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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

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/922,267	02/11/2020	10556381	MBOT-0051-P02	1809

43520 7590 01/22/2020
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 1002 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):

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

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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 10/09/2019
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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/922,267	10/26/2015	Aljosa Kemperle	MBOT-0051-P02	1809

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	\$1000	\$0.00	\$0.00	\$1000	01/09/2020

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 03-09 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,

(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.

1 Strategic Patents, P.C.

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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). 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. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies

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

☒ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 50-4262

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 /Thomas J. Bassolino/

Date January 3, 2020

Typed or printed name Thomas J. Bassolino

Registration No. 65946

Electronic Patent Application Fee Transmittal				
Application Number:		14922267		
Filing Date:		26-Oct-2015		
Title of Invention:		THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION		
First Named Inventor/Applicant Name:		Aljosa Kemperle		
Filer:		Thomas John Bassolino/Paula Ng		
Attorney Docket Number:		MBOT-0051-P02		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1000	1000

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1000

Electronic Acknowledgement Receipt	
EFS ID:	38199361
Application Number:	14922267
International Application Number:	
Confirmation Number:	1809
Title of Invention:	THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION
First Named Inventor/Applicant Name:	Aljosa Kemperle
Customer Number:	43520
Filer:	Thomas John Bassolino/Paula Ng
Filer Authorized By:	Thomas John Bassolino
Attorney Docket Number:	MBOT-0051-P02
Receipt Date:	03-JAN-2020
Filing Date:	26-OCT-2015
Time Stamp:	15:29:07
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$1000
RAM confirmation Number	E202013F29397982
Deposit Account	504262
Authorized User	Paula Ng
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	MBOT-0051- P02_20200103_IssueFeeTrans. pdf	102399	no	1
			c5ca743ae44af87b9eac43d4fd06dfd8834b aec6		

Warnings:**Information:**

2	Fee Worksheet (SB06)	fee-info.pdf	30415	no	2
			835392aee66dc69eff02050a0cb0e698f9e0 2022		

Warnings:**Information:**

Total Files Size (in bytes):	132814
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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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NOTICE OF ALLOWANCE AND FEE(S) DUE

43520 7590 10/09/2019
STRATEGIC PATENTS P.C.
P.O. BOX 920629
NEEDHAM, MA 02492

EXAMINER

NGUYEN, THUKHANH T

ART UNIT

PAPER NUMBER

1743

DATE MAILED: 10/09/2019

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/922,267	10/26/2015	Aljosa Kemperle	MBOT-0051-P02	1809

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	\$1000	\$0.00	\$0.00	\$1000	01/09/2020

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: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

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

43520 7590 10/09/2019
STRATEGIC PATENTS P.C.
P.O. BOX 920629
NEEDHAM, MA 02492

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Certificate of Mailing or Transmission

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(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/922,267	10/26/2015	Aljosa Kemperle	MBOT-0051-P02	1809

TITLE OF INVENTION: THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION

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nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	01/09/2020

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 03-09 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,

(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.

1 _____
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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). 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. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

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

☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

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.

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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. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/922,267	10/26/2015	Aljosa Kemperle	MBOT-0051-P02	1809
43520	7590	10/09/2019	EXAMINER	
STRATEGIC PATENTS P.C.			NGUYEN, THUKHANH T	
P.O. BOX 920629			ART UNIT	
NEEDHAM, MA 02492			PAPER NUMBER	
			1743	
DATE MAILED: 10/09/2019				

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 30 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.

Notice of Allowability	Application No. 14/922,267	Applicant(s) Kemperle et al.	
	Examiner THU-KHANH T NGUYEN	Art Unit 1743	AIA (FITF) Status 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 09/05/19.
☐ 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 1,3-11 and 13-18. 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 or send an inquiry to **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. ☐ Notice of References Cited (PTO-892)	5. ☐ Examiner's Amendment/Comment
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.	6. ☒ Examiner's Statement of Reasons for Allowance
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.	7. ☐ Other _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____.	

/JOSEPH S DEL SOLE/ Supervisory Patent Examiner, Art Unit 1743	
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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 1, 3-11, and 13-18 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 a three-dimensional printer comprising:
a fabrication tool including an extruder configured to extrude build material to fabricate an object during a build process;
one or more sensors mechanically coupled to the extruder, wherein the one or more sensors are collectively operable to sense a contact force between the extruder and a separate structure distinct from the fabrication tool; and

a controller configured to receive a signal from the one or more sensors on the extruder and to calculate the contact force between the extruder and the separate structure.

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 7:30-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph S. 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

<i>Search Notes</i> 	Application/Control No. 14/922,267	Applicant(s)/Patent Under Reexamination Kemperle et al.
	Examiner THU-KHANH T NGUYEN	Art Unit 1743

CPC - Searched*		
Symbol	Date	Examiner
B 29C 43/08,58,5808,5816,5833,5875; 64/20,393	09/28/2019	TN
B33Y 40/00; 50/00,02	09/28/2019	TN

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
425	143,170-171,78,344-345	09/28/2019	TN
700	197,206	09/28/2019	TN
141	71,74, 78	09/28/2019	TN

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Checked related application 14/065,516	09/28/2019	TN

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	B 29C 43/08,58,5808,5816,5833,5875,	09/28/2019	TN

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Issue Classification 	Application/Control No. 14/922,267	Applicant(s)/Patent Under Reexamination Kemperle et al.	
	Examiner THU-KHANH T NGUYEN	Art Unit 1743	

CPC						
Symbol				Type	Version	
B29C	/	64	/	205	F	2017-08-01
B29C	/	64	/	209	I	2017-08-01
B29C	/	48	/	92	I	2019-02-01
B29C	/	48	/	154	I	2019-02-01
B29C	/	64	/	106	I	2017-08-01
B29C	/	64	/	386	I	2017-08-01
B29C	/	64	/	40	I	2017-08-01
B33Y	/	30	/	00	I	2014-12-01
B33Y	/	50	/	02	I	2014-12-01
B33Y	/	80	/	00	A	2014-12-01
B29C	/	48	/	02	A	2019-02-01
B29C	/	48	/	265	A	2019-02-01
B29C	/	48	/	266	A	2019-02-01
B29C	/	2948	/	9258	A	2019-02-01
B29C	/	2948	/	92704	A	2019-02-01
B33Y	/	50	/	00	A	2014-12-01
B33Y	/	10	/	00	A	2014-12-01
B33Y	/	40	/	00	A	2014-12-01
B33Y	/	70	/	00	A	2014-12-01
B29K	/	2101	/	12	A	2013-01-01
B29K	/	2105	/	0067	A	2013-01-01

CPC Combination Sets					
Symbol			Type	Set	Ranking
	/		/		

/THU KHANH T NGUYEN/ Examiner, Art Unit 1743 (Assistant Examiner)	28 September 2019 (Date)	Total Claims Allowed: 16	
/JOSEPH S DEL SOLE/ Supervisory Patent Examiner, Art Unit 1743 (Primary Examiner)	30 September 2019 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

Issue Classification 	Application/Control No. 14/922,267	Applicant(s)/Patent Under Reexamination Kemperle et al.
	Examiner THU-KHANH T NGUYEN	Art Unit 1743

INTERNATIONAL CLASSIFICATION			
CLAIMED			
B29C		41	22
B29C		41	52
NON-CLAIMED			

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS
264	75

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					
264	245	255	308			
425	132	145	146	162	375	
700	119					

/THU KHANH T NGUYEN/ Examiner, Art Unit 1743 (Assistant Examiner)	28 September 2019 (Date)	Total Claims Allowed: 16	
/JOSEPH S DEL SOLE/ Supervisory Patent Examiner, Art Unit 1743 (Primary Examiner)	30 September 2019 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

Issue Classification 	Application/Control No. 14/922,267	Applicant(s)/Patent Under Reexamination Kemperle et al.
	Examiner THU-KHANH T NGUYEN	Art Unit 1743

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47
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CLAIMS															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	10	11												
2	3	11	13												
3	4	12	14												
4	5	13	15												
5	6	14	16												
6	7	15	17												
7	8	16	18												
8	9														
9	10														

/THU KHANH T NGUYEN/ Examiner, Art Unit 1743 (Assistant Examiner)	28 September 2019 (Date)	Total Claims Allowed: 16	
/JOSEPH S DEL SOLE/ Supervisory Patent Examiner, Art Unit 1743 (Primary Examiner)	30 September 2019 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	19908	(3D three-dimensional (three near dimension\$3) rapid) with (prototype printer printing imprinting lithography stereolithography sinter\$3) with (system apparatus method device machine tool)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:44
S2	471474	(gmbh "3D systems" Roland xyzprinting makerbot Samsung leapfrog stratasy "tyco electronics" "mobium Solutions" "Wisconsin Alumni Research Foundation" sodick "lg electronics" "Institute of Nuclear Energy Research Atomic Energy Council" Xjet).as. (libinson Desimone Cassara chase lacaze el-siblani kritchman).in.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:44
S3	107802	B29C\$ B33Y\$ B83Y\$ B41J02/045\$ B41J29/38\$	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:44
S4	629	S1 and S2 and S3	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:44
S5	101	(extruder jet nozzle) with contact with force with (sensor sensing)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:50
S6	2	S4 and S5	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:54
S7	17702	contact with force with (sensor sensing)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:59
S8	21	S4 and S7	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:59
S9	15	S3 and S5	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 10:14
S10	636	(extruder jet nozzle head) with contact with force with (sensor sensing)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 10:18
S11	12	S1 and S10 not S9	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 10:18

S12	865	(extruder jet nozzle) with force with (sensor sensing)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 10:22
S13	3	S4 and S12 not S11 not S9 not S8	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 10:22
S14	3	"14020535"	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 10:23
S15	5781	(extruder jet nozzle) with contact with force	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 11:32
S16	1217	(S1 S2) and S15	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 11:33
S17	1180	S15 same (sensor sensing sens\$3 measur\$3)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 11:33
S18	709	S16 and S17	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 11:34
S19	5	S3 and S18	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 11:35
S20	19	"7725209" "9193157"	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 12:30
S21	5	S18 and S19	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 12:31
S22	0	S18 and S20	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 12:31
S23	0	S15 and S20	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 12:31
S24	0	S12 and S20	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 12:32
S25	86	S1 and S7	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 12:34
S26	3	"14065516"	US-PGPUB; USPAT;	OR	OFF	2017/04/02 14:47

			USOCR			
S27	1	(US-20060156978-\$.did.	US-PGPUB	OR	OFF	2017/04/02 14:48
S28	1	S27 and (contact with force)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/02 14:48
S29	1080	(extruder jet nozzle head tool) with contact\$3 with force with (sensor sensing)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/02 14:57
S30	20041	(3D three-dimensional (three near dimension\$3) rapid) with (prototype printer printing imprinting lithography stereolithography sinter\$3) with (system apparatus method device machine tool)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/02 14:57
S31	472795	(gmbh "3D systems" Roland xyzprinting makerbot Samsung leapfrog stratasy "tyco electronics" "mobium Solutions" "Wisconsin Alumni Research Foundation" sodick "Ig electronics" "Institute of Nuclear Energy Research Atomic Energy Council" Xjet).as. (libinson Desimone Cassara chase lacaze el-siblani kritchman).in.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/02 14:57
S32	108225	B29C\$ B33Y\$ B83Y\$ B41J02/045\$ B41J29/38\$	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/02 14:57
S33	635	S30 and S31 and S32	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/02 14:57
S34	7	S29 and S33	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/02 14:58
S35	1	contact with force with (sensor sensing) and "7939003".pn.	US-PGPUB; USPAT; USOCR	OR	OFF	2018/09/08 19:22
S36	374	(contact with force with (sensor sensing)) same (nozzle jet inject\$3)	US-PGPUB; USPAT; USOCR	OR	OFF	2018/09/08 21:00
S37	7229	B29C64\$ B33Y\$	US-PGPUB; USPAT; USOCR	OR	OFF	2018/09/08 21:07
S38	19	S36 and S37	US-PGPUB; USPAT; USOCR	OR	OFF	2018/09/08 21:08
S39	48	(contact with force with (sensor sensing)) and S37	US-PGPUB; USPAT; USOCR	OR	OFF	2018/09/08 21:12
S40	29	S39 not S38	US-PGPUB; USPAT;	OR	OFF	2018/09/08 21:13

			USOCR			
S41	1	(contact with force with (sensor sensing)) and "7939003".pn.	US-PGPUB; USPAT; USOCR	OR	OFF	2018/09/09 10:21
S42	11922	B29C64\$ B33Y\$	US-PGPUB; USPAT; USOCR	OR	OFF	2019/09/27 13:31
S43	23451	contact with force with (sensor sensing)	US-PGPUB; USPAT; USOCR	OR	OFF	2019/09/27 13:31
S44	44	((force pressure) with sensor with (nozzle jet head extruder extrus\$3)) and S42 and S43	US-PGPUB; USPAT; USOCR	OR	OFF	2019/09/27 13:32
S45	0	"16169991" and magnet	US-PGPUB; USPAT; USOCR	OR	OFF	2019/09/27 13:54
S46	1	"16169991"	US-PGPUB; USPAT; USOCR	OR	OFF	2019/09/27 13:54
S47	1	S46 and magnet\$4	US-PGPUB; USPAT; USOCR	OR	OFF	2019/09/27 13:54
S48	1	S46 and magnet\$4 and (spring bias\$3)	US-PGPUB; USPAT; USOCR	OR	OFF	2019/09/27 13:56
S49	1	"6568587".pn.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/09/27 14:21
S50	1	"6728995".pn.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/09/27 14:21
S51	1	"5728995".pn.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/09/27 14:22
S52	1	"5568587".pn.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/09/27 14:22
S53	1	"6568578".pn.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/09/27 14:23
S54	1305	((force pressure) with sensor with (nozzle jet head extruder extrus\$3)) and S43	US-PGPUB; USPAT; USOCR	OR	OFF	2019/09/27 14:29
S55	127267	B29C\$	US-	OR	OFF	2019/09/27

EAST Search History

				PGPUB; USPAT; USOCR		14:30
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9/ 28/ 2019 4:23:51 PM
C:\ Users\ tnguyen34\ Documents\ EAST\ Workspaces\ 14922267 - 14922267 - contact force
sensor.wsp

Bibliographic Data

Application No: 14/922,267

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☒ No ☐ Met After Allowance

Verified and Acknowledged: /THU KHANH T NGUYEN/

Examiner's Signature

Initials

Title:

THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/26/2015	264	1743	MBOT-0051-P02
RULE			

APPLICANTS

MakerBot Industries, LLC, Brooklyn, NY,

INVENTORS

Aljosa Kemperle Brooklyn, NY, UNITED STATES

Filipp Gelman Staten Island, NY, UNITED STATES

Peter Joseph Schmehl Brooklyn, NY, UNITED STATES

CONTINUING DATA

This application is a CON of 14065516 10/29/2013 PAT 9168698

14065516 has PRO of 61719874 10/29/2012

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

11/04/2015

STATE OR COUNTRY

UNITED STATES

ADDRESS

STRATEGIC PATENTS P.C.

P.O. BOX 920629

NEEDHAM, MA 02492

UNITED STATES

FILING FEE RECEIVED

\$1,600

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial No.: 14/922,267
Filing Date: October 26, 2015
In re: KEMPERLE, Aljosa, *et al.*
Art Unit: 1743
Examiner: NGUYEN, Thukhanh T.
Conf. No.: 1809

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

REQUEST FOR CONTINUED EXAMINATION

Dear Commissioner:

In response to the Final Office Action mailed on April 5, 2019, the applicant requests continued examination of this application pursuant to 37 C.F.R. § 1.114. The fee of \$1,300 as specified by 37 C.F.R. § 1.17(e)(1) accompanies this request.

Please enter the following before continued examination of this application:

A Request for Extension of Time appears on page 2 of this paper.

Amendments to the Claims begin on page 3 of this paper.

Remarks begin on page 6 of this paper.

Request for Extension of Time

The applicant requests a two-month extension of time from July 5, 2019 until September 5, 2019. The fee of \$600 as specified by 37 C.F.R. § 1.17(a)(2) accompanies this request.

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. (Currently amended) A three-dimensional printer comprising:
a fabrication tool including an extruder configured to extrude build material to fabricate an object during a build process; [[and]]
one or more sensors mechanically coupled to the extruder, wherein the one or more sensors are collectively operable to sense a contact force between the extruder and a separate structure distinct from the fabrication tool; and
a controller configured to receive a signal from the one or more sensors on the extruder and to calculate the contact force between the extruder and the separate structure.
2. (Canceled)
3. (Previously presented) The three-dimensional printer of claim 1, wherein the contact force is a force along an extrusion axis of the extruder.
4. (Previously presented) The three-dimensional printer of claim 1, wherein the contact force includes a deflection force exerted by the separate structure on a tip of the extruder.
5. (Original) The three-dimensional printer of claim 1, wherein the separate structure includes an object being fabricated by the three-dimensional printer.
6. (Original) The three-dimensional printer of claim 1, wherein the separate structure includes a build platform of the three-dimensional printer.
7. (Original) The three-dimensional printer of claim 1, wherein the contact force is a force normal to a surface of the separate structure.

8. (Original) 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. (Original) 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. (Original) 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. (Original) The three-dimensional printer of claim 1, wherein the one or more sensors include one or more strain gauges.
12. (Canceled)
13. (Original) 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. (New) The three-dimensional printer of claim 1, wherein the controller is further configured to adjust operation of the three-dimensional printer according to one or more of the signal from the one or more sensors and the calculated contact force.

15. (New) The three-dimensional printer of claim 14, wherein the controller is configured to adjust a feed rate of build material from the extruder in response to the calculated contact force.
16. (New) The three-dimensional printer of claim 14, wherein the controller is configured to adjust a z-axis position of the extruder in response to the calculated contact force.
17. (New) The three-dimensional printer of claim 14, wherein the controller is configured to adjust a speed of movement of the extruder in response to the calculated contact force.
18. (New) The three-dimensional printer of claim 14, wherein the controller is configured to adjust a temperature of the extruder in response to the calculated contact force.

Remarks

Status of the Claims

Claims 1 is amended. Claim 12 is canceled. Claims 14–18 are added as new.

Claims 1, 3–11 and 13–18 are presented for examination, where claim 1 is independent.

The claim amendments find support in at least ¶¶ [0050], [0063] and [0065] of the as-filed Specification. No new matter is added.

Claim Rejections – 35 U.S.C. § 102

Independent claim 1 stands rejected under 35 U.S.C. § 102 as being anticipated by U.S. Pat. No. 7,939,003 to Bonassar, *et al.* (“*Bonassar*”). This rejection is traversed for at least the following reasons.

The applicant has devised a three-dimensional printer where “[a]n extruder . . . is instrumented to detect contact force against the extruder, such as by a build platform or an object being fabricated.”¹ With a force sensor included on the extruder itself, “resulting feedback data can be used in a variety of ways to control operation of the three-dimensional printer during fabrication or diagnostics.”² For example, the applicant’s extruder with a force sensor coupled thereto can be used to detect “warping of the [build] 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 for planarizing a build surface to compensate for measured irregularities.³ In this context, the build surface can include either a build platform or a layer of deposited build material upon which further material is deposited.⁴

The applicant maintains its previous position that the inventive concept of an extruder including a force sensor is not taught or suggested by *Bonassar*, which instead appears to contemplate a calibration device 44 with a force sensor 204, but this calibration device 44 (with force sensor 204) is included *on the substrate 16* (*i.e., the*

¹ Applicant’s as-filed Specification (hereinafter “Specification”), Abstract.

² Specification, Abstract.

³ Specification, ¶ [0054].

⁴ *See, e.g.*, Specification ¶ [0057] (“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.”).

*build surface*⁵), not on an extruder (e.g., the syringe 66 in *Bonassar*). Therefore, *Bonassar* does not teach or suggest an extruder having one or more sensors for sensing a contact force between the extruder and a separate structure as claimed. This is more than a passing distinction, as the system in *Bonassar* would not be able to perform many of the advantageous functions of the presently claimed three-dimensional printer, such as detecting a warped build surface (e.g., where the presently claimed extruder, unlike *Bonassar*, can sense a force in numerous locations on a build surface to see if they match, including at the extremities), planarizing a build surface, detecting leveling of a build surface, checking a printed layer for irregularities, and so on.

Nevertheless, to further advance prosecution on the merits, the applicant has amended independent claim 1 to include “a controller configured to receive a signal from the one or more sensors on the extruder and to calculate the contact force between the extruder and the separate structure,” and to further distinguish *Bonassar*. Again, because *Bonassar*’s calibration device 44 (with force sensor 204) is included *on the build surface*, not on the extruder, *Bonassar* cannot anticipate a controller that receives a signal from a sensor on the extruder and calculates the contact force between the extruder and a separate structure.

For at least the foregoing reasons, independent claim 1 is believed to be patentable over *Bonassar*. The remaining claims depend from an allowable base claim and are likewise in condition for allowance. The applicant respectfully requests reconsideration and withdrawal of the outstanding claim rejections under 35 U.S.C. § 102.

Claim Rejections – 35 U.S.C. § 103

Independent claim 1 stands rejected under 35 U.S.C. § 103 as being unpatentable 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*”). This rejection is traversed at least because, similar to the discussion above with respect to *Bonassar*, neither *Jang* nor *Lipson* teach or suggest an extruder with one or more sensors mechanically coupled thereto for sensing a contact

⁵ In *Bonassar*, the “[s]ubstrate 16 is a build surface upon which material from material deposition tool 18 is deposited.” *Bonassar*, col. 8, ll. 24–26.

force between the extruder and a separate structure. Additionally, neither *Jang* nor *Lipson* teach or suggest “a controller configured to receive a signal from the one or more sensors on the extruder and to calculate the contact force between the extruder and the separate structure,” as claimed.

Jang is directed to a “[p]rocess and apparatus for creating a colorful three-dimensional object.”⁶ As correctly noted in the Office Action, “*Jang* fails to disclose a sensor detecting contact force between the fabrication tool and a separate structure.”⁷ Therefore, while *Jang* may generally contemplate various components of a three-dimensional printer, conspicuously missing from *Jang* is any teaching or suggestion of an extruder having one or more sensors for sensing a contact force between the extruder and a separate structure, and a controller that receives a signal from a sensor on the extruder to calculate the contact force between the extruder and the separate structure.

Lipson does not fill the void left by *Jang*. *Lipson* appears to share inventorship and priority claim with *Bonassar* (discussed above), and *Lipson* also appears to include an identical specification/disclosure to *Bonassar*. Thus, similar to *Bonassar*, *Lipson* appears to contemplate a calibration device 44 that may include a force sensor 204, but the calibration device 44 (with force sensor 204) is included on the substrate 16 (i.e., the build surface), not on an extruder (e.g., the syringe 66).

Further, the entirety of the discussion of *Lipson* in the Office Action is as follows:

Lipson et al. discloses an for [sic] fabricating a 3-D article, comprising 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).⁸

M.P.E.P. § 2143 states that “[t]he key to supporting any rejection under 35 U.S.C. 103 is the **clear articulation** of the reason(s) why the claimed invention would have been obvious” and that “the analysis supporting a rejection under 35 U.S.C. 103 should be **made explicit**.”⁹ By merely offering the above sentence, the applicant believes that the Office has not satisfied its basic requirements of a *prima facie* case of obviousness and

⁶ *Jang*, Title.

⁷ Final Office Action mailed April 5, 2019 (hereinafter “Office Action”), p. 5.

⁸ Office Action, p. 5.

⁹ M.P.E.P. § 2143 (emphasis added).

invites the Office to provide an analysis (as required by the M.P.E.P.) that demonstrates how a reference (*Lipson*) that does not include a sensor “mechanically coupled to the extruder” renders such a structural configuration obvious.

For the foregoing reasons, independent claim 1 is believed to be patentable over the cited art. The remaining claims depend from an allowable base claim and are likewise in condition for allowance. The applicant respectfully requests reconsideration and withdrawal of the outstanding claim rejections under 35 U.S.C. § 103.

Note Regarding the Office’s “Response to Arguments”

In the “Response to Arguments,” the Office Action states:

Applicant’s arguments filed 12/10/2018 have been fully considered but they are not persuasive. In response to applicant’s argument that the prior art force sensors are not located at a claimed position to perform the functions of the presently claimed three-dimensional printer, *a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim.* In this case, one of ordinary skill in the art would have been motivated to relocate the position of the sensors to detect the contacting force between different structures in order to control the movements of different structures relative to one another so that there will not be an abrupt contact that could harms [sic] the nozzle and/or deform the material being injected.¹⁰

The applicant disagrees with the Office’s reasoning for at least the following reasons.

As an initial matter, independent claim 1 actively recites an actual state of configuration that has not been shown to be taught by the cited art—“one or more sensors *mechanically coupled to the extruder*.” This is not a “recitation of the intended use,” as stated in the Office Action, but rather a structural difference between the claimed invention (that includes sensors on an extruder) and the cited art (that lacks sensors on an extruder). Therefore, the statement by the Office that “[i]f the prior art structure is

¹⁰ Office Action, pp. 5–6 (emphasis added).

capable of performing the intended use, then it meets the claim” is moot.¹¹ Lastly, the Office recites that there is a motivation in the prior art to relocate sensors but provides no reasoning from the prior art for such a motivation. If this rejection is maintained, more is needed from the Office to meet its burden—specifically, the Office should demonstrate a motivation to move the sensors *based on facts gleaned from the prior art*.¹²

¹¹ To the applicant’s knowledge, this reasoning is meant for recitations in a preamble of a claim, or when a difference between a claimed invention and the prior art is based on function, not a structural difference, where neither of these reasonings would apply in the present context. The applicant invites the Office to elaborate on this reasoning if the present rejections are maintained.

¹² “[I]mpermissible hindsight must be avoided and the legal conclusion must be reached *on the basis of the facts gleaned from the prior art*.” M.P.E.P. § 2142 (emphasis added).

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.

Respectfully submitted
STRATEGIC PATENTS, P.C.

/Thomas J. Bassolino/
Thomas J. Bassolino
Reg. No. 65,946
Tel.: (646) 238-1234

September 5, 2019

Electronic Patent Application Fee Transmittal				
Application Number:		14922267		
Filing Date:		26-Oct-2015		
Title of Invention:		THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION		
First Named Inventor/Applicant Name:		Aljosa Kemperle		
Filer:		Thomas John Bassolino/Paula Ng		
Attorney Docket Number:		MBOT-0051-P02		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension - 2 months with \$0 paid	1252	1	600	600
Miscellaneous:				
RCE- 1ST REQUEST	1801	1	1300	1300
Total in USD (\$)				1900

Electronic Acknowledgement Receipt	
EFS ID:	37071626
Application Number:	14922267
International Application Number:	
Confirmation Number:	1809
Title of Invention:	THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION
First Named Inventor/Applicant Name:	Aljosa Kemperle
Customer Number:	43520
Filer:	Thomas John Bassolino/Paula Ng
Filer Authorized By:	Thomas John Bassolino
Attorney Docket Number:	MBOT-0051-P02
Receipt Date:	05-SEP-2019
Filing Date:	26-OCT-2015
Time Stamp:	11:02:44
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$1900
RAM confirmation Number	E201995B03102966
Deposit Account	504262
Authorized User	Paula Ng
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		MBOT-0051-P02_20190905_RCE.pdf	172618	yes	11
			0b4e0449b95caf37c94acb7c5f6f5b9a59c4938c		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Request for Continued Examination (RCE)		1	1	
	Extension of Time		2	2	
	Claims		3	5	
	Applicant Arguments/Remarks Made in an Amendment		6	11	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32731	no	2
			940d5375e63643600a5464722248c81fe4d0555e		
Warnings:					
Information:					
Total Files Size (in bytes):			205349		

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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 14/922,267		Filing Date 10/26/2015		☐ To be Mailed		
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO										
APPLICATION AS FILED - PART I										
		(Column 1)	(Column 2)							
FOR		NUMBER FILED	NUMBER EXTRA	RATE (\$)		FEE (\$)				
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A	N/A	N/A						
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))		N/A	N/A	N/A						
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A	N/A						
TOTAL CLAIMS (37 CFR 1.16(j))		minus 20 =	*	x \$80 =						
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =	*	x \$420 =						
☐ APPLICATION SIZE FEE (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).								
☐ 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						
APPLICATION AS AMENDED - PART II										
		(Column 1)	(Column 2)	(Column 3)						
AMENDMENT	09/05/2019	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))	* 16	Minus	** 20	= 0	x \$100 =		0		
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0	x \$460 =		0		
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
					TOTAL ADD'L FEE		0			
AMENDMENT		(Column 1)	(Column 2)	(Column 3)						
		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))	*	Minus	**	=	x \$0 =				
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x \$0 =				
	☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
					TOTAL ADD'L FEE					
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.					LIE					
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".					/ANNIE C SINGLETON/					
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".										
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										

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.
14/922,267	10/26/2015	Aljosa Kemperle	MBOT-0051-P02	1809
43520	7590	04/05/2019	EXAMINER	
STRATEGIC PATENTS P.C. P.O. BOX 920629 NEEDHAM, MA 02492			NGUYEN, THUKHANH T	
			ART UNIT	PAPER NUMBER
			1743	
			NOTIFICATION DATE	DELIVERY MODE
			04/05/2019	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

DETAILED ACTION

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

Claim Rejections - 35 USC § 102

2. 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.

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.

4. Claims 1 and 3-13 are again rejected under 35 U.S.C. 102(a)(1) as being anticipated by Bonassar et al. (7,939,003).

Regarding claims 1 and 4, Bonassar et al. discloses a 3D fabrication system, comprising a fabrication tool (2, 68) and one or more sensor (204) to sense a contact force between the fabrication tool (68) and a separate structure (44), wherein the fabrication tool is a tip of the extruder (68).

Regarding claims 5-7, wherein the separate structures can be any structures such as the object or the build platform that is located on the surface (44). Although Bonassar et al. used the

calibration device (44) with force sensor (204) to calibrate the tip (68), this is just the intended use of the force sensor, and the force sensor(s) can also be used for different purposes, such as to detect the small changes in applied force in a direction normal to a surface of the separate structure (44) with very little displacement of the tip (68), so that the Z coordinate of the tool tip (68) can be identified, and the position of the tool tip and/or the position of the forming article can be controlled with high accuracy.

Regarding claims 8-13, wherein more than one sensors/emitters/detectors can be used (Fig. 13, 200A-B, 202A-B, 204), wherein the signal varies symmetrically as an object moves perpendicular across an optical axis of the emitter/detector pair. Bonassar et al. further discloses that in place of the separate structure (44), another modules (300) with another receptacle (306) can be used to receive material dispensed from a material depositing tool, which could be the tip (68), wherein the receptacle (306) having a plural sensor ports (314, 316) with a plurality of sensors connecting to an electronic module (326) that contains any signal conditioning and processing required to operate and monitor whatever sensors and actuators are in module and a controller (300; col. 24, 19-66), wherein the sensors can be used to monitor a plurality of different variable, such as light, temperature, flow rate, current, or mechanical force (col. 25, lines 3-24). Thus, Bonassar et al. is capable of using many different type of sensors for sensing a mechanical force, including a force between a tip of the nozzle (68) and the forming article and/or the supporting surface.

Claim Rejections - 35 USC § 103

5. 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.

6. 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.

7. Claims 1 and 3-13 are again 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 an apparatus and 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 a sensor detecting contact force between the fabrication tool and a separate structure.

Lipson et al. discloses an for fabricating a 3-D article, comprising 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.

Response to Arguments

8. Applicant's arguments filed 12/10/2018 have been fully considered but they are not persuasive. In response to applicant's argument that the prior art force sensors are not located at a claimed position to perform the functions of the presently claimed three-dimensional printer, a recitation of the intended use of the claimed invention must result in a structural difference

between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In this case, one of ordinary skill in the art would have been motivated to relocate the position of the sensors to detect the contacting force between different structures in order to control the movements of different structures relative to one another so that there will not be an abrupt contact that could harm the nozzle and/or deform the material being injected.

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

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 7:30-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph S. 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/
Examiner, Art Unit 1743

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

<i>Search Notes</i> 	Application/Control No. 14/922,267	Applicant(s)/Patent Under Reexamination Kemperle et al.
	Examiner THU-KHANH T NGUYEN	Art Unit 1743

CPC - Searched*		
Symbol	Date	Examiner
B 29C 43/08,58,5808,5816,5833,5875; 64/20,393	04/01/2019	TN
B33Y 40/00; 50/00,02	04/01/2019	TN

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
425	143,170-171,78,344-345	04/01/2019	TN
700	197,206	04/01/2019	TN
141	71,74, 78	04/01/2019	TN

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Checked related application 14/065,516	09/07/2018	TN

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	B 29C 43/08,58,5808,5816,5833,5875,	09/07/2018	TN

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial No.: 14/922,267
Filing Date: October 26, 2015
In re: KEMPERLE, Aljosa, *et al.*
Art Unit: 1743
Examiner: NGUYEN, Thukhanh T.
Conf. No.: 1809

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 September 13, 2018:

An **Amendment to the Specification** begins on page 2 of this paper.

Amendments to the Claims begin on page 3 of this paper.

Remarks begin on page 5 of this paper.

Electronic Acknowledgement Receipt	
EFS ID:	34540197
Application Number:	14922267
International Application Number:	
Confirmation Number:	1809
Title of Invention:	THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION
First Named Inventor/Applicant Name:	Aljosa Kemperle
Customer Number:	43520
Filer:	Thomas John Bassolino/Paula Ng
Filer Authorized By:	Thomas John Bassolino
Attorney Docket Number:	MBOT-0051-P02
Receipt Date:	10-DEC-2018
Filing Date:	26-OCT-2015
Time Stamp:	18:07:00
Application Type:	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)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		MBOT-0051-P02_20181210_OAResponse.pdf	208082	yes	9
			c7e8800d927ec59861a14cf58877043ecfef8ab2		

Multipart Description/PDF files in .zip description			
	Document Description	Start	End
	Applicant Arguments/Remarks Made in an Amendment	5	9
	Claims	3	4
	Specification	2	2
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Warnings:			
Information:			
Total Files Size (in bytes):		208082	
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. <u>New Applications Under 35 U.S.C. 111</u> 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. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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.			

Remarks

Status of the Claims

Claims 1, 3 and 4 are amended. Claim 2 is canceled. Claims 1 and 3–13 are presented for examination, where claim 1 is independent.

The claim amendments find support in at least ¶ [0047] of the as-filed Specification. No new matter is added.

Specification

In the Office Action, “[t]he disclosure is objected to because of the following informalities: please update the status of the application 14/065,516 in paragraph [0001].”¹ In response, the applicant has amended ¶ [0001] of the specification to update the status of the aforementioned application.

In view of the above, the applicant respectfully requests reconsideration and withdrawal of the outstanding objection to the specification.

Claim Rejections – 35 U.S.C. § 102

Independent claim 1 stands rejected under 35 U.S.C. § 102 as being anticipated by U.S. Pat. No. 7,939,003 to Bonassar, *et al.* (“*Bonassar*”). This rejection is traversed for at least the following reasons.

The applicant has devised a three-dimensional printer where “[a]n extruder . . . is instrumented to detect contact force against the extruder, such as by a build platform or an object being fabricated.”² With a force sensor included on the extruder, “resulting feedback data can be used in a variety of ways to control operation of the three-dimensional printer during fabrication or diagnostics.”³ For example, the applicant’s extruder/force sensor configuration can be used to detect “warping of the [build] 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 for planarizing a build surface to compensate for measured

¹ Non-final Office Action mailed September 13, 2018 (hereinafter “Office Action”), p. 2.

² Applicant’s as-filed Specification (hereinafter “Specification”), Abstract.

³ Specification, Abstract.

irregularities.⁴ In this context, the build surface can include either a build platform or a layer of deposited build material upon which further material is deposited.⁵ The applicant has amended independent claim 1 to clarify the inventive concept of an extruder including a force sensor, which is not taught or suggested by the cited art.

Bonassar is directed to an article fabrication system including a “[c]artridge 26 [that] holds [a] syringe 66 that contains material to be deposited through [a] syringe needle 68.”⁶ To be sure, *Bonassar* contemplates a calibration device 44 that may include a force sensor 204, but this calibration device 44 (with force sensor 204) is included *on the substrate 16 (i.e., the build surface)*⁷, not on an extruder (e.g., the syringe 66):

As illustrated in FIG. 13, **calibration device 44 is mounted on substrate 16** [i.e., build surface]. Calibration device 44 eliminates the need for the registration mark and reliance on the human operator’s eye. Calibration device 44 has two infrared emitters 200A-B and two infrared detectors 202A-B oriented orthogonally to each other, and Teflon-covered analog force sensor 204 located at the intersection of the two optical axes.⁸

This is abundantly clear when viewing FIG. 13 of *Bonassar*, which is annotated below to highlight the force sensor 204 on the substrate 16 (i.e., the build surface).

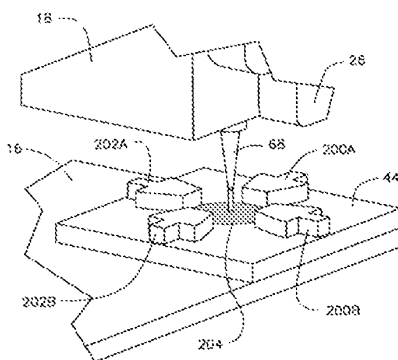


FIG. 13

⁴ Specification, ¶ [0054].

⁵ See, e.g., Specification ¶ [0057] (“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.”).

⁶ *Bonassar*, col. 14, ll. 19–20.

⁷ In *Bonassar*, the “[s]ubstrate 16 is a build surface upon which material from material deposition tool 18 is deposited.” *Bonassar*, col. 8, ll. 24–26.

⁸ *Bonassar*, col. 22, ll. 24–30 (emphasis added).

Therefore, *Bonassar* does not teach or suggest an extruder having one or more sensors for sensing a contact force between the extruder and a separate structure. This is more than a passing distinction, as the system in *Bonassar* would not be able to perform many of the advantageous functions of the presently claimed three-dimensional printer, such as detecting a warped build surface (e.g., where the presently claimed extruder, unlike *Bonassar*, can sense a force in numerous locations on a build surface to see if they match, including at the extremities), planarizing a build surface, detecting leveling of a build surface, checking a printed layer for irregularities, and so on.

For the foregoing reasons, independent claim 1 is believed to be patentable over *Bonassar*. The remaining claims depend from an allowable base claim and are likewise in condition for allowance. The applicant respectfully requests reconsideration and withdrawal of the outstanding claim rejections under 35 U.S.C. § 102.

Claim Rejections – 35 U.S.C. § 103

Independent claim 1 stands rejected under 35 U.S.C. § 103 as being unpatentable 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*”). This rejection is traversed at least because, similar to the discussion above with respect to *Bonassar*, neither *Jang* nor *Lipson* teach or suggest an extruder with one or more sensors mechanically coupled thereto for sensing a contact force between the extruder and a separate structure.

Jang is directed to a “[p]rocess and apparatus for creating a colorful three-dimensional object.”⁹ As correctly noted in the Office Action, “*Jang* fails to disclose a sensor detecting contact force between the fabrication tool and a separate structure.”¹⁰ Therefore, while *Jang* may generally contemplate various components of a three-dimensional printer, conspicuously missing from *Jang* is any teaching or suggestion of an extruder having one or more sensors for sensing a contact force between the extruder and a separate structure.

Lipson does not fill the void left by *Jang*. *Lipson* appears to share inventorship and priority claim with *Bonassar* (discussed above), and *Lipson* also appears to include

⁹ *Jang*, Title.

¹⁰ Office Action, p. 5.

an identical specification/disclosure to *Bonassar*. Thus, similar to *Bonassar, Lipson* appears to contemplate a calibration device 44 that may include a force sensor 204, but the calibration device 44 (with force sensor 204) is included *on the substrate 16 (i.e., the build surface)*, not on an extruder (e.g., the syringe 66).

For the foregoing reasons, independent claim 1 is believed to be patentable over the cited art. The remaining claims depend from an allowable base claim and are likewise in condition for allowance. The applicant respectfully requests reconsideration and withdrawal of the outstanding claim rejections under 35 U.S.C. § 103.

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 attorney.

Respectfully submitted
STRATEGIC PATENTS, P.C.

/Thomas J. Bassolino/
Thomas J. Bassolino
Reg. No. 65,946
Tel.: (646) 238-1234

December 10, 2018

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. (Currently amended) A three-dimensional printer comprising:
a fabrication tool including an extruder configured to extrude build material to fabricate an object during a build process; and
one or more sensors mechanically coupled to the ~~fabrication tool~~ extruder,
wherein the one or more sensors are collectively operable to sense a contact force between the ~~fabrication tool~~ extruder and a separate structure distinct from the fabrication tool.
2. (Canceled)
3. (Currently amended) The three-dimensional printer of claim ~~[[2]]~~ 1, wherein the contact force is a force along an extrusion axis of the extruder.
4. (Currently amended) The three-dimensional printer of claim ~~[[2]]~~ 1, wherein the contact force includes a deflection force exerted by the separate structure on a tip of the extruder.
5. (Original) The three-dimensional printer of claim 1, wherein the separate structure includes an object being fabricated by the three-dimensional printer.
6. (Original) The three-dimensional printer of claim 1, wherein the separate structure includes a build platform of the three-dimensional printer.
7. (Original) The three-dimensional printer of claim 1, wherein the contact force is a force normal to a surface of the separate structure.

8. (Original) 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. (Original) 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. (Original) 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. (Original) The three-dimensional printer of claim 1, wherein the one or more sensors include one or more strain gauges.
12. (Original) 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. (Original) 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.

Amendment to the Specification

Please replace ¶ [0001] of the as-filed Specification with the following re-written paragraph:

--[0001] This application is a continuation of U.S. Pat. App. No. 14/065,516 filed October 29, 2013 (now U.S. Pat. No. 9,168,698), which claims the benefit of U.S. Pat. App. No. 61/719,874, filed October 29, 2012, where the entirety of each is hereby incorporated by reference herein.--

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 14/922,267		Filing Date 10/26/2015		☐ To be Mailed		
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO										
APPLICATION AS FILED - PART I										
		(Column 1)	(Column 2)							
FOR		NUMBER FILED	NUMBER EXTRA	RATE (\$)		FEE (\$)				
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A	N/A	N/A						
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))		N/A	N/A	N/A						
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A	N/A						
TOTAL CLAIMS (37 CFR 1.16(j))		minus 20 =	*	x \$80 =						
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =	*	x \$420 =						
☐ APPLICATION SIZE FEE (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).								
☐ 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						
APPLICATION AS AMENDED - PART II										
		(Column 1)	(Column 2)	(Column 3)						
AMENDMENT	12/10/2018	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))	* 12	Minus	** 20	= 0	x \$100 =		0		
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0	x \$460 =		0		
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
					TOTAL ADD'L FEE		0			
AMENDMENT		(Column 1)	(Column 2)	(Column 3)						
		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))	*	Minus	**	=	x \$0 =				
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x \$0 =				
	☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
					TOTAL ADD'L FEE					
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.					LIE					
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".					/VERONICA EVERETTE/					
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".										
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										

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.
14/922,267	10/26/2015	Aljosa Kemperle	MBOT-0051-P02	1809
43520	7590	09/13/2018	EXAMINER	
STRATEGIC PATENTS P.C.			NGUYEN, THUKHANH T	
P.O. BOX 920629			ART UNIT	
NEEDHAM, MA 02492			PAPER NUMBER	
			1743	
			NOTIFICATION DATE	
			DELIVERY MODE	
			09/13/2018	
			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

DETAILED ACTION

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

Specification

2. The disclosure is objected to because of the following informalities: please update the status of the application 14/065,516 in paragraph [0001].

Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. 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.
4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.

5. Claims 1-13 are rejected under 35 U.S.C. 102(a)(1) as being anticipated by Bonassar et al. (7,939,003).

Regarding claim 1, Bonassar et al. discloses a 3D fabrication system, comprising a fabrication tool (2, 68) and one or more sensor (204) to sense a contact force between the fabrication tool (68) and a separate structure (44).

Regarding claims 2-4, wherein the fabrication tool is a tip of the extruder (68).

Regarding claims 5-7, wherein the separate structures can be any structures such as the object or the build platform that is located on the surface (44). Although Bonassar et al. used the calibration device (44) with force sensor (204) to calibrate the tip (68), this is just the intended use of the force sensor, and the force sensor(s) can also be used for different purposes, such as to detect the small changes in applied force in a direction normal to a surface of the separate structure (44) with very little displacement of the tip (68), so that the Z coordinate of the tool tip (68) can be identified, and the position of the tool tip and/or the position of the forming article can be controlled with high accuracy.

Regarding claims 8-13, wherein more than one sensors/emitters/detectors can be used (Fig. 13, 200A-B, 202A-B, 204), wherein the signal varies symmetrically as an object moves perpendicular across an optical axis of the emitter/detector pair. Bonassar et al. further discloses that in place of the separate structure (44), another modules (300) with another receptacle (306) can be used to receive material dispensed from a material depositing tool, which could be the tip (68), wherein the receptacle (306) having a plural sensor ports (314, 316) with a plurality of sensors connecting to an electronic module (326) that contains any signal conditioning and processing required to operate and monitor whatever sensors and actuators are in module and a controller (300; col. 24, 19-66), wherein the sensors can be used to monitor a plurality of different variable, such as light, temperature, flow rate, current, or mechanical force (col. 25, lines 3-24). Thus, Bonassar et al. is capable of using many different type of sensors for sensing a

mechanical force, including a force between a tip of the nozzle (68) and the forming article and/or the supporting surface.

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 1-13 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 an apparatus and 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 a sensor detecting contact force between the fabrication tool and a separate structure.

Lipson et al. discloses an for fabricating a 3-D article, comprising 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 7:30-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph S. 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/
Examiner, Art Unit 1743

<i>Notice of References Cited</i>	Application/Control No. 14/922,267		Applicant(s)/Patent Under Reexamination Kemperle et al.	
	Examiner THU-KHANH T NGUYEN		Art Unit 1743	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-7939003-B2	05-2011	Bonassar; Lawrence	A61L27/36	264/308
	B					
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	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.

<i>Search Notes</i> 	Application/Control No. 14/922,267	Applicant(s)/Patent Under Reexamination Kemperle et al.
	Examiner THU-KHANH T NGUYEN	Art Unit 1743

CPC - Searched*		
Symbol	Date	Examiner
B 29C 43/08,58,5808,5816,5833,5875; 64/20,393	09/07/2018	TN
B33Y 40/00; 50/00,02	09/07/2018	TN

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
425	143,170-171,78,344-345	09/07/2018	TN
700	197,206	09/07/2018	TN
141	71,74, 78	09/07/2018	TN

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Checked related application 14/065,516	09/07/2018	TN

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	B 29C 43/08,58,5808,5816,5833,5875,	09/07/2018	TN

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	19908	(3D three-dimensional (three near dimension\$3) rapid) with (prototype printer printing imprinting lithography stereolithography sinter\$3) with (system apparatus method device machine tool)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:44
S2	471474	(gmbh "3D systems" Roland xyzprinting makerbot Samsung leapfrog stratasy "tyco electronics" "mobium Solutions" "Wisconsin Alumni Research Foundation" sodick "lg electronics" "Institute of Nuclear Energy Research Atomic Energy Council" Xjet).as. (libinson Desimone Cassara chase lacaze el-siblani kritchman).in.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:44
S3	107802	B29C\$ B33Y\$ B83Y\$ B41J02/045\$ B41J29/38\$	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:44
S4	629	S1 and S2 and S3	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:44
S5	101	(extruder jet nozzle) with contact with force with (sensor sensing)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:50
S6	2	S4 and S5	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:54
S7	17702	contact with force with (sensor sensing)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:59
S8	21	S4 and S7	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 09:59
S9	15	S3 and S5	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 10:14
S10	636	(extruder jet nozzle head) with contact with force with (sensor sensing)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 10:18
S11	12	S1 and S10 not S9	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 10:18

S12	865	(extruder jet nozzle) with force with (sensor sensing)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 10:22
S13	3	S4 and S12 not S11 not S9 not S8	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 10:22
S14	3	"14020535"	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 10:23
S15	5781	(extruder jet nozzle) with contact with force	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 11:32
S16	1217	(S1 S2) and S15	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 11:33
S17	1180	S15 same (sensor sensing sens\$3 measur\$3)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 11:33
S18	709	S16 and S17	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 11:34
S19	5	S3 and S18	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 11:35
S20	19	"7725209" "9193157"	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 12:30
S21	5	S18 and S19	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 12:31
S22	0	S18 and S20	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 12:31
S23	0	S15 and S20	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 12:31
S24	0	S12 and S20	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 12:32
S25	86	S1 and S7	US-PGPUB; USPAT; USOCR	OR	OFF	2017/03/19 12:34
S26	3	"14065516"	US-PGPUB; USPAT;	OR	OFF	2017/04/02 14:47

			USOCR			
S27	1	(US-20060156978-\$.did.	US-PGPUB	OR	OFF	2017/04/02 14:48
S28	1	S27 and (contact with force)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/02 14:48
S29	1080	(extruder jet nozzle head tool) with contact\$3 with force with (sensor sensing)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/02 14:57
S30	20041	(3D three-dimensional (three near dimension\$3) rapid) with (prototype printer printing imprinting lithography stereolithography sinter\$3) with (system apparatus method device machine tool)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/02 14:57
S31	472795	(gmbh "3D systems" Roland xyzprinting makerbot Samsung leapfrog stratasys "tyco electronics" "mobium Solutions" "Wisconsin Alumni Research Foundation" sodick "Ig electronics" "Institute of Nuclear Energy Research Atomic Energy Council" Xjet).as. (libinson Desimone Cassara chase lacaze el-siblani kritchman).in.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/02 14:57
S32	108225	B29C\$ B33Y\$ B83Y\$ B41J02/045\$ B41J29/38\$	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/02 14:57
S33	635	S30 and S31 and S32	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/02 14:57
S34	7	S29 and S33	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/02 14:58
S35	1	contact with force with (sensor sensing) and "7939003".pn.	US-PGPUB; USPAT; USOCR	OR	OFF	2018/09/08 19:22
S36	374	(contact with force with (sensor sensing)) same (nozzle jet inject\$3)	US-PGPUB; USPAT; USOCR	OR	OFF	2018/09/08 21:00
S37	7229	B29C64\$ B33Y\$	US-PGPUB; USPAT; USOCR	OR	OFF	2018/09/08 21:07
S38	19	S36 and S37	US-PGPUB; USPAT; USOCR	OR	OFF	2018/09/08 21:08
S39	48	(contact with force with (sensor sensing)) and S37	US-PGPUB; USPAT; USOCR	OR	OFF	2018/09/08 21:12
S40	29	S39 not S38	US-PGPUB; USPAT;	OR	OFF	2018/09/08 21:13

EAST Search History

			USOCR			
S41	1	(contact with force with (sensor sensing)) and "7939003".pn.	US- PGPUB; USPAT; USOCR	OR	OFF	2018/09/09 10:21

9/ 9/ 2018 3:50:28 PM
C:\ Users\ tnguyen34\ Documents\ EAST\ Workspaces\ 14922267 - 14922267 - contact force
sensor.wsp

Bibliographic Data

Application No: 14/922,267

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☒ No ☐ Met After Allowance

Verified and Acknowledged: /THU KHANH T NGUYEN/

Examiner's Signature

Initials

Title:

THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/26/2015	264	1743	MBOT-0051-P02
RULE			

APPLICANTS

MakerBot Industries, LLC, Brooklyn, NY,

INVENTORS

Aljosa Kemperle Brooklyn, NY, UNITED STATES

Filipp Gelman Staten Island, NY, UNITED STATES

Peter Joseph Schmehl Brooklyn, NY, UNITED STATES

CONTINUING DATA

This application is a CON of 14065516 10/29/2013 PAT 9168698

14065516 has PRO of 61719874 10/29/2012

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

11/04/2015

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P.O. BOX 920629

NEEDHAM, MA 02492

UNITED STATES

FILING FEE RECEIVED

\$1,600

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

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14/922,267
	Filing Date	Oct 26, 2015
	First Named Inventor	Aljosa Kemperle
	Art Unit	1743
	Examiner Name	NGUYEN, THUKHANH T
Sheet 1 of 3	Attorney Docket No.	MBOT-0051-P02

U.S. PATENTS						
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-7625198		Dec 1, 2009	Lipson, Hod et al.	
		US-6629011		Sep 30, 2003	Calderon, Joseph L., et al.	
		US-6129872		Oct 10, 2000	Jang, Justin	
		US-5303141		Apr 12, 1994	Batchelder, John S., et al.	

U.S. PATENT APPLICATION PUBLICATIONS						
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-20140117575		May 1, 2014	Kemperle, Aljosa et al.	

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

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 ⁵
	NPL-81	"Touch Sensor and Automated Calibration", by Assargadon - http://forums.reprap.org/read.php?1,8028 , Jan. 4, 2008 , 14 pages	
	NPL-80	"HydraRaptor", http://hydraraptor.blogspot.com/2011/04/auto-z-probe.html Apr. 4, 2011 , 12 pages	
	NPL-79	"Automated Bed Leveling With Our 3D Printer", by Brian Benchhoff - http://hackaday.com/2012/04/23/automated-bed-televling-with-our-3d-printer/ Apr. 23, 2012 , 5 pages	
	NPL-180	USPTO, "Application Serial No. 14/065,516 (Atty Ref MBOT-0051-P01) , Non Final Office Action mailed 04-09-2015", 12 pages	

Doc code: IDS
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SUBSTITUTE PTO/SB/08 (01-10)
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Sheet 2 of 3	Attorney Docket No.	MBOT-0051-P02

NON-PATENT LITERATURE DOCUMENTS			
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	NPL-181	USPTO, "Application Serial No. 14/065,516 (Atty Ref MBOT-0051-P01), Notice of Allowance mailed 07-22-2015", , 7 pages	

EXAMINER SIGNATURE			
Examiner Signature	/THU KHANH T NGUYEN/	Date Considered	09/09/2018
*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.			
¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.			

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

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14/922,267
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	Art Unit	1743
	Examiner Name	NGUYEN, THUKHANH T
Sheet 3 of 3	Attorney Docket No.	MBOT-0051-P02

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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)	2016-01-12
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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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/922,267	10/26/2015	Aljosa Kemperle	MBOT-0051-P02

CONFIRMATION NO. 1809

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

PUBLICATION NOTICE



Title:THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION

Publication No.US-2016-0039150-A1

Publication Date:02/11/2016

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. 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 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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14/922,267
	Filing Date	Oct 26, 2015
	First Named Inventor	Aljosa Kemperle
	Art Unit	1743
	Examiner Name	NGUYEN, THUKHANH T
Sheet 1 of 3	Attorney Docket No.	MBOT-0051-P02

U.S. PATENTS						
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-7625198		Dec 1, 2009	Lipson, Hod et al.	
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		US-5303141		Apr 12, 1994	Batchelder, John S., et al.	

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		US-20140117575		May 1, 2014	Kemperle, Aljosa et al.	

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Examiner Initial*	Cite No	Foreign Document Number ³	Cnty Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵

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 ⁵
	NPL-81	"Touch Sensor and Automated Calibration", by Assargadon - http://forums.reprap.org/read.php?1,8028 , Jan. 4, 2008 , 14 pages	
	NPL-80	"HydraRaptor", http://hydraraptor.blogspot.com/2011/04/auto-z-probe.html Apr. 4, 2011 , 12 pages	
	NPL-79	"Automated Bed Leveling With Our 3D Printer", by Brian Benchhoff - http://hackaday.com/2012/04/23/automated-bed-televling-with-our-3d-printer/ Apr. 23, 2012 , 5 pages	
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	Filing Date	Oct 26, 2015
	First Named Inventor	Aljosa Kemperle
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Sheet 2 of 3	Attorney Docket No.	MBOT-0051-P02

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	NPL-181	USPTO, "Application Serial No. 14/065,516 (Atty Ref MBOT-0051-P01), Notice of Allowance mailed 07-22-2015", , 7 pages	

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14/922,267
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	Art Unit	1743
	Examiner Name	NGUYEN, THUKHANH T
Sheet 3 of 3	Attorney Docket No.	MBOT-0051-P02

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OR

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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

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)	2016-01-12
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:	24599147
Application Number:	14922267
International Application Number:	
Confirmation Number:	1809
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-P02
Receipt Date:	12-JAN-2016
Filing Date:	26-OCT-2015
Time Stamp:	15:00:56
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)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	MBOT-0051-P02_011216_Form1449.pdf	78547 a8a01a7422bc7696034fd30ce89ef6d6e9bcf956	no	3

Warnings:

Information:

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2	Non Patent Literature	NPL-81_TouchSensorAndAutomatedCalibration.pdf	4093737 4299f8f41c1f685aacf533999b60e675cf6a8e94	no	14
Warnings:					
Information:					
3	Non Patent Literature	NPL-80_HydraRaptor_Auto_z-probe.pdf	4757566 48d652adb542281408af5cf88c9fd6f41d637d0	no	12
Warnings:					
Information:					
4	Non Patent Literature	NPL-79_AutomatedBedLevelingWith3DPrinter.pdf	1476169 f8c6b562c3c1f8385fba1ad973daf0f6b0488d1	no	5
Warnings:					
Information:					
5	Non Patent Literature	NPL-180_SN14065516_NFOA-040915.pdf	445983 1ff9323dad57d44e7e128eac1d41e7526d123666	no	12
Warnings:					
Information:					
6	Non Patent Literature	NPL-181_SN14065516_NOA-072215.pdf	409362 bd8a3b101771d7fa585a696bb7b0be78f302011e	no	7
Warnings:					
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Total Files Size (in bytes):			11261364		
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 14/922,267				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280			
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	600			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720			
TOTAL CLAIMS (37 CFR 1.16(i))	13	minus 20 = *				x 80 =	0.00			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1	minus 3 = *				x 420 =	0.00			
APPLICATION SIZE FEE (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	1600			
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE			TOTAL ADD'L FEE	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE			TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.										



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
14/922,267	10/26/2015	1742	1600	MBOT-0051-P02	13	1

CONFIRMATION NO. 1809

FILING RECEIPT

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



0000000078482019

Date Mailed: 11/06/2015

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, Brooklyn, NY;

Applicant(s)

MakerBot Industries, LLC, Brooklyn, NY;

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

Domestic Priority data as claimed by applicant

This application is a CON of 14/065,516 10/29/2013 PAT 9168698
which 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: 11/04/2015

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/922,267**

Projected Publication Date: 02/11/2016

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: No

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.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

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).

SelectUSA

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.

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) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	Unknown
Filing Date	October 26, 2015
First Named Inventor	Aljosa Kemperle
Title	THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION
Art Unit	Unknown
Examiner Name	Unknown
Attorney Docket Number	MBOT-0051-P02

SIGNATURE of Applicant or Patent Practitioner

Signature	/Robert Mazzaresse/	Date (Optional)	Oct. 26, 2015
Name	Robert Mazzaresse	Registration Number	42852
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)	MakerBot Industries, LLC		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐

*Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.131, 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.

POWER OF ATTORNEY BY APPLICANT

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

Application Number

Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)



I hereby appoint the Patent 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 identified above:

43520

OR



I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) 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 patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above 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 (if the Applicant is a juristic entity, list the Applicant name in the box):

MakerBot Industries, LLC



Inventor or Joint Inventor (title not required below)



Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)



Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)



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) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature

Date (Optional)

Name

Title

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. If more than one applicant, use multiple forms.

☐ Total of

forms are submitted.

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

POWER OF ATTORNEY BY APPLICANT

No more than ten (10) patent practitioners total may be appointed as set forth below by name and registration number. This page need not be submitted if appointing the Patent Practitioner(s) associated with a Customer Number (see form PTO/AIA/82B):

Name	Registration 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 the Freedom of Information Act requires disclosure of these records.
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 inspections 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.

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.

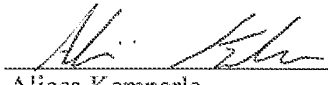
I accept and agree to the terms of the ASSIGNMENT above.

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

DECLARATION

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

THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION

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- (b) I have read and understood the application; and
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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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AND the Inventor hereby authorizes and requests the issuing authority to issue any and all patents issuing from any of the foregoing 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: 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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- (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
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- (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

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(e).

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: 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: _____

12/11/2013

§ 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.

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION		
First Named Inventor/Applicant Name:		Aljosa Kemperle		
Filer:		Robert A. Mazzaresse/Paula Ng		
Attorney Docket Number:		MBOT-0051-P02		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility application filing	1011	1	280	280
Utility Search Fee	1111	1	600	600
Utility Examination Fee	1311	1	720	720
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1600

Electronic Acknowledgement Receipt	
EFS ID:	23885046
Application Number:	14922267
International Application Number:	
Confirmation Number:	1809
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-P02
Receipt Date:	26-OCT-2015
Filing Date:	
Time Stamp:	11:05:19
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$1600
RAM confirmation Number	8527
Deposit Account	504262
Authorized User	NG, PAULA
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	MBOT-0051-P02_102615_ADS.pdf	1819334	no	7
			31ecd9ca68d796ef8ff7431707e1055614e050fa		
Warnings:					
Information:					
2	Drawings-only black and white line drawings	MBOT-0051-P02_102615_Drawings.pdf	112924	no	5
			4eacc81eada01baf7ad594084e4a56f8d65fa877		
Warnings:					
Information:					
3		MBOT-0051-P02_102615_Specification.pdf	119987	yes	21
			0df582f2dca1805056899cddf4833e9ed6f52ed8		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	18	
	Claims		19	20	
	Abstract		21	21	
Warnings:					
Information:					
4	Power of Attorney	MBOT-0051-P02_102615_POA-PTO.pdf	377365	no	4
			36f83fa753c3d50fe27288cef7ecbc6ef602cac5		
Warnings:					
Information:					
5	Oath or Declaration filed	MBOT-0051-P01_121113_Executed_DeclAs sg_Kemperle_PTO.pdf	2213405	no	4
			ab219145a1ac5d4982f7e232e0e7b19c4b42434f		
Warnings:					
Information:					
6	Oath or Declaration filed	MBOT-0051-P01_121313_Executed_DeclAs sg_Gelman_PTO.pdf	1416777	no	4
			a7b54b26d8d525e77e8509c7bb99177f459721e8		

Warnings:					
Information:					
7	Oath or Declaration filed	MBOT-0051-P01_121113_Executed_DeclAs sg_Schmehl_PTO.pdf	2238956 0767ada4a830fb6dcabae6b73e50abc364c decdb	no	4
Warnings:					
Information:					
8	Fee Worksheet (SB06)	fee-info.pdf	35355 ee630f7f72d4ed65ed0429a9c12553447db 79712	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			8334103		
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. <u>New Applications Under 35 U.S.C. 111</u> 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. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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.					

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	MBOT-0051-P02
		Application Number	
Title of Invention	THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION		
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. 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.			

Secrecy Order 37 CFR 5.2

☐ 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:

Inventor 1					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Aljosa		Kemperle		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Brooklyn	State/Province	NY	Country of Residence i	US
Mailing Address of Inventor:					
Address 1		465 State Street			
Address 2		Apt. 2			
City	Brooklyn	State/Province	NY		
Postal Code	11217	Country i	US		
Inventor 2					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Filipp		Gelman		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Staten Island	State/Province	NY	Country of Residence i	US
Mailing Address of Inventor:					
Address 1		MakerBot Industries, LLC			
Address 2		1 Metrotech Center, 21st Floor			
City	Brooklyn	State/Province	NY		
Postal Code	11201	Country i	US		
Inventor 3					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Peter	Joseph	Schmehl		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					

Application Data Sheet 37 CFR 1.76		Attorney Docket Number		MBOT-0051-P02	
		Application Number			
Title of Invention	THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION				
City	Brooklyn	State/Province	NY	Country of Residence i	US
Mailing Address of Inventor:					
Address 1	573 2nd Street				
Address 2	Apt. 6				
City	Brooklyn	State/Province	NY		
Postal Code	11215	Country i	US		
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.					Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).		
☐ An Address is being provided for the correspondence Information of this application.		
Customer Number	43520	
Email Address	patents@stratpat.com	Add Email Remove Email

Application Information:

Title of the Invention	THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION		
Attorney Docket Number	MBOT-0051-P02	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	5	Suggested Figure for Publication (if any)	

Filing By Reference :

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country i

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐ Request Not to Publish. 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 has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	MBOT-0051-P02
		Application Number	
Title of Invention	THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION		

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:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
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, 365(c), or 386(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.

When referring to the current application, please leave the application number blank.

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation of	14/065516	2013-10-29
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
14/065516	Claims benefit of provisional	61/719874	2012-10-29
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

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. 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(i)(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).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove
			Access Code ^j (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			Add

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	MBOT-0051-P02
		Application Number	
Title of Invention	THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION		

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

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. ☐ NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.
--

Authorization to Permit Access:

☒ Authorization to Permit Access to the Instant Application by the Participating Offices 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. 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. In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.
--

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.
--

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	MBOT-0051-P02
		Application Number	
Title of Invention	THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION		

Applicant 1				Remove
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.				
Clear				
☒ Assignee		☐ Legal Representative under 35 U.S.C. 117		☐ Joint Inventor
☐ Person to whom the inventor is obligated to assign.		☐ 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. ☒				
Organization Name	MakerBot Industries, LLC			
Mailing Address Information For Applicant:				
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. Add				

Assignee Information including 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.	
Assignee 1	
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.	
Remove	
If the Assignee or Non-Applicant Assignee is an Organization check here. ☐	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	MBOT-0051-P02
		Application Number	
Title of Invention	THREE-DIMENSIONAL PRINTER WITH FORCE DETECTION		

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		State/Province	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Signature:

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

Signature	/Robert Mazzaresse/		Date (YYYY-MM-DD)	2015-10-26
First Name	Robert	Last Name	Mazzaresse	Registration Number
				42852

Additional Signature may be generated within this form by selecting the Add button.

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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.**

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 the Freedom of Information Act requires disclosure of these records.
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 inspections 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.

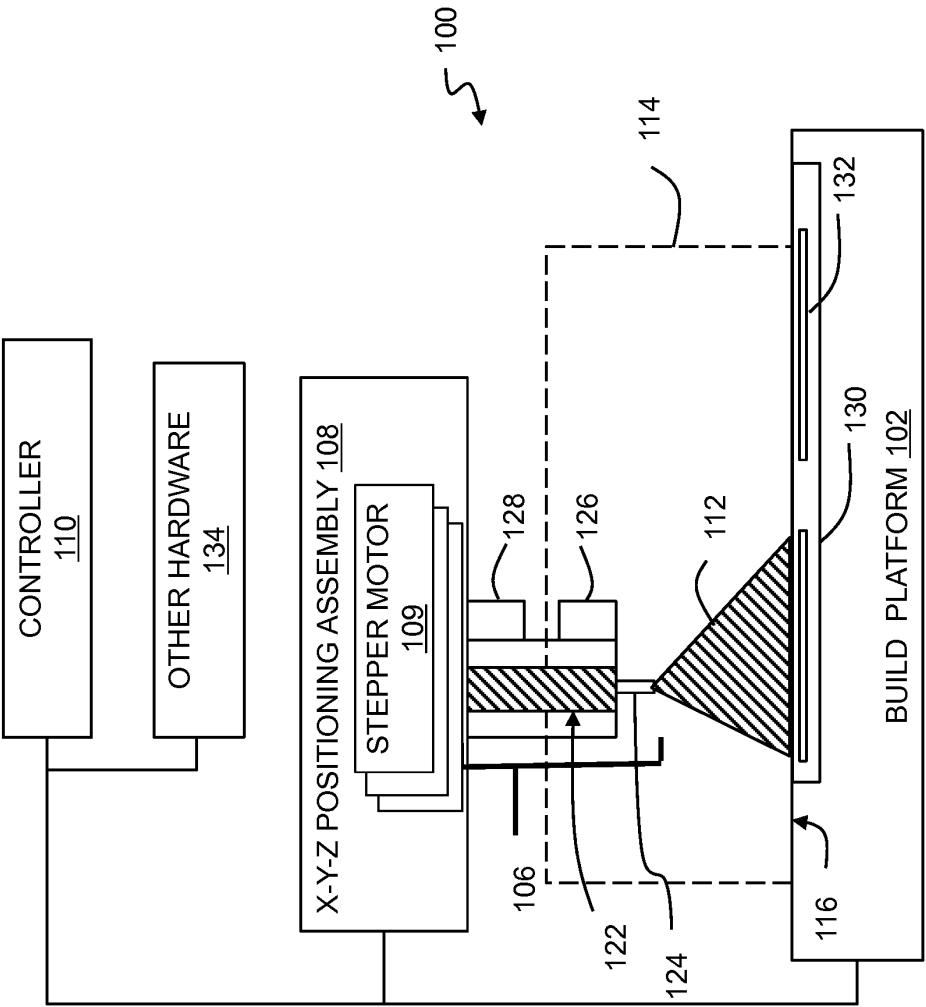


Fig. 1

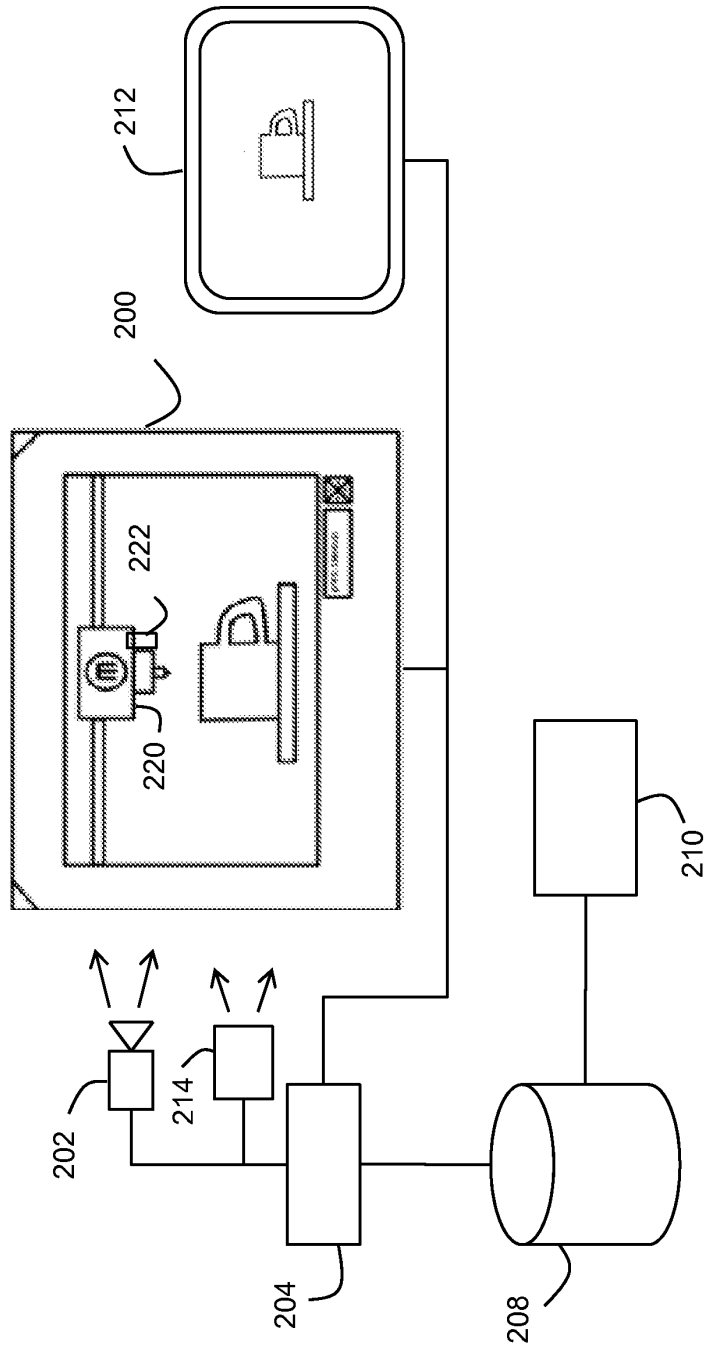


Fig. 2

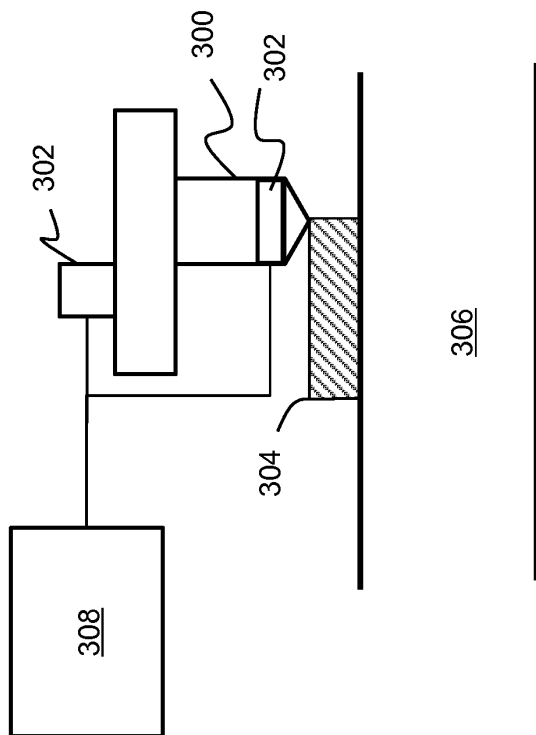


Fig. 3

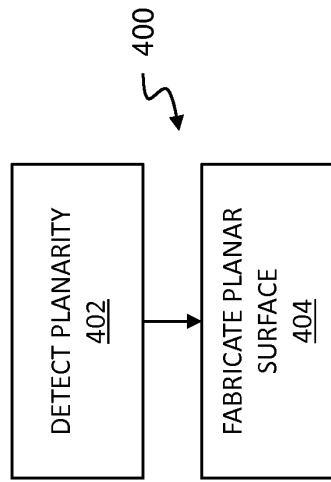


Fig. 4

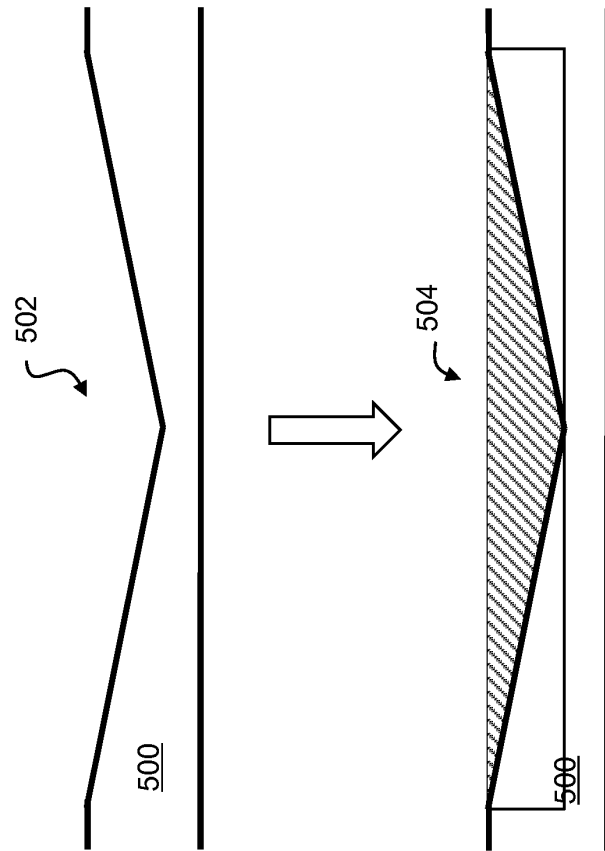
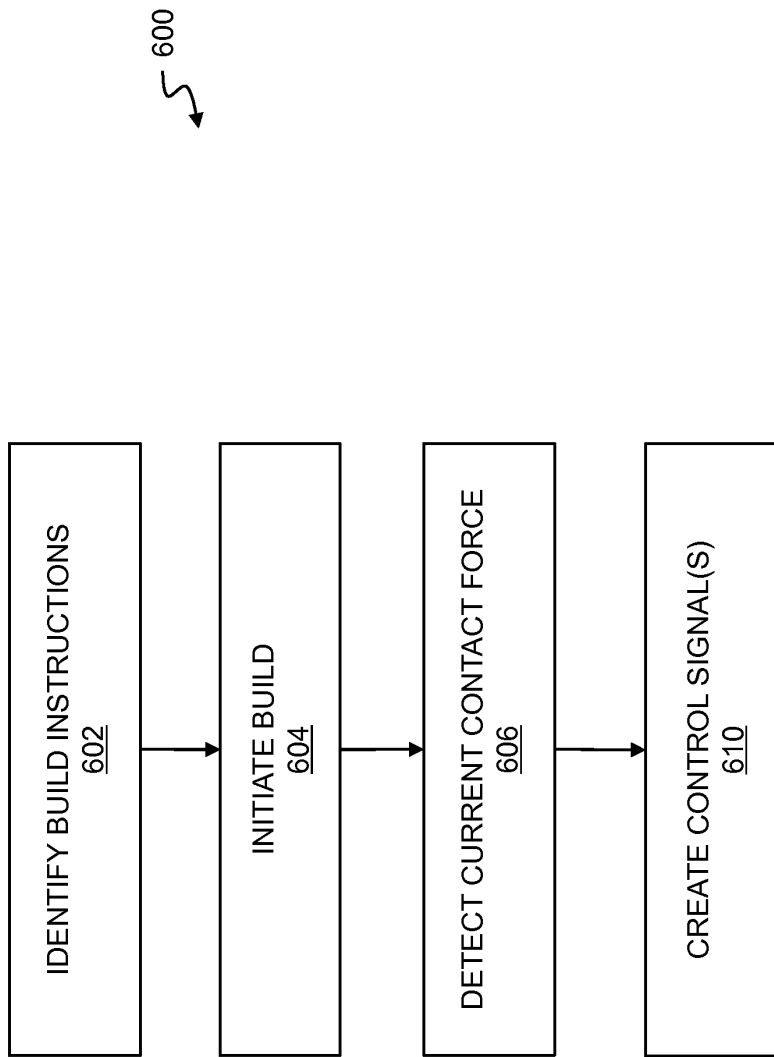


Fig. 5

**Fig. 6**

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

[0001] This application is a continuation of U.S. Pat. App. No. 14/065,516 filed October 29, 2013, which claims the benefit of U.S. Pat. App. 61/719,874, filed October 29, 2012, where the entirety of each is hereby 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 (“HDPL”), 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 a 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.

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.