</b><br>(Not for submission under 37 CFR 1.99) | <b>Application Number</b>   | 14/065,516      |
|   | <b>Filing Date</b>          | Oct 29, 2013    |
|   | <b>First Named Inventor</b> | Aljosa Kemperle |
|   | <b>Art Unit</b>             | 1742            |
|   | <b>Examiner Name</b>        | Not yet known   |
| Sheet 2 of 2  | <b>Attorney Docket No.</b>  | MBOT-0051-P01   |

<sup>1</sup> See Kind Codes of USPTO Patent Documents at [www.USPTO.GOV](http://www.USPTO.GOV) or MPEP 901.04. <sup>2</sup> Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>3</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>4</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>5</sup> Applicant is to place a check mark here if English language translation is attached.

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☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ Applicant believes that no fees are required with this filing. However, if an Office Action on the merits has been mailed, or a fee is otherwise required, the Commissioner is hereby authorized to charge any fees due under 37 C.F.R. §§1.16 or 1.17, or to credit any overpayments, to Deposit Account No. 50-4262 in order to have this information disclosure statement considered.

### SIGNATURE

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| Signature  | /Robert A. Mazzaresse/ | Date (YYYY-MM-DD)   | 2014-05-30 |
| Name/Print | Robert A. Mazzaresse   | Registration Number | 42,852     |

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| <b>EFS ID:</b>                              | 19175960                                       |
| <b>Application Number:</b>                  | 14065516                                       |
| <b>International Application Number:</b>    |  |
| <b>Confirmation Number:</b>                 | 9906   |
| <b>Title of Invention:</b>                  | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |
| <b>First Named Inventor/Applicant Name:</b> | Aljosa Kemperle                                |
| <b>Customer Number:</b>                     | 43520  |
| <b>Filer:</b>                               | John H. Nortrop                                |
| <b>Filer Authorized By:</b>                 |  |
| <b>Attorney Docket Number:</b>              | MBOT-0051-P01                                  |
| <b>Receipt Date:</b>                        | 30-MAY-2014                                    |
| <b>Filing Date:</b>                         | 29-OCT-2013                                    |
| <b>Time Stamp:</b>                          | 17:47:46                                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                    |

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### File Listing:

| Document Number | Document Description                               | File Name                     | File Size(Bytes)/ Message Digest                  | Multi Part /.zip | Pages (if appl.) |
|-----------------|--|-------------------------------|---|------------------|------------------|
| 1               | Information Disclosure Statement (IDS) Form (SB08) | MBOT-0051-P01_053014_1449.pdf | 77350<br>460278e7f3868683cfc3c03b4f82c13577fdd357 | no               | 2                |

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| 2  | Non Patent Literature | NPL-79_AutomatedBedLevelingWith3DPrinter.pdf  | 1476169<br>f8c6b562c3c1f8385fbfa1ad973daf0f6b0488d1 | no | 5  |
| <b>Warnings:</b>   |                       |   |   |    |    |
| <b>Information:</b>  |                       |   |   |    |    |
| 3  | Non Patent Literature | NPL-80_HydraRaptor_Auto_z-probe.pdf           | 4757566<br>48d652adb542281408af5cf88c9fd641d637d0   | no | 12 |
| <b>Warnings:</b>   |                       |   |   |    |    |
| <b>Information:</b>  |                       |   |   |    |    |
| 4  | Non Patent Literature | NPL-81_TouchSensorAndAutomatedCalibration.pdf | 4093737<br>4299f8f41c1f685aacf533999b60e675cf6a8e94 | no | 14 |
| <b>Warnings:</b>   |                       |   |   |    |    |
| <b>Information:</b>  |                       |   |   |    |    |
| <b>Total Files Size (in bytes):</b>  |                       |   | 10404822  |    |    |
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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 14/065,516         | 10/29/2013            | Aljosa Kemperle       | MBOT-0051-P01          |

**CONFIRMATION NO. 9906**

43520  
STRATEGIC PATENTS P.C.  
P.O. BOX 920629  
NEEDHAM, MA 02492

## PUBLICATION NOTICE



**Title:**THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION

**Publication No.**US-2014-0117575-A1

**Publication Date:**05/01/2014

## NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at [www.uspto.gov](http://www.uspto.gov). The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at [www.uspto.gov](http://www.uspto.gov) using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

|   |                             |                 |
|---|-----------------------------|-----------------|
| <b>INFORMATION DISCLOSURE<br/>         STATEMENT BY APPLICANT</b><br>(Not for submission under 37 CFR 1.99) | <b>Application Number</b>   | 14/065,516      |
|   | <b>Filing Date</b>          | Oct 29, 2013    |
|   | <b>First Named Inventor</b> | Aljosa Kemperle |
|   | <b>Art Unit</b>             | 1742            |
|   | <b>Examiner Name</b>        | Unknown         |
| Sheet 1 of 2  | <b>Attorney Docket No.</b>  | MBOT-0051-P01   |

| U.S. PATENTS      |         |               |                        |              |   |   |
|-------------------|---------|---------------|------------------------|--------------|---|---|
| Examiner Initial* | Cite No | Patent Number | Kind Code <sup>1</sup> | Issue Date   | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|                   |         | US-6629011    |                        | Sep 30, 2003 | Calderon, Joseph L., et al.                     |   |

| U.S. PATENT APPLICATION PUBLICATIONS |         |                    |                        |                  |   |   |
|--------------------------------------|---------|--------------------|------------------------|------------------|---|---|
| Examiner Initial*                    | Cite No | Publication Number | Kind Code <sup>1</sup> | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |

| FOREIGN PATENT DOCUMENTS |         |                                      |                        |                        |                  |   |  |                |
|--------------------------|---------|--------------------------------------|------------------------|------------------------|------------------|---|--|----------------|
| Examiner Initial*        | Cite No | Foreign Document Number <sup>3</sup> | Cnty Code <sup>2</sup> | Kind Code <sup>4</sup> | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear | T <sup>5</sup> |

| NON-PATENT LITERATURE DOCUMENTS |         |   |                |
|---------------------------------|---------|---|----------------|
| Examiner Initials*              | Cite No | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>5</sup> |

| EXAMINER SIGNATURE  |  |                 |  |
|---|--|-----------------|--|
| Examiner Signature  |  | Date Considered |  |
| *EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.   |  |                 |  |
| <sup>1</sup> See Kind Codes of USPTO Patent Documents at <a href="http://www.USPTO.GOV">www.USPTO.GOV</a> or MPEP 901.04. <sup>2</sup> Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>3</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>4</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>5</sup> Applicant is to place a check mark here if English language translation is attached. |  |                 |  |

|   |                             |                 |
|---|-----------------------------|-----------------|
| <b>INFORMATION DISCLOSURE<br/>         STATEMENT BY APPLICANT</b><br>(Not for submission under 37 CFR 1.99) | <b>Application Number</b>   | 14/065,516      |
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|   | <b>First Named Inventor</b> | Aljosa Kemperle |
|   | <b>Art Unit</b>             | 1742            |
|   | <b>Examiner Name</b>        | Unknown         |
| Sheet 2 of 2  | <b>Attorney Docket No.</b>  | MBOT-0051-P01   |

### CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e) (1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e) (2).

☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ Applicant believes that no fees are required with this filing. However, if an Office Action on the merits has been mailed, or a fee is otherwise required, the Commissioner is hereby authorized to charge any fees due under 37 C.F.R. §§1.16 or 1.17, or to credit any overpayments, to Deposit Account No. 50-4262 in order to have this information disclosure statement considered.

### SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

|            |                      |                     |            |
|------------|----------------------|---------------------|------------|
| Signature  | /Robert Mazzaresse/  | Date (YYYY-MM-DD)   | 2014-01-15 |
| Name/Print | Robert A. Mazzaresse | Registration Number | 42,852     |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

| Electronic Acknowledgement Receipt   |  |
|--------------------------------------|--|
| EFS ID:                              | 17920745                                       |
| Application Number:                  | 14065516                                       |
| International Application Number:    |  |
| Confirmation Number:                 | 9906   |
| Title of Invention:                  | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |
| First Named Inventor/Applicant Name: | Aljosa Kemperle                                |
| Customer Number:                     | 43520  |
| Filer:                               | Robert A. Mazzaresse/Paula Ng                  |
| Filer Authorized By:                 | Robert A. Mazzaresse                           |
| Attorney Docket Number:              | MBOT-0051-P01                                  |
| Receipt Date:                        | 15-JAN-2014                                    |
| Filing Date:                         | 29-OCT-2013                                    |
| Time Stamp:                          | 15:07:04                                       |
| Application Type:                    | Utility under 35 USC 111(a)                    |

### Payment information:

|                        |    |
|------------------------|----|
| Submitted with Payment | no |
|------------------------|----|

### File Listing:

| Document Number | Document Description                               | File Name                         | File Size(Bytes)/<br>Message Digest               | Multi Part /.zip | Pages (if appl.) |
|-----------------|--|-----------------------------------|---|------------------|------------------|
| 1               | Information Disclosure Statement (IDS) Form (SB08) | MBOT-0051-P01_011514_Form1449.pdf | 73539<br>52506ef5e36d5bf95be8dda06d8076c52a4a0c55 | no               | 2                |

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### Information:

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73539

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.





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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 14/065,516         | 10/29/2013            | Aljosa Kemperle       | MBOT-0051-P01          |

**CONFIRMATION NO. 9906**

**POA ACCEPTANCE LETTER**

43520  
STRATEGIC PATENTS P.C.  
P.O. BOX 920629  
NEEDHAM, MA 02492



Date Mailed: 01/07/2014

**NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY**

This is in response to the Power of Attorney filed 12/31/2013.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/ybedada/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



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www.uspto.gov

| APPLICATION<br>NUMBER | FILING or<br>371(c) DATE | GRP ART<br>UNIT | FIL FEE REC'D | ATTY. DOCKET NO. | TOT CLAIMS | IND CLAIMS |
|-----------------------|--------------------------|-----------------|---------------|------------------|------------|------------|
| 14/065,516            | 10/29/2013               | 1742            | 2140          | MBOT-0051-P01    | 25         | 2          |

CONFIRMATION NO. 9906

43520  
STRATEGIC PATENTS P.C.  
P.O. BOX 920629  
NEEDHAM, MA 02492

## UPDATED FILING RECEIPT



\*OC000000065867711\*

Date Mailed: 01/07/2014

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

### Inventor(s)

Aljosa Kemperle, Brooklyn, NY;  
Filipp Gelman, Staten Island, NY;  
Peter Joseph Schmehl, New York, NY;

### Applicant(s)

MakerBot Industries, LLC, Brooklyn, NY

### Assignment For Published Patent Application

MakerBot Industries, LLC, Brooklyn, NY

**Power of Attorney:** The patent practitioners associated with Customer Number 43520

### Domestic Priority data as claimed by applicant

This appln claims benefit of 61/719,874 10/29/2012

**Foreign Applications** for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

*Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.*

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

### If Required, Foreign Filing License Granted: 11/13/2013

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/065,516**

**Projected Publication Date:** 05/01/2014

**Non-Publication Request:** No

**Early Publication Request:** No

**Title**

THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION

**Preliminary Class**

264

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** Yes

## **PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES**

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

**LICENSE FOR FOREIGN FILING UNDER**  
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**Title 37, Code of Federal Regulations, 5.11 & 5.15**

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The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

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The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

**NOT GRANTED**

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875   |   |                                  |          |                                    |               | Application or Docket Number<br>14/065,516 |                    |
|---|---|----------------------------------|----------|------------------------------------|---------------|--|--------------------|
| <b>APPLICATION AS FILED - PART I</b>  |   |                                  |          |                                    |               |  |                    |
| (Column 1)  |   | (Column 2)                       |          | SMALL ENTITY                       |               | OTHER THAN SMALL ENTITY                    |                    |
| FOR   | NUMBER FILED  | NUMBER EXTRA                     | RATE(\$) | FEE(\$)                            |               | RATE(\$)                                   | FEE(\$)            |
| BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))  | N/A   | N/A                              | N/A      |                                    |               | N/A  | 280                |
| SEARCH FEE<br>(37 CFR 1.16(k), (l), or (m))   | N/A   | N/A                              | N/A      |                                    |               | N/A  | 600                |
| EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))  | N/A   | N/A                              | N/A      |                                    |               | N/A  | 720                |
| TOTAL CLAIMS<br>(37 CFR 1.16(j))  | 25  | minus 20 =<br>*                  | 5        |                                    |               | x 80 =                                     | 400                |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))  | 2   | minus 3 =<br>*                   |          |                                    |               | x 420 =                                    | 0.00               |
| APPLICATION SIZE FEE<br>(37 CFR 1.16(s))  | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                  |          |                                    |               |  | 0.00               |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))   |   |                                  |          |                                    |               |  | 0.00               |
| * If the difference in column 1 is less than zero, enter "0" in column 2.   |   |                                  |          | TOTAL                              |               | TOTAL                                      | 2000               |
| <b>APPLICATION AS AMENDED - PART II</b>   |   |                                  |          |                                    |               |  |                    |
| (Column 1)  |   | (Column 2)                       |          | (Column 3)                         |               | SMALL ENTITY                               |                    |
| AMENDMENT A   |   | CLAIMS REMAINING AFTER AMENDMENT |          | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE(\$)                                   | ADDITIONAL FEE(\$) |
|   | Total<br>(37 CFR 1.16(i))   | *                                | Minus    | **                                 | =             | x  | =                  |
|   | Independent<br>(37 CFR 1.16(h))   | *                                | Minus    | ***                                | =             | x  | =                  |
|   | Application Size Fee (37 CFR 1.16(s))   |                                  |          |                                    |               |  |                    |
|   | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))   |                                  |          |                                    |               |  |                    |
|   |   |                                  |          |                                    |               | TOTAL<br>ADD'L FEE                         |                    |
| (Column 1)  |   | (Column 2)                       |          | (Column 3)                         |               | OTHER THAN SMALL ENTITY                    |                    |
| AMENDMENT B   |   | CLAIMS REMAINING AFTER AMENDMENT |          | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE(\$)                                   | ADDITIONAL FEE(\$) |
|   | Total<br>(37 CFR 1.16(i))   | *                                | Minus    | **                                 | =             | x  | =                  |
|   | Independent<br>(37 CFR 1.16(h))   | *                                | Minus    | ***                                | =             | x  | =                  |
|   | Application Size Fee (37 CFR 1.16(s))   |                                  |          |                                    |               |  |                    |
|   | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))   |                                  |          |                                    |               |  |                    |
|   |   |                                  |          |                                    |               | TOTAL<br>ADD'L FEE                         |                    |
| <p style="font-size: x-small;">* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p style="font-size: x-small;">** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p style="font-size: x-small;">*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p style="font-size: x-small;">The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.</p> |   |                                  |          |                                    |               |  |                    |



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| 14/065,516         | 10/29/2013            | Aljosa Kemperle       | MBOT-0051-P01          |

**CONFIRMATION NO. 9906**

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P.O. BOX 920629  
NEEDHAM, MA 02492

## FORMALITIES LETTER



Date Mailed: 11/15/2013

## NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

### Filing Date Granted

#### Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.  
*Applicant must submit \$280 to complete the basic filing fee for an undiscounted entity. If appropriate, applicant may make a written assertion of entitlement to small entity status and pay the small entity filing fee (37 CFR 1.27) or make a certification of entitlement to micro entity status and pay the micro entity filing fee (37 CFR 1.29).*

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- Additional claim fees of \$ 400 as an undiscounted entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.
- A surcharge (for late submission of the basic filing fee, search fee, examination fee or inventor's oath or declaration) as set forth in 37 CFR 1.16(f) of \$ 140 for an undiscounted entity, must be submitted.

#### SUMMARY OF FEES DUE:

Total fee(s) required within **TWO MONTHS** from the date of this Notice is \$ 2140 for an undiscounted entity

- \$ 280 Statutory basic filing fee.
- \$ 140 Surcharge.
- The application search fee has not been paid. Applicant must submit \$ 600 to complete the search fee.
- The application examination fee has not been paid. Applicant must submit \$ 720 to complete the examination fee for an undiscounted entity.
- Total additional claim fee(s) for this application is \$ 400
  - \$ 400 for 5 total claims over 20.

#### Items Required To Avoid Processing Delays:

page 1 of 2

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):

Aljosa Kemperle

Filipp Gelman

Peter Joseph Schmehl

Applicant may submit the inventor's oath or declaration at any time before the Notice of Allowance and Fee(s) Due, PTOL-85, is mailed.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts  
Commissioner for Patents  
P.O. Box 1450  
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.

<https://portal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/ldvan/

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Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

In re application of Aljosa Kemperle *et al.* : Group Art Unit: 1742  
Serial No. 14/065,516 : Confirmation No. 9906  
Filed: October 29, 2013 : Examiner: Not yet known

**NOTICE TO FILE MISSING PARTS RESPONSE**

**Mail Stop Missing Parts**  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

For the above identified application, in response to a Notice To File Missing Parts mailed November 15, 2013, the applicant submits herewith an executed declaration for each of the inventors, and the total application filing fees. The application fees are provided by EFS Web.

The applicant hereby authorizes the Patent Office to charge any deficiencies or credit any overpayments associated with this filing to Deposit Account No. 50-4262.

Please direct any inquiry regarding this matter to the below signed agent.

Respectfully Submitted,

STRATEGIC PATENTS, P.C.

/John Nortrup/

---

John H. Nortrup  
Reg. No. 59,063  
(207) 590-0723  
Customer Number 43520

December 31, 2013



**United States Patent Application**  
**COMBINED DECLARATION AND ASSIGNMENT**

**DECLARATION**

As a below named inventor I hereby declare with respect to the U.S. patent application entitled

**THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION**

the specification of which was filed on October 29, 2013 as application serial no. 14/065,516, that:

- (a) the above-identified application was made or authorized to be made by me;
- (b) I have read and understood the application; and
- (c) I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I acknowledge the duty to disclose information which is material to the patentability of this application as defined in 37 C.F.R. § 1.56 (attached hereto). I also acknowledge my duty to disclose all information known to be material to patentability which became available between a filing date of a prior application and the national or PCT international filing date in the event this is a Continuation-In-Part application in accordance with 37 C.F.R. § 1.63(c).

## ASSIGNMENT

WHEREAS, the undersigned inventor ("Inventor") has developed certain inventions ("Inventions") described in the above U.S. patent application, and has full right to convey his or her entire interest, both legal and equitable, in and to said Inventions free from all prior assignments, agreements, licenses, mortgages, security interests, or other encumbrances whatsoever; and

WHEREAS, MakerBot Industries, LLC ("ASSIGNEE"), an entity organized and existing under the laws of the state of New York, and having a place of business at 1 Metrotech Center, 21st Floor, Brooklyn, NY 11201 is desirous of acquiring the entire right, title, and interest in and to the Inventions and any and all patents to be obtained therefore;

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged by the Inventor, the Inventor hereby sells, assigns and transfers unto the ASSIGNEE, its successors and assigns, his or her entire right, title and interest in and to the Inventions as described in the above application and all applications resulting therefrom, including any and all conversions, divisions, continuations, continuations-in-part, substitute applications, and reissues or extensions thereof; and all resulting patents in any jurisdiction worldwide; along with all rights of priority and rights to sue for past infringement.

AND the Inventor hereby authorizes and requests the issuing authority to issue any and all patents issuing from any of the forgoing to the ASSIGNEE or its successors and assigns.

AND each Inventor agrees that ASSIGNEE's counsel, Strategic Patents, P.C. having Patent Office Customer Number 43520, shall hereinafter act on behalf of the ASSIGNEE with respect to the Inventions.

AND, the Inventor further agrees, without any further payment or compensation by the ASSIGNEE or its successors and assigns, to communicate to the ASSIGNEE, its representatives or agents or its successors and assigns, any facts relating to the Inventions including evidence for interference purposes or for other legal proceedings whenever requested; to testify in any interference or other legal proceedings, whenever requested; to execute and deliver, on request, all lawful papers required to make any of the foregoing provisions effective; and to generally do everything possible to aid the ASSIGNEE, its successors or assigns and nominees to secure, obtain and enforce proper patent protection for the Inventions in this or any foreign country.

The Inventor hereby authorizes the attorneys and agents associated with Patent Office Customer Number 43520 to insert hereon any further information necessary or desirable for recordation of this document.

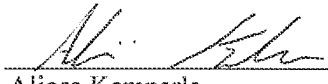
I accept and agree to the terms of the ASSIGNMENT above.

I hereby declare that all statements made in the DECLARATION above of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of inventor: Aljosa Kemperle

Residence: Brooklyn, NY

Post Office Address: MakerBot Industries, LLC  
1 Metrotech Center, 21st Floor  
Brooklyn, NY 11201

Signature:  Date: 12-11-2013  
Aljosa Kemperle

§ 1.56 Duty to disclose information material to patentability.

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

- (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or
- (2) It refutes, or is inconsistent with, a position the applicant takes in:
  - (i) Opposing an argument of unpatentability relied on by the Office, or
  - (ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

- (1) Each inventor named in the application;
- (2) Each attorney or agent who prepares or prosecutes the application; and
- (3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

(e) In any continuation-in-part application, the duty under this section includes the duty to disclose to the Office all information known to the person to be material to patentability, as defined in paragraph (b) of this section, which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

## **United States Patent Application COMBINED DECLARATION AND ASSIGNMENT**

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#### **THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION**

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## ASSIGNMENT

WHEREAS, the undersigned inventor ("Inventor") has developed certain inventions ("Inventions") described in the above U.S. patent application, and has full right to convey his or her entire interest, both legal and equitable, in and to said Inventions free from all prior assignments, agreements, licenses, mortgages, security interests, or other encumbrances whatsoever; and

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I hereby declare that all statements made in the DECLARATION above of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of inventor: Philipp Gelman

Residence: Staten Island, NY

Post Office Address: MakerBot Industries, LLC  
1 Metrotech Center, 21st Floor  
Brooklyn, NY 11201

Signature: Philipp Gelman Date: 12/13/2013  
Philipp Gelman

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Full Name of inventor: Peter Joseph Schmehl

Residence: New York, NY

Post Office Address: MakerBot Industries, LLC  
1 Metrotech Center, 21st Floor  
Brooklyn, NY 11201

Signature: 

Peter Joseph Schmehl

Date: 

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| Electronic Patent Application Fee Transmittal  |  |          |        |                      |
|--|--|----------|--------|----------------------|
| <b>Application Number:</b>                     | 14065516                                       |          |        |                      |
| <b>Filing Date:</b>                            | 29-Oct-2013                                    |          |        |                      |
| <b>Title of Invention:</b>                     | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |          |        |                      |
| <b>First Named Inventor/Applicant Name:</b>    | Aljosa Kemperle                                |          |        |                      |
| <b>Filer:</b>                                  | John H. Nortrop                                |          |        |                      |
| <b>Attorney Docket Number:</b>                 | MBOT-0051-P01                                  |          |        |                      |
| Filed as Large Entity                          |  |          |        |                      |
| <b>Utility under 35 USC 111(a) Filing Fees</b> |  |          |        |                      |
| Description                                    | Fee Code                                       | Quantity | Amount | Sub-Total in USD(\$) |
| <b>Basic Filing:</b>                           |  |          |        |                      |
| Utility application filing                     | 1011   | 1        | 280    | 280                  |
| Utility Search Fee                             | 1111   | 1        | 600    | 600                  |
| Utility Examination Fee                        | 1311   | 1        | 720    | 720                  |
| <b>Pages:</b>                                  |  |          |        |                      |
| <b>Claims:</b>                                 |  |          |        |                      |
| Claims in Excess of 20                         | 1202   | 5        | 80     | 400                  |
| <b>Miscellaneous-Filing:</b>                   |  |          |        |                      |
| Late Filing Fee for Oath or Declaration        | 1051   | 1        | 140    | 140                  |

| Description                              | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|--|----------|----------|--------|----------------------|
| <b>Petition:</b>                         |          |          |        |                      |
| <b>Patent-Appeals-and-Interference:</b>  |          |          |        |                      |
| <b>Post-Allowance-and-Post-Issuance:</b> |          |          |        |                      |
| <b>Extension-of-Time:</b>                |          |          |        |                      |
| <b>Miscellaneous:</b>                    |          |          |        |                      |
| <b>Total in USD (\$)</b>                 |          |          |        | <b>2140</b>          |

| Electronic Acknowledgement Receipt          |  |
|---|--|
| <b>EFS ID:</b>                              | 17787720                                       |
| <b>Application Number:</b>                  | 14065516                                       |
| <b>International Application Number:</b>    |  |
| <b>Confirmation Number:</b>                 | 9906   |
| <b>Title of Invention:</b>                  | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |
| <b>First Named Inventor/Applicant Name:</b> | Aljosa Kemperle                                |
| <b>Customer Number:</b>                     | 43520  |
| <b>Filer:</b>                               | John H. Nortrop                                |
| <b>Filer Authorized By:</b>                 |  |
| <b>Attorney Docket Number:</b>              | MBOT-0051-P01                                  |
| <b>Receipt Date:</b>                        | 31-DEC-2013                                    |
| <b>Filing Date:</b>                         | 29-OCT-2013                                    |
| <b>Time Stamp:</b>                          | 12:39:30                                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                    |

### Payment information:

|  |                 |
|--|-----------------|
| Submitted with Payment   | yes             |
| Payment Type   | Deposit Account |
| Payment was successfully received in RAM   | \$2140          |
| RAM confirmation Number  | 95              |
| Deposit Account  | 504262          |
| Authorized User  |                 |
| <p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)</p> <p>Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)</p> |                 |

| File Listing:                |   |   |  |                  |                  |
|------------------------------|---|---|--|------------------|------------------|
| Document Number              | Document Description                              | File Name   | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
| 1                            | Applicant Response to Pre-Exam Formalities Notice | MBOT-0051-P01_123113_MissingParts.pdf             | 92753                                    | no               | 2                |
|                              |   |   | c3f4066d6e5e3c497be2f1d54b5933b51d72db7e |                  |                  |
| Warnings:                    |   |   |  |                  |                  |
| Information:                 |   |   |  |                  |                  |
| 2                            | Transmittal Letter                                | MBOT-0051-P01_123113_MPCommunication.pdf          | 85838                                    | no               | 1                |
|                              |   |   | b0b3a14690ddc00e1091661ef97b77c00d437c68 |                  |                  |
| Warnings:                    |   |   |  |                  |                  |
| Information:                 |   |   |  |                  |                  |
| 3                            | Oath or Declaration filed                         | MBOT-0051-P01_123113_ExecutedDecAssg_Kemperle.pdf | 2338736                                  | no               | 4                |
|                              |   |   | 1b5e8ce9f8006d155a633ec190412570b7aec211 |                  |                  |
| Warnings:                    |   |   |  |                  |                  |
| Information:                 |   |   |  |                  |                  |
| 4                            | Oath or Declaration filed                         | MBOT-0051-P01_123113_ExecutedDecAssg_Gelman.pdf   | 1495655                                  | no               | 4                |
|                              |   |   | 5324783d32349bfa0c5d8e7b569d23661ae10eb6 |                  |                  |
| Warnings:                    |   |   |  |                  |                  |
| Information:                 |   |   |  |                  |                  |
| 5                            | Oath or Declaration filed                         | MBOT-0051-P01_123113_ExecutedDecAssg_Schmehl.pdf  | 2365651                                  | no               | 4                |
|                              |   |   | 8e18c48c7269590a83008bc421883b622b0f522  |                  |                  |
| Warnings:                    |   |   |  |                  |                  |
| Information:                 |   |   |  |                  |                  |
| 6                            | Fee Worksheet (SB06)                              | fee-info.pdf                                      | 38364                                    | no               | 2                |
|                              |   |   | 00ae25262a8a18f3ff8cdef6f8d050d7721f9069 |                  |                  |
| Warnings:                    |   |   |  |                  |                  |
| Information:                 |   |   |  |                  |                  |
| Total Files Size (in bytes): |   |   | 6416997                                  |                  |                  |



This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

| Electronic Acknowledgement Receipt          |  |
|---|--|
| <b>EFS ID:</b>                              | 17787720                                       |
| <b>Application Number:</b>                  | 14065516                                       |
| <b>International Application Number:</b>    |  |
| <b>Confirmation Number:</b>                 | 9906   |
| <b>Title of Invention:</b>                  | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |
| <b>First Named Inventor/Applicant Name:</b> | Aljosa Kemperle                                |
| <b>Customer Number:</b>                     | 43520  |
| <b>Filer:</b>                               | John H. Nortrop                                |
| <b>Filer Authorized By:</b>                 |  |
| <b>Attorney Docket Number:</b>              | MBOT-0051-P01                                  |
| <b>Receipt Date:</b>                        | 31-DEC-2013                                    |
| <b>Filing Date:</b>                         | 29-OCT-2013                                    |
| <b>Time Stamp:</b>                          | 12:39:30                                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                    |

### Payment information:

|  |                 |
|--|-----------------|
| Submitted with Payment   | yes             |
| Payment Type   | Deposit Account |
| Payment was successfully received in RAM   | \$2140          |
| RAM confirmation Number  | 95              |
| Deposit Account  | 504262          |
| Authorized User  |                 |
| <p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)</p> <p>Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)</p> |                 |

| File Listing:                |   |   |  |                  |                  |
|------------------------------|---|---|--|------------------|------------------|
| Document Number              | Document Description                              | File Name   | File Size(Bytes)/ Message Digest         | Multi Part /.zip | Pages (if appl.) |
| 1                            | Applicant Response to Pre-Exam Formalities Notice | MBOT-0051-P01_123113_MissingParts.pdf             | 92753                                    | no               | 2                |
|                              |   |   | c3f4066d6e5e3c497be2f1d54b5933b51d72db7e |                  |                  |
| Warnings:                    |   |   |  |                  |                  |
| Information:                 |   |   |  |                  |                  |
| 2                            | Transmittal Letter                                | MBOT-0051-P01_123113_MPCommunication.pdf          | 85838                                    | no               | 1                |
|                              |   |   | b0b3a14690ddc00e1091661ef97b77c00d437c68 |                  |                  |
| Warnings:                    |   |   |  |                  |                  |
| Information:                 |   |   |  |                  |                  |
| 3                            | Oath or Declaration filed                         | MBOT-0051-P01_123113_ExecutedDecAssg_Kemperle.pdf | 2338736                                  | no               | 4                |
|                              |   |   | 1b5e8ce9f8006d155a633ec190412570b7aec211 |                  |                  |
| Warnings:                    |   |   |  |                  |                  |
| Information:                 |   |   |  |                  |                  |
| 4                            | Oath or Declaration filed                         | MBOT-0051-P01_123113_ExecutedDecAssg_Gelman.pdf   | 1495655                                  | no               | 4                |
|                              |   |   | 5324783d32349bfa0c5d8e7b569d23661ae10eb6 |                  |                  |
| Warnings:                    |   |   |  |                  |                  |
| Information:                 |   |   |  |                  |                  |
| 5                            | Oath or Declaration filed                         | MBOT-0051-P01_123113_ExecutedDecAssg_Schmehl.pdf  | 2365651                                  | no               | 4                |
|                              |   |   | 8e18c48c7269590a83008bc421883b622b0f522  |                  |                  |
| Warnings:                    |   |   |  |                  |                  |
| Information:                 |   |   |  |                  |                  |
| 6                            | Fee Worksheet (SB06)                              | fee-info.pdf                                      | 38364                                    | no               | 2                |
|                              |   |   | 00ae25262a8a18f3ff8cdef6f8d050d7721f9069 |                  |                  |
| Warnings:                    |   |   |  |                  |                  |
| Information:                 |   |   |  |                  |                  |
| Total Files Size (in bytes): |   |   | 6416997                                  |                  |                  |

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**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



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P.O. Box 1450  
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www.uspto.gov

| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 14/065,516         | 10/29/2013            | Aljosa Kemperle       | MBOT-0051-P01          |

**CONFIRMATION NO. 9906**

43520  
STRATEGIC PATENTS P.C.  
P.O. BOX 920629  
NEEDHAM, MA 02492

## FORMALITIES LETTER



Date Mailed: 11/15/2013

## NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

### Filing Date Granted

#### Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.  
*Applicant must submit \$280 to complete the basic filing fee for an undiscounted entity. If appropriate, applicant may make a written assertion of entitlement to small entity status and pay the small entity filing fee (37 CFR 1.27) or make a certification of entitlement to micro entity status and pay the micro entity filing fee (37 CFR 1.29).*

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- Additional claim fees of \$ 400 as an undiscounted entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.
- A surcharge (for late submission of the basic filing fee, search fee, examination fee or inventor's oath or declaration) as set forth in 37 CFR 1.16(f) of \$ 140 for an undiscounted entity, must be submitted.

#### SUMMARY OF FEES DUE:

Total fee(s) required within **TWO MONTHS** from the date of this Notice is \$ 2140 for an undiscounted entity

- \$ 280 Statutory basic filing fee.
- \$ 140 Surcharge.
- The application search fee has not been paid. Applicant must submit \$ 600 to complete the search fee.
- The application examination fee has not been paid. Applicant must submit \$ 720 to complete the examination fee for an undiscounted entity.
- Total additional claim fee(s) for this application is \$ 400
  - \$ 400 for 5 total claims over 20.

#### Items Required To Avoid Processing Delays:

page 1 of 2

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):

Aljosa Kemperle

Filipp Gelman

Peter Joseph Schmehl

Applicant may submit the inventor's oath or declaration at any time before the Notice of Allowance and Fee(s) Due, PTOL-85, is mailed.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts  
Commissioner for Patents  
P.O. Box 1450  
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.

<https://portal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/ldvan/

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Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875   |   |                                    |               |                    |                    | Application or Docket Number<br>14/065,516 |                    |                         |  |
|---|---|------------------------------------|---------------|--------------------|--------------------|--|--------------------|-------------------------|--|
| <b>APPLICATION AS FILED - PART I</b>  |   |                                    |               |                    |                    |  |                    |                         |  |
| (Column 1)  |   | (Column 2)                         |               | SMALL ENTITY       |                    | OTHER THAN SMALL ENTITY                    |                    |                         |  |
| FOR   | NUMBER FILED  | NUMBER EXTRA                       | RATE(\$)      | FEE(\$)            |                    | RATE(\$)                                   | FEE(\$)            |                         |  |
| BASIC FEE<br><small>(37 CFR 1.16(a), (b), or (c))</small>   | N/A   | N/A                                | N/A           |                    |                    | N/A  | 280                |                         |  |
| SEARCH FEE<br><small>(37 CFR 1.16(k), (l), or (m))</small>  | N/A   | N/A                                | N/A           |                    |                    | N/A  | 600                |                         |  |
| EXAMINATION FEE<br><small>(37 CFR 1.16(o), (p), or (q))</small>   | N/A   | N/A                                | N/A           |                    |                    | N/A  | 720                |                         |  |
| TOTAL CLAIMS<br><small>(37 CFR 1.16(i))</small>   | 25  | minus 20 =<br>*                    | 5             |                    |                    | x 80 =                                     | 400                |                         |  |
| INDEPENDENT CLAIMS<br><small>(37 CFR 1.16(h))</small>   | 2   | minus 3 =<br>*                     |               |                    |                    | x 420 =                                    | 0.00               |                         |  |
| APPLICATION SIZE FEE<br><small>(37 CFR 1.16(s))</small>   | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                    |               |                    |                    |  | 0.00               |                         |  |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))   |   |                                    |               |                    |                    |  | 0.00               |                         |  |
| * If the difference in column 1 is less than zero, enter "0" in column 2.   |   |                                    |               | TOTAL              |                    | TOTAL                                      | 2000               |                         |  |
| <b>APPLICATION AS AMENDED - PART II</b>   |   |                                    |               |                    |                    |  |                    |                         |  |
| (Column 1)  |   | (Column 2)                         |               | (Column 3)         |                    | SMALL ENTITY                               |                    | OTHER THAN SMALL ENTITY |  |
| AMENDMENT A   | CLAIMS REMAINING AFTER AMENDMENT  | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE(\$)           | ADDITIONAL FEE(\$) | RATE(\$)                                   | ADDITIONAL FEE(\$) |                         |  |
|   | Total<br><small>(37 CFR 1.16(i))</small>  | *                                  | Minus         | **                 | =                  | x  | =                  |                         |  |
|   | Independent<br><small>(37 CFR 1.16(h))</small>  | *                                  | Minus         | ***                | =                  | x  | =                  |                         |  |
|   | Application Size Fee (37 CFR 1.16(s))   |                                    |               |                    |                    |  |                    |                         |  |
|   | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))   |                                    |               |                    |                    |  |                    |                         |  |
|   |   |                                    |               | TOTAL<br>ADD'L FEE |                    | TOTAL<br>ADD'L FEE                         |                    |                         |  |
| AMENDMENT B   | CLAIMS REMAINING AFTER AMENDMENT  | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE(\$)           | ADDITIONAL FEE(\$) | RATE(\$)                                   | ADDITIONAL FEE(\$) |                         |  |
|   | Total<br><small>(37 CFR 1.16(i))</small>  | *                                  | Minus         | **                 | =                  | x  | =                  |                         |  |
|   | Independent<br><small>(37 CFR 1.16(h))</small>  | *                                  | Minus         | ***                | =                  | x  | =                  |                         |  |
|   | Application Size Fee (37 CFR 1.16(s))   |                                    |               |                    |                    |  |                    |                         |  |
|   | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))   |                                    |               |                    |                    |  |                    |                         |  |
|   |   |                                    |               | TOTAL<br>ADD'L FEE |                    | TOTAL<br>ADD'L FEE                         |                    |                         |  |
| <p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.</p> |   |                                    |               |                    |                    |  |                    |                         |  |



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| APPLICATION<br>NUMBER | FILING or<br>371(c) DATE | GRP ART<br>UNIT | FIL FEE REC'D | ATTY. DOCKET NO | TOT CLAIMS | IND CLAIMS |
|-----------------------|--------------------------|-----------------|---------------|-----------------|------------|------------|
| 14/065,516            | 10/29/2013               | 1742            | 0.00          | MBOT-0051-P01   | 25         | 2          |

CONFIRMATION NO. 9906

43520  
STRATEGIC PATENTS P.C.  
P.O. BOX 920629  
NEEDHAM, MA 02492

## FILING RECEIPT



OC000000064963484

Date Mailed: 11/15/2013

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

### Inventor(s)

Aljosa Kemperle, Brooklyn, NY;  
Filipp Gelman, Staten Island, NY;  
Peter Joseph Schmehl, New York, NY;

### Applicant(s)

MakerBot Industries, LLC, Brooklyn, NY

### Assignment For Published Patent Application

MakerBot Industries, LLC, Brooklyn, NY

**Power of Attorney:** The patent practitioners associated with Customer Number 43520

### Domestic Priority data as claimed by applicant

This appln claims benefit of 61/719,874 10/29/2012

**Foreign Applications** for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

*Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.*

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

### If Required, Foreign Filing License Granted: 11/13/2013

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/065,516**

**Projected Publication Date:** To Be Determined - pending completion of Missing Parts

page 1 of 3



**Non-Publication Request:** No

**Early Publication Request:** No

**Title**

THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION

**Preliminary Class**

264

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** Yes

## **PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES**

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

**LICENSE FOR FOREIGN FILING UNDER**  
**Title 35, United States Code, Section 184**  
**Title 37, Code of Federal Regulations, 5.11 & 5.15**

**GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

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**NOT GRANTED**

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 14/065,516         | 10/29/2013            | Aljosa Kemperle       | MBOT-0051-P01          |

**CONFIRMATION NO. 9906**

**POA ACCEPTANCE LETTER**

43520  
STRATEGIC PATENTS P.C.  
P.O. BOX 920629  
NEEDHAM, MA 02492



Date Mailed: 11/15/2013

**NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY**

This is in response to the Power of Attorney filed 10/29/2013.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/gkejela/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

## TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

**NOTE:** This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B or equivalent) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5. If the Power of Attorney by Applicant form is not accompanied by this transmittal form or an equivalent, the Power of Attorney will not be recognized in the application.

|                        |  |
|------------------------|--|
| Application Number     | Not yet known                                  |
| Filing Date            | October 29, 2013                               |
| First Named Inventor   | Aljosa Kemperle                                |
| Title                  | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |
| Art Unit               | Not yet known                                  |
| Examiner Name          | Not yet known                                  |
| Attorney Docket Number | MBOT-0051-P01                                  |

### SIGNATURE of Applicant or Patent Practitioner

|                     |                      |           |                  |
|---------------------|----------------------|-----------|------------------|
| Signature           | /Robert Mazzaresse/  | Date      | October 29, 2013 |
| Name                | Robert A. Mazzaresse | Telephone | 617-916-2658     |
| Registration Number | 42,852               |           |                  |

**NOTE:** This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications.

☐ \*Total of 1 (one) forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

Doc Code: PA...

Document Description: Power of Attorney

PTO/AIA/82B(07-12)  
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## POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in the attached transmittal letter.

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent):

43520

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent):

| Name | Registration Number | Name | Registration Number |
|------|---------------------|------|---------------------|
|      |                     |      |                     |
|      |                     |      |                     |
|      |                     |      |                     |
|      |                     |      |                     |
|      |                     |      |                     |

Please recognize or change the correspondence address for the application identified in the attached transmittal letter to:

☒ The address associated with the above-mentioned Customer Number.

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name:

Address:

City:

State:

Zip:

Country:

Telephone:

Email:

I am the Applicant:

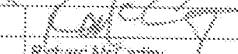
☐ Inventor or Joint Inventor

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor

☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document)

SIGNATURE of Applicant for Patent

|                   |   |           |              |
|-------------------|---|-----------|--------------|
| Signature         |  | Date      | 8-2-13       |
| Name              | Richard McCarthy  | Telephone | 347-304-6800 |
| Title and Company | Corporate Counsel, Merenlot Industries LLC  |           |              |

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms for more than one signature, see below \*.

☒ \*Total of 1 (one) forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to be (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 123 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1480, Alexandria, VA 22313-1480. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1480, Alexandria, VA 22313-1480.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

| Electronic Acknowledgement Receipt          |  |
|---|--|
| <b>EFS ID:</b>                              | 17250923                                       |
| <b>Application Number:</b>                  | 14065516                                       |
| <b>International Application Number:</b>    |  |
| <b>Confirmation Number:</b>                 | 9906   |
| <b>Title of Invention:</b>                  | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |
| <b>First Named Inventor/Applicant Name:</b> | Aljosa Kemperle                                |
| <b>Customer Number:</b>                     | 43520  |
| <b>Filer:</b>                               | John H. Nortrop                                |
| <b>Filer Authorized By:</b>                 |  |
| <b>Attorney Docket Number:</b>              | MBOT-0051-P01                                  |
| <b>Receipt Date:</b>                        | 29-OCT-2013                                    |
| <b>Filing Date:</b>                         |  |
| <b>Time Stamp:</b>                          | 10:46:13                                       |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                    |

### Payment information:

|                        |    |
|------------------------|----|
| Submitted with Payment | no |
|------------------------|----|

### File Listing:

| Document Number | Document Description   | File Name                    | File Size(Bytes)/<br>Message Digest                 | Multi Part /.zip | Pages (if appl.) |
|-----------------|------------------------|------------------------------|---|------------------|------------------|
| 1               | Application Data Sheet | MBOT-0051-P01_102913_ADS.pdf | 1503591<br>a00141a15f6e47496cea7223b9247cd3cb1be1a1 | no               | 7                |

### Warnings:

### Information:

|  |  |  |   |            |    |
|--|--|--|---|------------|----|
| 2  | Drawings-only black and white line drawings                | MBOT-0051-P01_102913_Drawings.pdf      | 37331<br>f5e1dd6d8298e22c3b8b61ffcdac1b3ba0b9a12b   | no         | 5  |
| <b>Warnings:</b>   |  |  |   |            |    |
| <b>Information:</b>  |  |  |   |            |    |
| 3  |  | MBOT-0051-P01_102913_Specification.pdf | 122978<br>5eefaffd965c46081392c20ac8b8becfbc0e84d   | yes        | 23 |
|  | <b>Multipart Description/PDF files in .zip description</b> |  |   |            |    |
|  | <b>Document Description</b>                                |  | <b>Start</b>  | <b>End</b> |    |
|  | Specification  |  | 1   | 18         |    |
|  | Claims   |  | 19  | 22         |    |
|  | Abstract   |  | 23  | 23         |    |
| <b>Warnings:</b>   |  |  |   |            |    |
| <b>Information:</b>  |  |  |   |            |    |
| 4  | Power of Attorney  | MBOT-0051-P01_102913_POA.pdf           | 1557327<br>c49dc606aa9edf2e01062fc0936685dc8341ce8c | no         | 2  |
| <b>Warnings:</b>   |  |  |   |            |    |
| <b>Information:</b>  |  |  |   |            |    |
| <b>Total Files Size (in bytes):</b>  |  |  | 3221227   |            |    |
| <p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |  |  |   |            |    |

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|   |  |                               |               |
|---|--|-------------------------------|---------------|
| <b>Application Data Sheet 37 CFR 1.76</b>   |  | <b>Attorney Docket Number</b> | MBOT-0051-P01 |
|   |  | <b>Application Number</b>     |               |
| <b>Title of Invention</b>   | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |                               |               |
| <p>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.</p> <p>This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</p> |  |                               |               |

## Secrecy Order 37 CFR 5.2

|  |
|--|
| <input type="checkbox"/> Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.) |
|--|

## Inventor Information:

|   |                   |                                |                    |                               |               |
|---|-------------------|--------------------------------|--------------------|-------------------------------|---------------|
| <b>Inventor 1</b>   |                   |                                |                    |                               | <b>Remove</b> |
| <b>Legal Name</b>   |                   |                                |                    |                               |               |
| <b>Prefix</b>   | <b>Given Name</b> | <b>Middle Name</b>             | <b>Family Name</b> | <b>Suffix</b>                 |               |
|   | Aljosa            |                                | Kemperle           |                               |               |
| <b>Residence Information (Select One)</b> <input checked="" type="radio"/> US Residency <input type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |                   |                                |                    |                               |               |
| <b>City</b>   | Brooklyn          | <b>State/Province</b>          | NY                 | <b>Country of Residence i</b> | US            |
| <b>Mailing Address of Inventor:</b>   |                   |                                |                    |                               |               |
| <b>Address 1</b>  |                   | MakerBot Industries, LLC       |                    |                               |               |
| <b>Address 2</b>  |                   | 1 Metrotech Center, 21st Floor |                    |                               |               |
| <b>City</b>   | Brooklyn          | <b>State/Province</b>          | NY                 |                               |               |
| <b>Postal Code</b>  |                   | 11201                          | <b>Country i</b>   | US                            |               |
| <b>Inventor 2</b>   |                   |                                |                    |                               | <b>Remove</b> |
| <b>Legal Name</b>   |                   |                                |                    |                               |               |
| <b>Prefix</b>   | <b>Given Name</b> | <b>Middle Name</b>             | <b>Family Name</b> | <b>Suffix</b>                 |               |
|   | Filipp            |                                | Gelman             |                               |               |
| <b>Residence Information (Select One)</b> <input checked="" type="radio"/> US Residency <input type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |                   |                                |                    |                               |               |
| <b>City</b>   | Staten Island     | <b>State/Province</b>          | NY                 | <b>Country of Residence i</b> | US            |
| <b>Mailing Address of Inventor:</b>   |                   |                                |                    |                               |               |
| <b>Address 1</b>  |                   | MakerBot Industries, LLC       |                    |                               |               |
| <b>Address 2</b>  |                   | 1 Metrotech Center, 21st Floor |                    |                               |               |
| <b>City</b>   | Brooklyn          | <b>State/Province</b>          | NY                 |                               |               |
| <b>Postal Code</b>  |                   | 11201                          | <b>Country i</b>   | US                            |               |
| <b>Inventor 3</b>   |                   |                                |                    |                               | <b>Remove</b> |
| <b>Legal Name</b>   |                   |                                |                    |                               |               |
| <b>Prefix</b>   | <b>Given Name</b> | <b>Middle Name</b>             | <b>Family Name</b> | <b>Suffix</b>                 |               |
|   | Peter             | Joseph                         | Schmehl            |                               |               |
| <b>Residence Information (Select One)</b> <input checked="" type="radio"/> US Residency <input type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |                   |                                |                    |                               |               |



|   |          |  |    |                        |            |
|---|----------|--|----|------------------------|------------|
| <b>Application Data Sheet 37 CFR 1.76</b>   |          | Attorney Docket Number                         |    | MBOT-0051-P01          |            |
|   |          | Application Number                             |    |                        |            |
| Title of Invention  |          | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |    |                        |            |
| City  | New York | State/Province                                 | NY | Country of Residence i | US         |
| <b>Mailing Address of Inventor:</b>   |          |  |    |                        |            |
| Address 1   |          | MakerBot Industries, LLC                       |    |                        |            |
| Address 2   |          | 1 Metrotech Center, 21st Floor                 |    |                        |            |
| City  | Brooklyn | State/Province                                 | NY |                        |            |
| Postal Code   | 11201    | Country i                                      | US |                        |            |
| All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the <b>Add</b> button. |          |  |    |                        | <b>Add</b> |

**Correspondence Information:**

|   |                      |                  |                     |
|---|----------------------|------------------|---------------------|
| Enter either Customer Number or complete the Correspondence Information section below.<br>For further information see 37 CFR 1.33(a). |                      |                  |                     |
| <input type="checkbox"/> An Address is being provided for the correspondence information of this application.                         |                      |                  |                     |
| Customer Number   | 43520                |                  |                     |
| Email Address   | patents@stratpat.com | <b>Add Email</b> | <b>Remove Email</b> |

**Application Information:**

|   |  |  |  |
|---|--|--|--|
| Title of the Invention                  | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |  |  |
| Attorney Docket Number                  | MBOT-0051-P01                                  | Small Entity Status Claimed <input type="checkbox"/> |  |
| Application Type                        | Nonprovisional                                 |  |  |
| Subject Matter                          | Utility  |  |  |
| Total Number of Drawing Sheets (if any) | 5  | Suggested Figure for Publication (if any)            |  |

**Publication Information:**

|  |
|--|
| <input type="checkbox"/> Request Early Publication (Fee required at time of Request 37 CFR 1.219)  |
| <input type="checkbox"/> <b>Request Not to Publish.</b> I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application <b>has not and will not</b> be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing. |

**Representative Information:**

|   |                                   |                       |                        |
|---|-----------------------------------|-----------------------|------------------------|
| Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing. |                                   |                       |                        |
| Please Select One:  |                                   |                       |                        |
| <input checked="" type="radio"/>  | Customer Number                   | <input type="radio"/> | US Patent Practitioner |
| <input type="radio"/>   | Limited Recognition (37 CFR 11.9) |                       |                        |

|   |  |                        |               |
|---|--|------------------------|---------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |  | Attorney Docket Number | MBOT-0051-P01 |
|   |  | Application Number     |               |
| Title of Invention                        | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |                        |               |
| Customer Number                           | 43520  |                        |               |

### Domestic Benefit/National Stage Information:

|  |                    |                          |                          |
|--|--------------------|--------------------------|--------------------------|
| This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78. |                    |                          |                          |
| Prior Application Status   | Pending            | <a href="#">Remove</a>   |                          |
| Application Number   | Continuity Type    | Prior Application Number | Filing Date (YYYY-MM-DD) |
|  | non provisional of | 61/719874                | 2012-10-29               |
| Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the <b>Add</b> button.  |                    |                          | <a href="#">Add</a>      |

### Foreign Priority Information:

|   |                      |                          |  |
|---|----------------------|--------------------------|--|
| This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1). |                      |                          |  |
|   |                      |                          | <a href="#">Remove</a>                   |
| Application Number  | Country <sup>i</sup> | Filing Date (YYYY-MM-DD) | Access Code <sup>1</sup> (if applicable) |
|   |                      |                          |  |
| Additional Foreign Priority Data may be generated within this form by selecting the <b>Add</b> button.  |                      |                          | <a href="#">Add</a>                      |

### Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

|  |
|--|
| <input checked="" type="checkbox"/> This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. |
|--|

### Authorization to Permit Access:

|   |  |                        |               |
|---|--|------------------------|---------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |  | Attorney Docket Number | MBOT-0051-P01 |
|   |  | Application Number     |               |
| Title of Invention                        | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |                        |               |

|  |
|--|
| <input checked="" type="checkbox"/> <b>Authorization to Permit Access to the Instant Application by the Participating Offices</b>  |
| <p>If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.</p> <p>In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.</p> <p>In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.</p> |

## Applicant Information:

|   |  |                                       |
|---|--|---------------------------------------|
| Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.   |  |                                       |
| <b>Applicant 1</b>  |  | <input type="button" value="Remove"/> |
| <p>If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.</p> |  |                                       |
|   |  | <input type="button" value="Clear"/>  |
| <input checked="" type="radio"/> Assignee   | <input type="radio"/> Legal Representative under 35 U.S.C. 117         | <input type="radio"/> Joint Inventor  |
| <input type="radio"/> Person to whom the inventor is obligated to assign.   | <input type="radio"/> Person who shows sufficient proprietary interest |                                       |
| If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:   |  |                                       |
|   |  |                                       |
| Name of the Deceased or Legally Incapacitated Inventor :  |  |                                       |
| If the Applicant is an Organization check here. <input checked="" type="checkbox"/>   |  |                                       |
| Organization Name   | MakerBot Industries, LLC   |                                       |

|   |  |                        |               |
|---|--|------------------------|---------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |  | Attorney Docket Number | MBOT-0051-P01 |
|   |  | Application Number     |               |
| Title of Invention                        | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |                        |               |

|   |    |                    |                   |
|---|----|--------------------|-------------------|
| <b>Mailing Address Information:</b>   |    |                    |                   |
| Address 1   |    | 1 Metrotech Center |                   |
| Address 2   |    | 21st Floor         |                   |
| City  |    | Brooklyn           | State/Province NY |
| Country i   | US | Postal Code        | 11201             |
| Phone Number  |    | Fax Number         |                   |
| Email Address   |    |                    |                   |
| Additional Applicant Data may be generated within this form by selecting the Add button. <span>Add</span> |    |                    |                   |

## Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

|  |            |             |                |        |
|--|------------|-------------|----------------|--------|
| <b>Assignee 1</b>  |            |             |                |        |
| Complete this section only if non-applicant assignee information is desired to be included on the patent application publication in accordance with 37 CFR 1.215(b). Do not include in this section an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest), as the patent application publication will include the name of the applicant(s). |            |             |                |        |
| <span>Remove</span>  |            |             |                |        |
| If the Assignee is an Organization check here. <input type="checkbox"/>  |            |             |                |        |
| Prefix   | Given Name | Middle Name | Family Name    | Suffix |
|  |            |             |                |        |
| <b>Mailing Address Information:</b>  |            |             |                |        |
| Address 1  |            |             |                |        |
| Address 2  |            |             |                |        |
| City   |            |             | State/Province |        |
| Country i  |            | Postal Code |                |        |
| Phone Number   |            | Fax Number  |                |        |
| Email Address  |            |             |                |        |
| Additional Assignee Data may be generated within this form by selecting the Add button. <span>Add</span>   |            |             |                |        |

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|   |  |                        |               |
|---|--|------------------------|---------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |  | Attorney Docket Number | MBOT-0051-P01 |
|   |  | Application Number     |               |
| Title of Invention                        | THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION |                        |               |

**Signature:**

Remove

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications

|   |                   |                  |         |                            |            |
|---|-------------------|------------------|---------|----------------------------|------------|
| <b>Signature</b>  | /John H. Nortrup/ |                  |         | <b>Date (YYYY-MM-DD)</b>   | 2013-10-29 |
| <b>First Name</b>   | John              | <b>Last Name</b> | Nortrup | <b>Registration Number</b> | 59063      |
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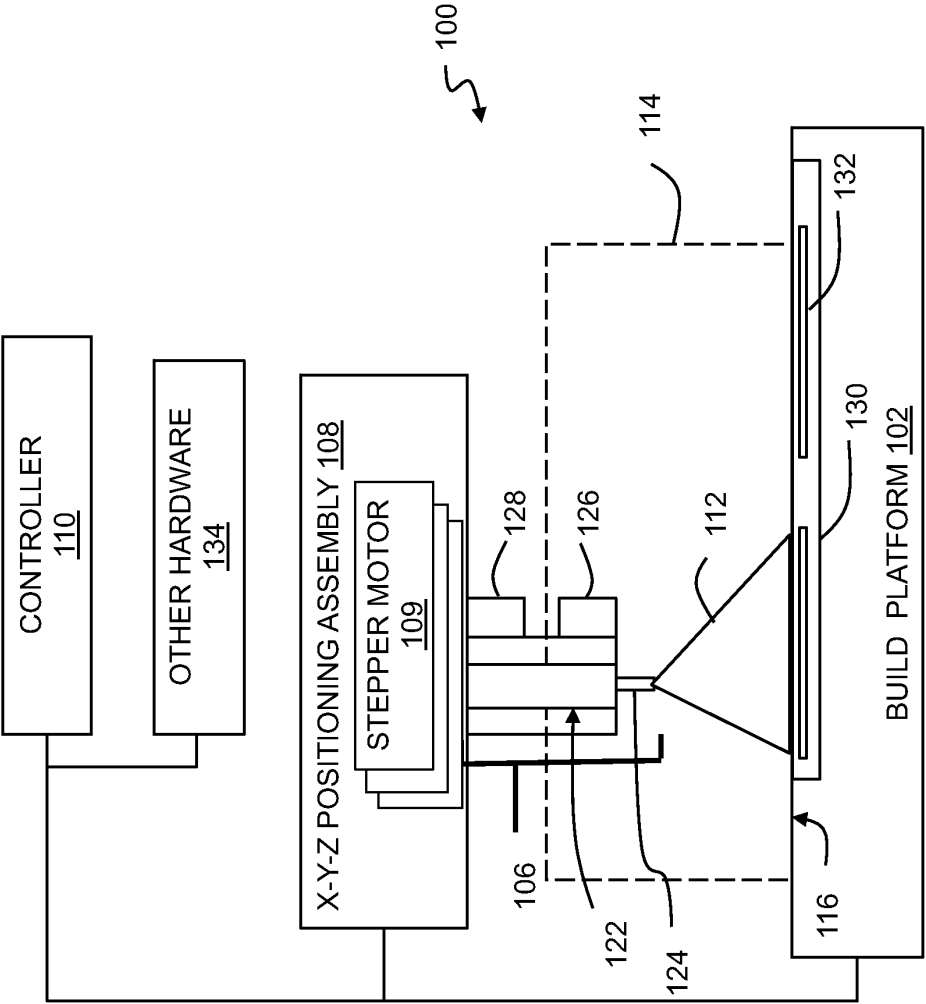
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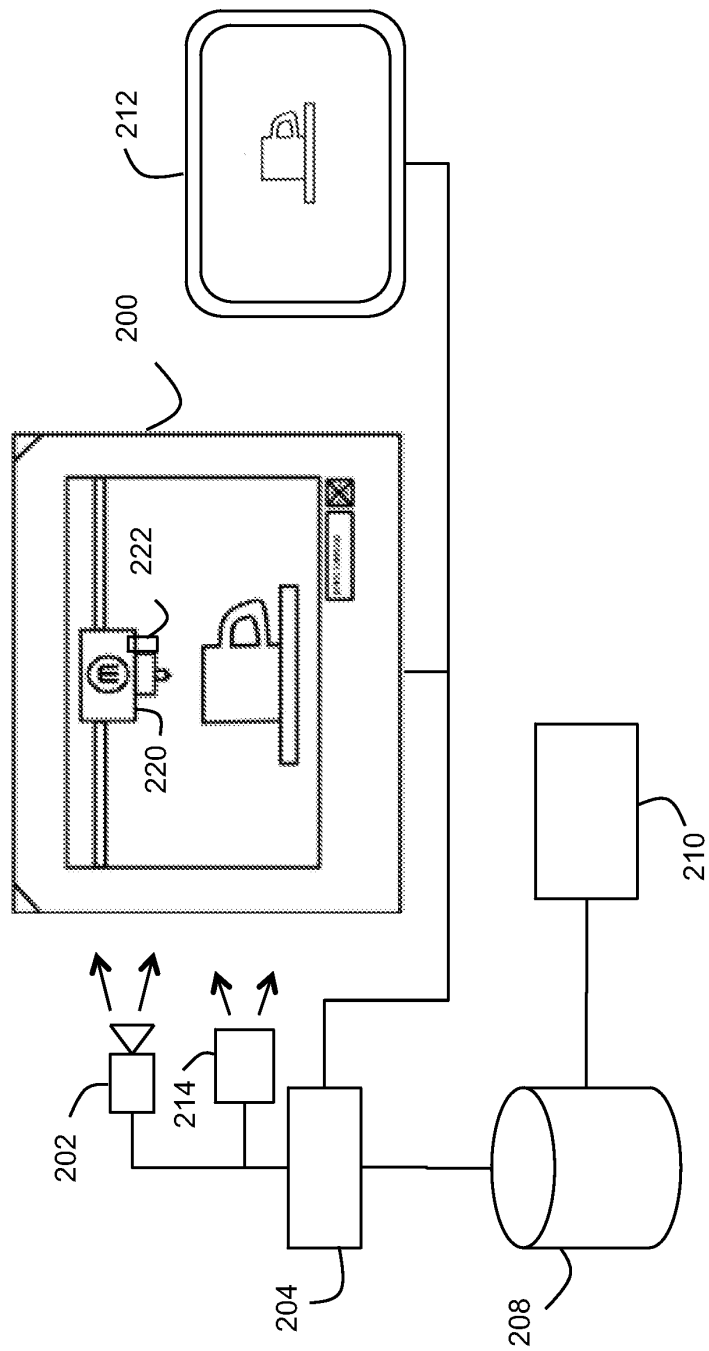
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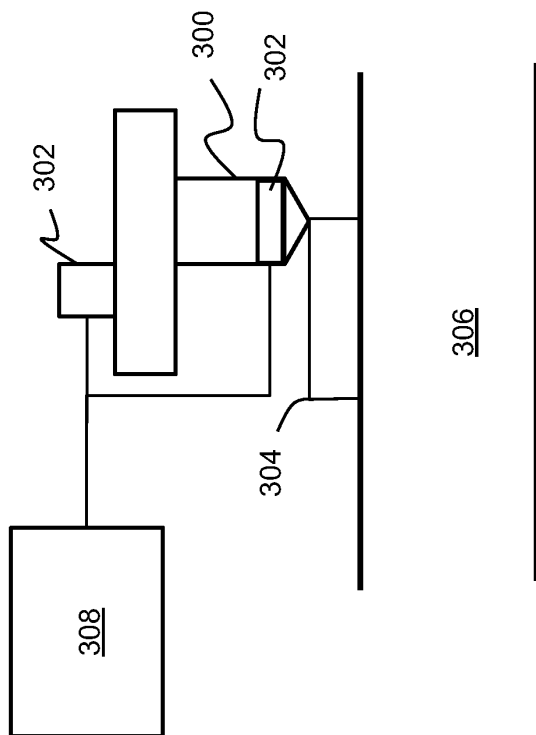


**Fig. 1**

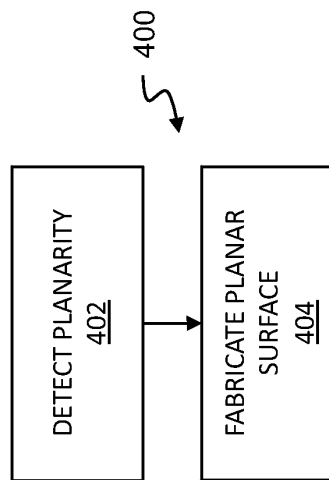


**Fig. 2**

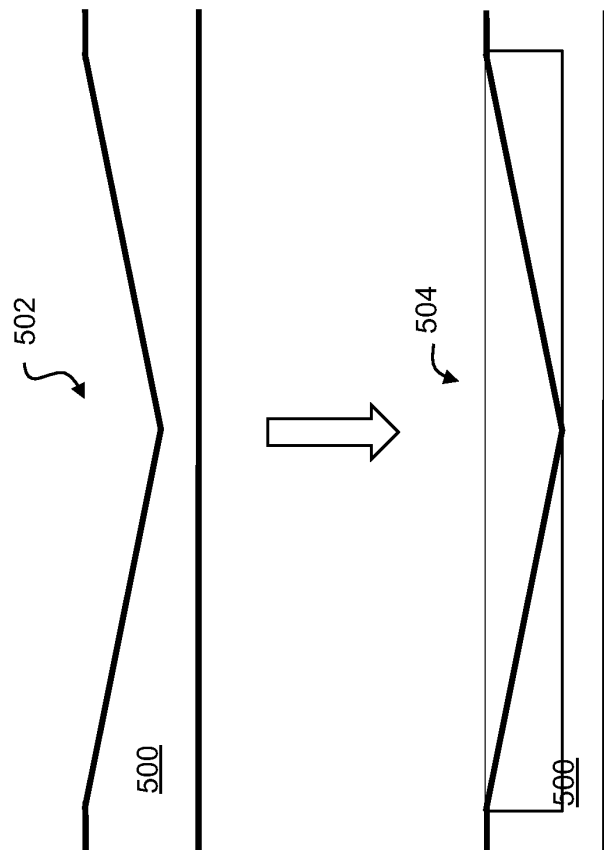




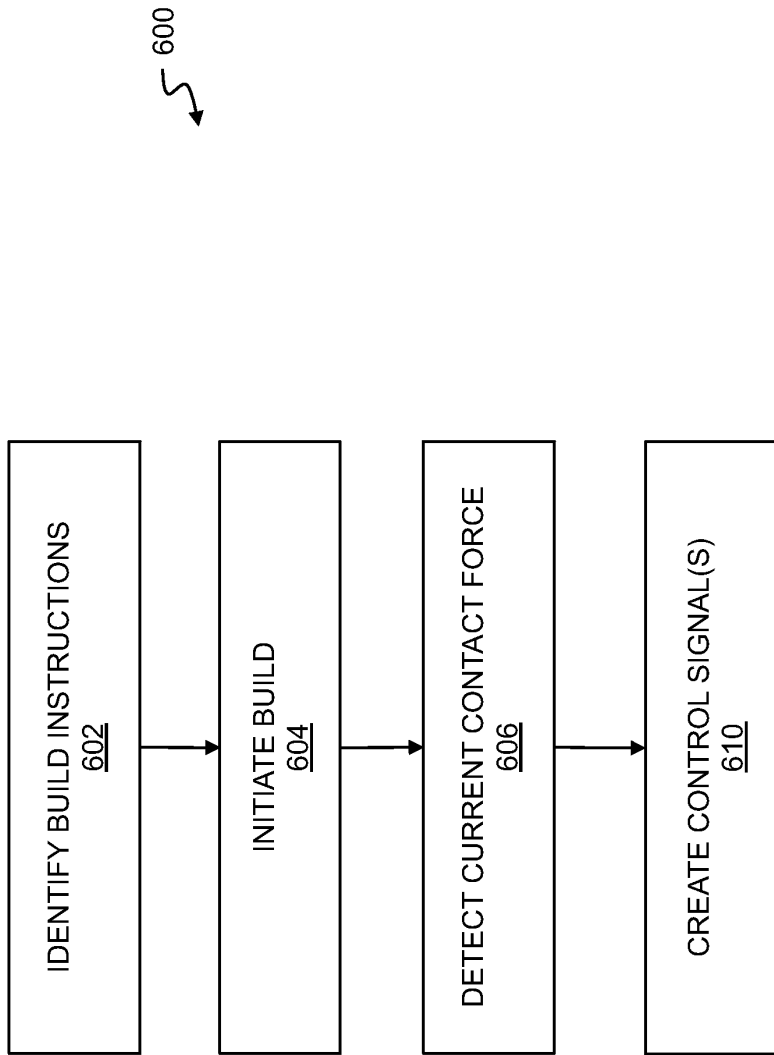
**Fig. 3**



**Fig. 4**



**Fig. 5**

**Fig. 6**

**THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION****RELATED APPLICATIONS**

**[0001]** This application claims the benefit of U.S. Pat. App. 61/719,874, filed October 29, 2012, the entirety of which is incorporated by reference herein.

**BACKGROUND**

**[0002]** Three-dimensional printers can be used to fabricate various desired objects based on computer models of those objects. However, components of the three-dimensional printer may degrade with time – i.e., become dented, warped, misaligned, etc. These errors may disadvantageously affect the ability of the three-dimensional printer to accurately fabricate objects. There remains a need for pressure-sensing extruders and methods for using same.

**SUMMARY**

**[0003]** An extruder or other tool head of a three-dimensional printer is instrumented to detect contact force against the extruder, such as by a build platform or an object being fabricated. The tool head may also be instrumented to detect deflection forces and the like acting on the tool that might indicate an operating error. The resulting feedback data can be used in a variety of ways to control operation of the three-dimensional printer during fabrication or diagnostics.

**BRIEF DESCRIPTION OF THE FIGURES**

**[0004]** The invention and the following detailed description of certain embodiments thereof may be understood by reference to the following figures:

**[0005]** Fig. 1 is a block diagram of a three-dimensional printer.

**[0006]** Fig. 2 shows a three-dimensional printer.

**[0007]** Fig. 3 is a block diagram of a fabrication tool for use in a three-dimensional printer.

**[0008]** Fig. 4 is a flowchart of a process for using an instrumented fabrication tool.

[0009] Fig. 5 shows a cross section of a leveling operation.

[0010] Fig. 6 is a flowchart of a process for fabricating an object.

#### DETAILED DESCRIPTION

[0011] All documents mentioned herein are hereby incorporated in their entirety by reference. References to items in the singular should be understood to include items in the plural, and vice versa, unless explicitly stated otherwise or clear from the text. Grammatical conjunctions are intended to express any and all disjunctive and conjunctive combinations of conjoined clauses, sentences, words, and the like, unless otherwise stated or clear from the context. Thus the term “or” should generally be understood to mean “and/or” and so forth.

[0012] The following description emphasizes three-dimensional printers using fused deposition modeling or similar techniques where a bead of material is extruded in a layered series of two dimensional patterns as “roads,” “paths” or the like to form a three-dimensional object from a digital model. It will be understood, however, that numerous additive fabrication techniques are known in the art including without limitation multijet printing, stereolithography, Digital Light Processor (“DLP”) three-dimensional printing, selective laser sintering, and so forth. Such techniques may benefit from the systems and methods described below, and all such printing technologies are intended to fall within the scope of this disclosure, and within the scope of terms such as “printer”, “three-dimensional printer”, “fabrication system”, and so forth, unless a more specific meaning is explicitly provided or otherwise clear from the context.

[0013] Fig. 1 is a block diagram of a three-dimensional printer. In general, the printer 100 may include a build platform 102, an extruder 106, an x-y-z positioning assembly 108, and a controller 110 that cooperate to fabricate an object 112 within a working volume 114 of the printer 100.

[0014] The build platform 102 may include a surface 116 that is rigid and substantially planar. The surface 116 may provide a fixed, dimensionally and positionally stable platform on which to build the object 112. The build platform 102 may include a thermal element 130 that controls the temperature of the build platform 102 through one or more active devices 132, such as resistive elements that convert electrical current into

heat, Peltier effect devices that can create a heating or cooling affect, or any other thermoelectric heating and/or cooling devices. The thermal element 130 may be coupled in a communicating relationship with the controller 110 in order for the controller 110 to controllably impart heat to or remove heat from the surface 116 of the build platform 102.

[0015] The extruder 106 may include a chamber 122 in an interior thereof to receive a build material. The build material may, for example, include acrylonitrile butadiene styrene (“ABS”), high-density polyethylene (“HDPE”), polylactic acid (“PLA”), or any other suitable plastic, thermoplastic, or other material that can usefully be extruded to form a three-dimensional object. The extruder 106 may include an extrusion tip 124 or other opening that includes an exit port with a circular, oval, slotted or other cross-sectional profile that extrudes build material in a desired cross-sectional shape.

[0016] The extruder 106 may include a heater 126 (also referred to as a heating element) to melt thermoplastic or other meltable build materials within the chamber 122 for extrusion through an extrusion tip 124 in liquid form. While illustrated in block form, it will be understood that the heater 126 may include, e.g., coils of resistive wire wrapped about the extruder 106, one or more heating blocks with resistive elements to heat the extruder 106 with applied current, an inductive heater, or any other arrangement of heating elements suitable for creating heat within the chamber 122 sufficient to melt the build material for extrusion. The extruder 106 may also or instead include a motor 128 or the like to push the build material into the chamber 122 and/or through the extrusion tip 124.

[0017] In general operation (and by way of example rather than limitation), a build material such as ABS plastic in filament form may be fed into the chamber 122 from a spool or the like by the motor 128, melted by the heater 126, and extruded from the extrusion tip 124. By controlling a rate of the motor 128, the temperature of the heater 126, and/or other process parameters, the build material may be extruded at a controlled volumetric rate. It will be understood that a variety of techniques may also or instead be employed to deliver build material at a controlled volumetric rate, which may depend upon the type of build material, the volumetric rate desired, and any other factors. All such techniques that might be suitably adapted to delivery of build material for

fabrication of a three-dimensional object are intended to fall within the scope of this disclosure.

**[0018]** The x-y-z positioning assembly 108 may generally be adapted to three-dimensionally position the extruder 106 and the extrusion tip 124 within the working volume 114. Thus by controlling the volumetric rate of delivery for the build material and the x, y, z position of the extrusion tip 124, the object 112 may be fabricated in three dimensions by depositing successive layers of material in two-dimensional patterns derived, for example, from cross-sections of a computer model or other computerized representation of the object 112. A variety of arrangements and techniques are known in the art to achieve controlled linear movement along one or more axes. The x-y-z positioning assembly 108 may, for example, include a number of stepper motors 109 to independently control a position of the extruder 106 within the working volume along each of an x-axis, a y-axis, and a z-axis. More generally, the x-y-z positioning assembly 108 may include without limitation various combinations of stepper motors, encoded DC motors, gears, belts, pulleys, worm gears, threads, and so forth. For example, in one aspect the build platform 102 may be coupled to one or more threaded rods by a threaded nut so that the threaded rods can be rotated to provide z-axis positioning of the build platform 102 relative to the extruder 124. This arrangement may advantageously simplify design and improve accuracy by permitting an x-y positioning mechanism for the extruder 124 to be fixed relative to a build volume. Any such arrangement suitable for controllably positioning the extruder 106 within the working volume 114 may be adapted to use with the printer 100 described herein.

**[0019]** In general, this may include moving the extruder 106, or moving the build platform 102, or some combination of these. Thus it will be appreciated that any reference to moving an extruder relative to a build platform, working volume, or object, is intended to include movement of the extruder or movement of the build platform, or both, unless a more specific meaning is explicitly provided or otherwise clear from the context. Still more generally, while an x, y, z coordinate system serves as a convenient basis for positioning within three dimensions, any other coordinate system or combination of coordinate systems may also or instead be employed, such as a positional controller and assembly that operates according to cylindrical or spherical coordinates.

**[0020]** The controller 110 may be electrically or otherwise coupled in a communicating relationship with the build platform 102, the x-y-z positioning assembly 108, and the other various components of the printer 100. In general, the controller 110 is operable to control the components of the printer 100, such as the build platform 102, the x-y-z positioning assembly 108, and any other components of the printer 100 described herein to fabricate the object 112 from the build material. The controller 110 may include any combination of software and/or processing circuitry suitable for controlling the various components of the printer 100 described herein including without limitation microprocessors, microcontrollers, application-specific integrated circuits, programmable gate arrays, and any other digital and/or analog components, as well as combinations of the foregoing, along with inputs and outputs for transceiving control signals, drive signals, power signals, sensor signals, and so forth. In one aspect, this may include circuitry directly and physically associated with the printer 100 such as an on-board processor. In another aspect, this may be a processor associated with a personal computer or other computing device coupled to the printer 100, e.g., through a wired or wireless connection. Similarly, various functions described herein may be allocated between an on-board processor for the printer 100 and a separate computer. All such computing devices and environments are intended to fall within the meaning of the term “controller” or “processor” as used herein, unless a different meaning is explicitly provided or otherwise clear from the context.

**[0021]** A variety of additional sensors and other components may be usefully incorporated into the printer 100 described above. These other components are generically depicted as other hardware 134 in Fig. 1, for which the positioning and mechanical/electrical interconnections with other elements of the printer 100 will be readily understood and appreciated by one of ordinary skill in the art. The other hardware 134 may include a temperature sensor positioned to sense a temperature of the surface of the build platform 102, the extruder 126, or any other system components. This may, for example, include a thermistor or the like embedded within or attached below the surface of the build platform 102. This may also or instead include an infrared detector or the like directed at the surface 116 of the build platform 102.



**[0022]** In another aspect, the other hardware 134 may include a sensor to detect a presence of the object 112 at a predetermined location. This may include an optical detector arranged in a beam-breaking configuration to sense the presence of the object 112 at a predetermined location. This may also or instead include an imaging device and image processing circuitry to capture an image of the working volume and to analyze the image to evaluate a position of the object 112. This sensor may be used for example to ensure that the object 112 is removed from the build platform 102 prior to beginning a new build on the working surface 116. Thus the sensor may be used to determine whether an object is present that should not be, or to detect when an object is absent. The feedback from this sensor may be used by the controller 110 to issue processing interrupts or otherwise control operation of the printer 100.

**[0023]** The other hardware 134 may also or instead include a heating element (instead of or in addition to the thermal element 130) to heat the working volume such as a radiant heater or forced hot air heater to maintain the object 112 at a fixed, elevated temperature throughout a build, or the other hardware 134 may include a cooling element to cool the working volume.

**[0024]** Fig. 2 shows a three-dimensional printer. The printer 200 may include a camera 202 and a processor 204. The printer 200 may be configured for augmented operation using two-dimensional data acquired from the camera 202.

**[0025]** The printer 200 may, for example, be any of the three-dimensional printers described above.

**[0026]** The camera 202 may be any digital still camera, video camera, or other image sensor(s) positioned to capture images of the printer 200, or the working volume of the printer 200.

**[0027]** The processor 204, which may be an internal processor of the printer 200, an additional processor provided for augmented operation as contemplated herein, a processor of a desktop computer or the like locally coupled to the printer 200, a server or other processor coupled to the printer 200 through a data network, or any other processor or processing circuitry. In general, the processor 204 may be configured to control operation of the printer 200 to fabricate an object from a build material. The processor 204 may be further configured to adjust a parameter of the printer 200 based upon an

analysis of the object in the image. It should be appreciated that the processor 204 may include a number of different processors cooperating to perform the steps described herein, such as where an internal processor of the printer 200 controls operation of the printer 200 while a connected processor of a desktop computer performs image processing used to control print parameters.

**[0028]** A variety of parameters may be usefully adjusted during a fabrication process. For example, the parameter may be a temperature of the working volume. This temperature may be increased or decreased based upon, e.g., an analysis of road dimensions (e.g. height and width of line of deposited build material), or the temperature may be adjusted according to a dimensional stability of a partially fabricated object. Thus, where sagging or other variations from an intended shape are detected, the temperature may be decreased. Similarly, where cooling-induced warping or separation of layers is detected, the temperature may be increased. The working volume temperature may be controlled using a variety of techniques such as with active heating elements and/or use of heated or cooled air circulating through the working volume.

**[0029]** Another parameter that may be usefully controlled according to the camera image is the temperature of a build platform in the working volume. For example, the camera 202 may capture an image of a raft or other base layer for a fabrication, or a first layer of the fabricated object, and may identify defects such as improper spacing between adjacent lines of build material or separation of the initial layer from the build platform. The temperature of the build platform may in such cases be heated in order to alleviate cooling-induced warping of the fabricated object at the object-platform interface.

**[0030]** Another parameter that may be usefully controlled according to an analysis of the camera image is the extrusion temperature of an extruder. By heating or cooling the extruder, the viscosity of a build material may be adjusted in order to achieve a desired material deposition rate and shape, as well as appropriate adhesion to underlying layers of build material. Where roads of material deviate from a predetermined cross-sectional shape, or otherwise contain visible defects, the extrusion temperature of the extruder may be adjusted to compensate for such defects.

[0031] Similarly, the parameter may be an extrusion rate of a build material from the extruder. By controlling a drive motor or other hardware that forces build material through the extruder, the volumetric rate of material delivery may be controlled, such as to reduce gaps between adjacent lines of build material, or to reduce bulges due to excess build material.

[0032] In another aspect, the parameter may be a viscosity of build material, which may be controlled, e.g., by controlling the extruder temperature or any other controllable element that can transfer heat to and from build material as it passes through the extruder. It will be understood that temperature control is one technique for controlling viscosity, but other techniques are known and may be suitably employed, such as by selectively delivering a solvent or the like into the path of the build material in order to control thermal characteristics of the build material.

[0033] Another parameter that may be usefully controlled is a movement speed of the extruder during an extrusion. By changing the rate of travel of the extruder, other properties of the build (e.g., road thickness, spatial rate of material delivery, and so forth) may be controlled in response to images captured by the camera 202 and analyzed by the processor 204.

[0034] In another aspect, the parameter may be a layer height. By controlling the z-positioning hardware of the printer 200, the layer height may be dynamically adjusted during a build.

[0035] The printer may include a memory 208, such as a local memory or a remote storage device, that stores a log of data for an object being fabricated including without limitation a value or one or more of the parameters described above, or any other data relating to a print. The memory 208 may also or instead store a log of data aggregated from a number of fabrications of a particular object, which may include data from the printer 200 and/or data from a number of other three-dimensional printers.

[0036] A second processor 210, such as a processor on a server or other remote processing resource, may be configured to analyze the log of data in the memory 208 to identify a feature of the object that is difficult to print. For example, where a corner, overhang, or the like consistently fails, this may be identified by analysis of the log of data, particularly where such failures can be automatically detected based upon analysis

of images from the camera 202. Such failures may be logged in any suitable manner including quantitatively as data characterizing the failure (based upon image analysis), metadata (e.g., percent completion, build parameters, and so forth) and/or a simple failure flag, which may be accompanied by an image of the failed build. In this manner, the second processor 210 can identify features that should be avoided in printable models, and/or objects that are generally difficult or impossible to print. The second processor 210 may also or instead be configured to analyze the results of variations in one or more of the parameters described above. It will be understood that, while the second processor 210 may be usefully located on a remote processing resource such as a server, the second processor 210 may also be the same as the processor 204, with logging and related analysis performed locally by the printer 200 or a locally coupled computer.

[0037] The printer 200 may optionally include a display 212 configured to display a view of the working volume. The display 212, which may obtain images of the working volume from the camera 202 or any other suitable imaging hardware, may be configured, e.g., by the processor 204, to superimpose thermal data onto the view of the working volume. This may, for example, include thermistor data or data from other temperature sensors or similar instrumentation on the printer 200. For example, the printer 200 may include sensors for measuring a temperature of at least one of the extruder, the object, the build material, the working volume, an ambient temperature outside the working volume, and a build platform within the working volume. These and any similar instrumentation may be used to obtain thermal data correlated to specific or general regions within and without the printer 200. Where the camera 202 includes an infrared camera, the thermal data may also or instead include an infrared image, or a thermal image derived from such an infrared image.

[0038] The display 212 may serve other useful purposes. For example, the view from the camera 202 may be presented in the display. The processor 204 may be configured to render an image of a three-dimensional model used to fabricate an object from the pose of the camera 202. If the camera 202 is a fixed camera then the pose may be a predetermined pose corresponding to the camera position and orientation. If the camera 202 is a moving camera, the processor 204 may be further programmed to determine a pose of the camera 202 based upon, e.g., fiducials or known, visually

identifiable objects within the working volume such as corners of a build platform or a tool head, or to determine the pose using data from sensors coupled to the camera and/or from any actuators used to move the camera. The rendered image of the three-dimensional model rendered from this pose may be superimposed on the view of the working volume within the display 212. In this manner, the printer 200 may provide a preview of an object based upon a digital three-dimensional model, which preview may be rendered within the display 212 for the printer, or a user interface of the display, with the as-fabricated size, orientation, and so forth. In order to enhance the preview, other features such as build material color may also be rendered using texture mapping or the like for the rendered image. This may assist a user in selecting build material, scaling, and so forth for an object that is to be fabricated from a digital model.

**[0039]** In another aspect, the printer 200 may optionally include a sensor 214 for capturing three-dimensional data from the object. A variety of suitable sensors are known in the art, such as a laser sensor, an acoustical range finding sensor, an x-ray sensor, and a millimeter wave radar system, any of which may be adapted alone or in various combinations to capture three-dimensional data. The display 212 may be configured to superimpose such three-dimensional data onto the display of the object within the working volume. In this manner, the processor 204 may detect one or more dimensional inaccuracies in the object, such as by comparison of three-dimensional measurements to a digital model used to fabricate the object. These may be presented as dimensional annotations within the display 212, or as color-coded regions (e.g., yellow for small deviations, red for large deviations, or any other suitable color scheme) superimposed on the display of the object. The processor 206 may be further configured to show summary data in the display 212 concerning any dimensional inaccuracies detected within the object.

**[0040]** The sensor 214 may more generally include one or more spatial sensors configured to capture data from the object placed within the working volume. The second processor 210 (which may be the processor 204) may convert this data into a digital model of the object, and the processor 204 may be configured to operate the printer 200 to fabricate a geometrically related object within the working volume based upon the digital model. In this manner, the printer 200 may be used for direct replication of objects

simply by placing an object into the working volume, performing a scan to obtain the digital model, removing the object from the working volume, and then fabricating a replica of the object based upon the digital model. More generally, any geometrically related shape may be usefully fabricated using similar techniques.

**[0041]** For example, the geometrically related object may be a three-dimensional copy of the object, which may be a scaled copy, and/or which may be repeated as many times as desired in a single build subject to spatial limitations of the working volume and printer 200. In another aspect, the geometrically related object may include material to enclose a portion of the object. In this manner, a container or other enclosure for the object may be fabricated. In another aspect, the geometrically related object may include a mating surface to the object, e.g., so that the fabricated object can be coupled to the original source object. This may be particularly useful for fabrication of snap on parts such as aesthetic or functional accessories, or any other objects that might be usefully physically mated to other objects. Similarly, a repair piece for a broken object may be fabricated with a surface matched to an exposed surface of the broken object, which surface may be glued or otherwise affixed to the broken object to affect a repair.

**[0042]** The processor 204 may obtain the digital model using, e.g., shape from motion or any other processing technique based upon a sequence of two-dimensional images of an object. The multiple images may be obtained, for example, from a plurality of cameras positioned to provide coverage of different surfaces of the object within the working volume. In another aspect, the one or more spatial sensors may include a single camera configured to navigate around the working volume, e.g., on a track or with an articulating arm. Navigating around the working volume may more generally include circumnavigating the working volume, moving around and/or within the working volume, and/or changing direction to achieve various poses from a single position. The one or more spatial sensors may also or instead include articulating mirrors that can be controlled to obtain multiple views of an object from a single camera.

**[0043]** In another aspect, the one or more spatial sensors 214 may include controllable lighting that can be used, e.g., to obtain different shadowed views of an object that can be interpreted to obtain three-dimensional surface data. The processor 204 (or the second processor 210) may also provide a computer automated design

environment to view and/or modify the digital model so that changes, adjustments, additions, and so forth may be made prior to fabrication.

**[0044]** In another aspect, a tool head 220 of the printer may be usefully supplemented with a camera 222. The tool head 220 may include any tool, such as an extruder or the like, to fabricate an object in the working volume of the printer. In general, the tool head 220 may be spatially controlled by an x-y-z positioning assembly of the printer, and the camera 222 may be affixed to and moving with the tool head 220. The camera 222 may be directed toward the working volume, such as downward toward a build platform, and may provide a useful bird's eye view of an object on the build platform. The processor 204 may be configured to receive an image from the camera and to provide diagnostic information for operation of the three-dimensional printer based upon an analysis of the image.

**[0045]** For example, the diagnostic information may include a determination of a position of the tool head within the working volume. The diagnostic information may also or instead include a determination of whether the three-dimensional printer has effected a color change in build material. The diagnostic information may also or instead include a determination of whether the three-dimensional printer has effected a change from a first build material to a second build material. The diagnostic information may also or instead include an evaluation of whether a build material is extruding correctly from the tool head. The diagnostic information may also or instead include an evaluation of whether an infill for the object is being fabricated correctly. In one aspect, the diagnostic information may include the image from the camera, which may be independently useful as a diagnostic tool.

**[0046]** Where the processor 204 is capable of dynamically modifying tool instructions, the processor 204 may be configured to dynamically generate a pattern to infill the object based, for example, on an outline image of the object or previous infilling patterns identified in the image from the camera.

**[0047]** Fig. 3 is a block diagram of a fabrication tool for use in a three-dimensional printer. The tool 300 may include, for example, an extruder or other tool operable to add build material to an object 304 during a build process as generally described above. One or more sensors 302 may be mechanically coupled or otherwise

included in the fabrication tool 300. Each sensor 302 may be operable to sense a contact force between the fabrication tool 300 and a separate structure, such as the object 304, the build platform 306, or some other structure.

**[0048]** The sensors 302 may collectively or individually sense the contact force along one, two, three, or more pairwise non-parallel axes. For example, a normal force (e.g., instantaneous contact force) between the fabrication tool 300 and the build platform 306 may be sensed; a direction and magnitude of deflection of the tip of the fabrication tool (including displacement and/or force) may be sensed in any positions or directions, etc. More generally, sensors that are collectively operable to sense any force or displacement of the fabrication tool and separate structure, or any related properties such as compression or strain, may be used as sensors 302, so long as the contact force(s) described above may be calculated from the sensed physical characteristics.

**[0049]** In some implementations, sensors 302 may include one or more of capacitive sensors, optical sensors, potentiometric sensors, piezoelectric sensors, or other electromechanical, electromagnetic (e.g., those relying on inductance, the Hall effect, electromagnetic eddy currents, linear variable differential transformers, etc.), acoustical, or other sensors, as well as other sensors or combinations of the foregoing. Strain gauges are one common sensor used for such measurements, and may be suitably adapted for use with the systems and methods disclosed herein, such as by affixing one or more strain gauges to an extruder or other location along a mechanical chain that supports an extruder in an intended position during fabrication. By using a pair of strain gauges, deflection forces may be isolated from normal force.

**[0050]** Each sensor 302 may be in data communication with a controller 308. The data communication may be implemented by any means, including via physical connection (e.g., by wire or fiber optic cable) directly to the controller 308, indirectly through other components, or wirelessly (e.g., via WiFi signal, infrared signal, acoustic signal, etc.). Each sensor 302 may be operable to transmit a signal to the controller, such that the contact force(s) between the fabrication tool and the separate structure may be calculated from the collection of sensor signals 302. As described more fully below, the controller 308 may include circuitry for determining and transmitting, based at least in part on the sensor signals, a control signal to various actuators or other components of the



three-dimensional printer to control the three-dimensional printer in a manner responsive to the detected forces.

**[0051]** Fig. 4 is a flowchart for using an instrumented fabrication tool. In particular, Fig. 4 shows a technique for mitigating planar irregularities in a build surface such as a build platform or a top surface of an object being fabricated.

**[0052]** In one aspect, the process 400 may be performed prior to fabricating a desired object so as to planarize as build platform.

**[0053]** As shown in step 402, the process 400 may begin by detecting the planarity of a surface (e.g., the build platform of a three-dimensional printer). This evaluation may be based upon a number of contact force measurements across the surface. It may be expected that for ideal (e.g., perfectly planar) surfaces and a similarly ideal x-y carriage for positioning a tool, a number of contact force measurements at different locations on the surface should be equal. However, it may occur that some of these contact force measurements are different from others.

**[0054]** The differences amongst the measured contact forces may be attributed to warping of the surface, physical damage to the surface, (e.g., dents, scratches, etc.), the surface having become skewed or misaligned with respect to its intended mounting position in the three-dimensional printer, or other causes. It will be understood that positional measurements may also or instead be suitably employed to planarize a surface as contemplated herein. In some implementations, the surface contact forces may be stored along with corresponding x-y positions on the surface and used later (e.g., during fabrication) to compensate for the measured irregularities, as described more fully below.

**[0055]** Other steps may optionally be performed at this point. For example, where the collection of measurements indicates that the surface is level, but skewed to an x-y plane of a fabrication process, a user alert may be generated notifying the user that the surface (e.g., a build platform) requires leveling. In another aspect, where the collection of measurements indicates gross irregularities that may be difficult to address with added built material, an error message may be created and operation of the three-dimensional printer may be paused or terminated.

**[0056]** As shown in step 404, a layer may be fabricated on the surface that mitigates one or more irregularities in the surface. In some implementations, fabricating

the layer may include: (a) identifying the maximum contact force (or displacement) measured across the surface; (b) at locations where the contact force was measured, depositing an amount of build material at those locations on the surface proportional to the deviation of the contact force measured at that location from the maximum contact force; and (c) at locations where the contact force was not measured, deriving an estimated contact force by interpolation, regression, multi-dimensional curve fitting, or other mathematical model; and (d) depositing an amount of build material at those locations proportional to the deviation of the estimated contact force at that location from the maximum contact force. Equivalently, this process involves filling in gaps in the surface with build material, so that the resultant layer is effectively planar.

**[0057]** This process 400 may be usefully employed prior to initiating a fabrication process in order to ensure a level surface for building. This process 400 may also or instead be used periodically during a fabrication process to ensure that a build remains leveled, or continuously, e.g., by monitoring contact force and controlling flow rate, to maintain a level top surface of an object during fabrication.

**[0058]** Fig. 5 shows a cross section of a leveling operation, such as the leveling process described above. In general, a surface 500 of a build platform (or a top surface of an object being fabricated) may include a dent 502, which is subsequently filled with build material to form the layer 504. Fabrication of additional objects may now be performed on the top surface of the layer, and any errors that may have been introduced by the dent 502 may be mitigated by the layer 504.

**[0059]** Fig. 6 is a flowchart of a process for fabricating an object.

**[0060]** As shown in step, 602, the process 600 may begin with identifying build instructions for fabricating an object. It will be understood that in this context, the term “identifying” is intended to be construed broadly, and may include retrieving instructions from storage, generating machine-ready code from a three-dimensional model, or modifying other machine-ready code prior to fabrication. Regardless of how such instructions are identified, a printer may be provided with instructions that can be executed to fabricate an object.

**[0061]** As shown in step 604, the process 600 may include initiating a build using a three-dimensional printer. The three-dimensional printer may include any of the three-

dimensional printers described above, and may for example include a fabrication tool such as an extruder and one or more sensors such as strain gauges mechanically coupled to the fabrication tool. The one or more sensors may be configured to detect a current contact force between the fabrication tool and the separate structure, and to provide corresponding data to a controller of the three-dimensional printer for use during fabrication.

**[0062]** As shown in step 606, a current contact force may be detected. The current contact force may be used directly as an input to a control program executing on the controller for the three-dimensional printer, or the current contact force may be compared to other data such as a previous contact force or an expected contact force in order to determine an appropriate response. It will be appreciated that other forces may also be sensed and used in feedback systems as contemplated herein. For example, a deflection force on the fabrication tool may be measured, or a positional deflection or displacement may be measured, in order to determine when adjustments might be made or when a process should be paused or terminated due to an inferred failure.

**[0063]** As shown in step 608, the process 600 may include creating a control signal in response to the current contact force. The control signal may be generated, e.g., by the controller, to control at least one component of the three-dimensional printer during a build. For example, the component may be a drive system for a filament of build material or other hardware that controls a feed rate for build material, and the control signal may change the feed rate of build material extruded by an extruder to increase or decrease the current contact force measured by the sensor(s). In another aspect, the component may be a component that controls a z-axis position of an extruder within a build volume of a three-dimensional printer, e.g., by controlling a distance between the extruder and a build platform (or more generally, between a fabrication tool and a separate structure), and the control signal may vary the distance to adjust to maintain relatively steady material deposition while adjusting to surface irregularities. More generally, the controller may adjust to sensed conditions by adjusting any suitable parameter of the three-dimensional printer to obtain an operational target, such as reducing a difference between the current contact force and an expected contact force or a target contact force.

**[0064]** Where a detected current contact force exceeds some threshold, or deviates from an expected value by a certain relative or absolute amount, other actions may be taken. For example, the process 600 may include terminating a build when a difference between the current contact force and the expected contact force indicates a fabrication error.

**[0065]** In another aspect, control data may be incorporated directly into machine ready code for use during fabrication. For example a build instruction in machine-ready code may directly specify a target for the contact force, e.g., as an explicit instruction to achieve or maintain a specified contact force between the fabrication tool and a separate structure. With such an instruction, a control signal may be generated during fabrication that controls one or more components of a three-dimensional printer (e.g., components that control feed rate, z-axis position, extrusion head speed, temperature) to achieve the specified contact force.

**[0066]** In another aspect, the method may include detecting planarity and responsively making corrections as described above with reference to Fig. 4. This leveling process may be performed prior to or concurrently with a fabrication process for an object.

**[0067]** The methods or processes described above, and steps thereof, may be realized in hardware, software, or any combination of these suitable for a particular application. The hardware may include a general-purpose computer and/or dedicated computing device. The processes may be realized in one or more microprocessors, microcontrollers, embedded microcontrollers, programmable digital signal processors, or other programmable device, along with internal and/or external memory. The processes may also, or instead, be embodied in an application specific integrated circuit, a programmable gate array, programmable array logic, or any other device or combination of devices that may be configured to process electronic signals. It will further be appreciated that one or more of the processes may be realized as computer executable code created using a structured programming language such as C, an object oriented programming language such as C++, or any other high-level or low-level programming language (including assembly languages, hardware description languages, and database programming languages and technologies) that may be stored, compiled or interpreted to

run on one of the above devices, as well as heterogeneous combinations of processors, processor architectures, or combinations of different hardware and software.

**[0068]** Thus, in one aspect, each method described above and combinations thereof may be embodied in computer executable code that, when executing on one or more computing devices, performs the steps thereof. In another aspect, the methods may be embodied in systems that perform the steps thereof, and may be distributed across devices in a number of ways, or all of the functionality may be integrated into a dedicated, standalone device or other hardware. In another aspect, means for performing the steps associated with the processes described above may include any of the hardware and/or software described above. All such permutations and combinations are intended to fall within the scope of the present disclosure.

**[0069]** It should further be appreciated that the methods above are provided by way of example. Absent an explicit indication to the contrary, the disclosed steps may be modified, supplemented, omitted, and/or re-ordered without departing from the scope of this disclosure.

**[0070]** The method steps of the invention(s) described herein are intended to include any suitable method of causing such method steps to be performed, consistent with the patentability of the following claims, unless a different meaning is expressly provided or otherwise clear from the context. So for example performing the step of X includes any suitable method for causing another party such as a remote user or a remote processing resource (e.g., a server or cloud computer) to perform the step of X. Similarly, performing steps X, Y and Z may include any method of directing or controlling any combination of such other individuals or resources to perform steps X, Y and Z to obtain the benefit of such steps.

**[0071]** While particular embodiments of the present invention have been shown and described, it will be apparent to those skilled in the art that various changes and modifications in form and details may be made therein without departing from the spirit and scope of this disclosure and are intended to form a part of the invention as defined by the following claims, which are to be interpreted in the broadest sense allowable by law.

## CLAIMS

What is claimed is:

1. A three-dimensional printer comprising:  
a fabrication tool; and  
one or more sensors mechanically coupled to the fabrication tool, wherein the one or more sensors are collectively operable to sense a contact force between the fabrication tool and a separate structure.
2. The three-dimensional printer of claim 1, wherein the fabrication tool includes an extruder.
3. The three-dimensional printer of claim 2, wherein the contact force is a force along an extrusion axis of the extruder.
4. The three-dimensional printer of claim 2 wherein the contact force includes a deflection force exerted by the separate structure on a tip of the extruder.
5. The three-dimensional printer of claim 1, wherein the separate structure includes an object being fabricated by the three-dimensional printer.
6. The three-dimensional printer of claim 1, wherein the separate structure includes a build platform of the three-dimensional printer.
7. The three-dimensional printer of claim 1, wherein the contact force is a force normal to a surface of the separate structure.
8. The three-dimensional printer of claim 1, wherein the one or more sensors are collectively operable to sense a force between the fabrication tool and the separate structure along two or more non-parallel axes.

9. The three-dimensional printer of claim 8, wherein the one or more sensors are collectively operable to sense a force between the fabrication tool and the separate structure along three or more non-parallel axes.
10. The three-dimensional printer of claim 1, wherein each of the one or more sensors are selected from the group consisting of: capacitive sensors, electromagnetic sensors, optical sensors, potentiometric sensors, and piezoelectric sensors.
11. The three-dimensional printer of claim 1, wherein the one or more sensors include one or more strain gauges.
12. The three-dimensional printer of claim 1 further comprising a controller configured to receive a signal from the one or more sensors and to calculate the contact force.
13. The three-dimensional printer of claim 1, further comprising:
  - one or more actuators mechanically coupled to the fabrication tool, and
  - a control circuit in data communication with the one or more actuators and the one or more sensors, the control circuit configured to control the one or more actuators to achieve a specified contact force between the one or more sensors and the separate structure.
14. A method comprising:
  - identifying build instructions for fabricating an object;
  - initiating a build using a three-dimensional printer comprising a fabrication tool and one or more sensors mechanically coupled to the fabrication tool, the one or more sensors configured to detect a current contact force between the fabrication tool and a separate structure;
  - detecting the current contact force; and
  - responsively creating a control signal to control at least one component of the three-dimensional printer during the build.

15. The method of claim 14, wherein the fabrication tool includes an extruder.
16. The method of claim 15, wherein the at least one component of the three-dimensional printer controls a feed rate for a build material used in the build.
17. The method of claim 15, wherein the at least one component of the three-dimensional printer controls a z-distance between the extruder and a build platform of the three-dimensional printer.
18. The method of claim 15 further comprising comparing the current contact force to an expected contact force.
19. The method of claim 18 further comprising adjusting at least one parameter of the three-dimensional printer to reduce a difference between the current contact force and the expected contact force.
20. The method of claim 18 further comprising terminating the build when a difference between the current contact force and the expected contact force indicates a fabrication error.
21. The method of claim 14 wherein the control signal includes a signal to the three-dimensional printer to change a distance between the fabrication tool and the separate structure.
22. The method of claim 15 wherein the control signal includes a signal to the three-dimensional printer to change a feed rate of build material extruded by the extruder.
23. The method of claim 15 further comprising detecting a planarity of the separate structure based upon a number of contact force measurements across a surface of the separate structure.



24. The method of claim 23 further comprising fabricating a layer on the surface of the separate structure that decreases one or more irregularities in the surface of the separate structure.

25. The method of claim 14, wherein the build instructions include at least one instruction for achieving a specified contact force between the fabrication tool and a separate structure, and wherein the control signal controls the at least one component of the three-dimensional printer to achieve the specified contact force.

**THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION****ABSTRACT**

An extruder or other tool head of a three-dimensional printer is instrumented to detect contact force against the extruder, such as by a build platform or an object being fabricated. The tool head may also be instrumented to detect deflection forces and the like acting on the tool that might indicate an operating error. The resulting feedback data can be used in a variety of ways to control operation of the three-dimensional printer during fabrication or diagnostics.