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# THIRD-PARTY SUBMISSION UNDER 37 CFR 1.290

(Do **not** submit this form electronically via EFS-Web)

Application Number (required): 13/530,191

## U.S. PATENTS AND U.S. PATENT APPLICATION PUBLICATIONS

| Cite No. | Document Number (Number-Kind Code[1]) | Issue Date or Publication Date (MM/DD/YYYY) | First Named Inventor |
|---|---|---|---|
| | US- | | |
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## FOREIGN PATENTS AND PUBLISHED FOREIGN PATENT APPLICATIONS

| Cite No. | Country or Patent Office and Document Number (Country Code[2]-Number[3]-Kind Code[4]) | Publication Date (MM/DD/YYYY) | Applicant, Patentee or First Named Inventor | Translation Attached |
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1. If known, enter kind of document by the appropriate symbols indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a). 2. Enter the country or patent office that issued the document by two-letter country code under WIPO Standard ST.3. See MPEP 1851. 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. If known, enter kind of document by the appropriate symbols indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a).

# THIRD-PARTY SUBMISSION UNDER 37 CFR 1.290



Application Number (required): 13/530,191

## NON-PATENT PUBLICATIONS (e.g., journal article, Office action)

| Cite No. | Author (if any), title of the publication, page(s) being submitted, publication date, publisher (where available), and place of publication (where available) | Translation Attached | Evidence of Publication Attached |
|---|---|---|---|
| 1 | Adrian Bowyer, Drink Bottle Feedstock, 3/15/09, at http://blog.reprap.org/2009/03/drink-bottle-feedstock.html | ☐ | ☐ |
| 2 | http://www.engineeringtoolbox.com/young-modulus-d_417.html, web.archive.org snapshot from Feb 18, 2007 | ☐ | ☐ |
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## STATEMENTS

The party making the submission is not an individual who has a duty to disclose information with respect to the above-identified application under 37 CFR 1.56.

This submission complies with the requirements of 35 U.S.C. 122(e) and 37 CFR 1.290.

☐ The fee set forth in 37 CFR 1.290(f) is submitted herewith.

☒ The fee set forth in 37 CFR 1.290(f) is not required because this submission lists three or fewer total items and, to the knowledge of the person signing the statement after making reasonable inquiry, this submission is the first and only submission under 35 U.S.C. 122(e) filed in the above-identified application by the party making the submission or by a party in privity with the party.

| | | | |
|---|---|---|---|
| **Signature** | s/Kit Walsh/ | **Date** | 4/11/2013 |
| **Name (Printed/Typed)** | Kit Walsh | **Reg. No., if applicable** | |

| | | | |
|---|---|---|---|
| **Examiner Signature*** | | **Date Considered** | |

*EXAMINER: Signature indicates all items listed have been considered, except for citations through which a line is drawn. Draw line through citation if not considered. Include a copy of this form with next communication to applicant.

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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.

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

| | | |
|---|---|---|
| Application No: | 13/530,191 | Confirmation No.: 7197 |
| Inventor(s): | J. Samuel Batchelder, William J. Swanson, and S. Scott Crump | |
| Filed: | June 22, 2012 | |
| Art Unit: | 1742 | |
| Examiner: | Tentoni, Leo B. | |
| For: | Ribbon Filament and Assembly for Use in Extrusion-Based Digital Manufacturing Systems | |
| Petitioners: | Electronic Frontier Foundation | |

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**NOTIFICATION REQUEST OF NON-COMPLIANT THIRD-PARTY PREISSUANCE SUBMISSION**

The undersigned requests notification via e-mail to the following address in the event the third-party submission is determined to be non-compliant.

E-mail Address: cwalsh@cyber.law.harvard.edu

Respectfully submitted,

ELECTRONIC FRONTIER FOUNDATION

By its counsel,

s/Kit Walsh/

Kit Walsh
Clinical Instructional Fellow, Cyberlaw Clinic,
Berkman Center for Internet and Society
Harvard Law School
23 Everett Street, 2nd Floor
Cambridge, MA 02138
Phone: (617) 495-7547
Fax: (617) 495-7641

Date: April 11, 2013

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

| | | |
|---|---|---|
| Application No: | 13/530,191 | Confirmation No.: 7197 |
| Inventor(s): | J. Samuel Batchelder, William J. Swanson, and S. Scott Crump | |
| Filed: | June 22, 2012 | |
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| Petitioners: | Electronic Frontier Foundation | |

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## THIRD-PARTY PREISSUANCE SUBMISSION UNDER 37 C.F.R. § 1.290
## CONCISE DESCRIPTION OF RELEVANCE

### Cite No. 1 – Bowyer reference

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

Dear Examiner Tentoni:

Listed on accompanying Form PTO/SB/429 are documents that may be considered material to the patentability of this application pursuant to 37 C.F.R. § 1.290. Copies of the patents or publications cited are enclosed, except as waived by 37 C.F.R. § 1.290(d)(3).

In accordance with 37 C.F.R. § 1.290(d)(2), Petitioners' undersigned representative submits the following concise description of relevance for the Bowyer reference, Cite No. 1 on Form PTO/SB/429:

Bowyer discloses the concept of using 6mm wide strips from polyethylene terephthalate drink bottles as feedstock for the extruder of a RepRap 3D printer. *See* Bowyer at 1-2. These strips are similar to the ribbon filaments disclosed in ¶¶ 0024-0040 of the Specification and recited by Claims 1-20 of the instant Application. Further, Bowyer contemplates "designing the channel to be the thickness of the folded strip."

Bowyer at 2. This narrowed channel is similar to the ribbon liquefier disclosed in ¶ 8, ¶ 15, and Fig. 5C and recited by claims 1-20 of the instant Application.

Should Examiner or the Office find that the above statement of relevance, or any portion thereof, is non-compliant with some requirement of 37 C.F.R. § 1.290, Petitioners respectfully request the third-party submission be entered if the error is of such minor character that it does not raise an ambiguity as to the content of the submission. *See* 70 Fed. Reg. 42,150, 42,168 (July 17, 2012).

Respectfully submitted,

ELECTRONIC FRONTIER FOUNDATION

By its counsel,

Kit Walsh
Clinical Instructional Fellow, Cyberlaw Clinic,
Berkman Center for Internet and Society
Harvard Law School
23 Everett Street, 2nd Floor
Cambridge, MA 02138
Phone: (617) 495-7547
Fax: (617) 495-7641

Date: April 11, 2013

# RepRap: Blog

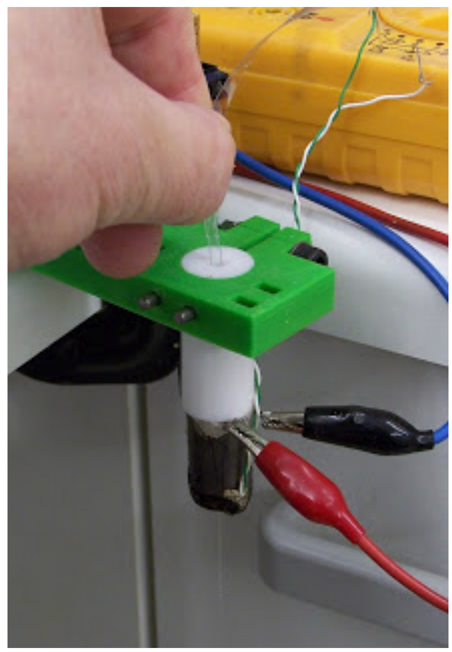
**Blog for the RepRap project at www.reprap.org - a project to create an open-source self-copying 3D printer.**

## Contributors

prusajr
Buzz
Christopher Olah
Ian Adkins
Simon McAuliffe
Wizard23
Sebastien Bailard
eD
D1plo1d
jmil
Enrique
Bogdan Kecman
Forrest Higgs
nop head
Rhys Jones
Adrian Bowyer
Steve DeGroof
Wade Bortz
Jonathan Marsden
Neil Underwood
Marius Kintel
Zach Smith
Vik Olliver

**Sunday, March 15, 2009**

## Drink Bottle Feedstock



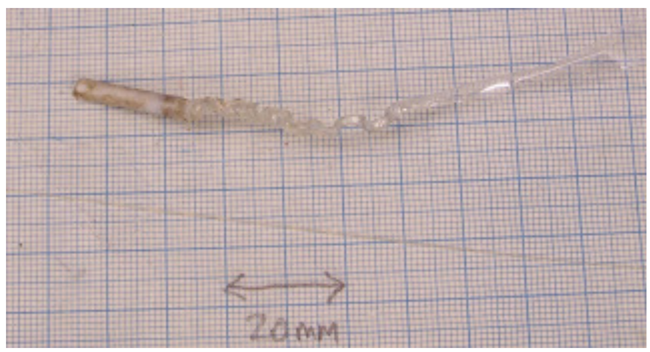
Over on the Builder's Blog Paul Midgley had the brilliant idea of cutting polyethylene terephthalate (PET) drink bottles into helical strips and using them as a RepRap extruder feedstock. I thought of folding the strip in half to make it stiffer (and hence easier to push into the melt zone).

So. Time for an experiment. I took my old screw-drive extruder (now replaced by the rapidly coming-together pinch-wheel design), clamped it to the bench, cut a very crude strip of PET from a drink bottle about 6mm wide, folded it in half, and pushed it into the nozzle by hand.

It extruded well at about 230 °C. It behaved in very similar way to polylactic acid, though that will extrude at about 180 °C.

Cutting the strip in production should be fairly straightforward using a blade held 6mm from a barrier, and simply pulling on the forming strip. The pull could even come from the extruder. The pinch-wheel design could both generate the pull, and - with a small redesign of the polymer channel - automatically start the fold, which would then be completed by the pinch wheel.

When it was cooling, I pulled it back out to see what had happened:




As you would expect, the strip had concertinaed in the wider nozzle channel (top of this picture). This didn't stop the device working at all, but in a real extruder it would lead to a lack of controllability because of the springiness of the zig-zag. This would be easy to fix simply by designing the channel to be the thickness of the folded strip.

The PET at the tip set cloudy, when the original was clear. I suspect that this means that it's become semi-crystaline as opposed to amorphous (see the PET Wikipedia entry). What this means for objects built from PET remains to be seen.

The filament created is at the bottom of this picture, incidentally.

# posted by Adrian Bowyer @ 8:43 PM



Site Feed

## archives

## Comments:

Odd that you can extrude it below its melting point!

# posted by nophead : March 15, 2009 11:04 PM

Yup - that's what I thought. But it comes out pretty runny. My temperature measuring is a thermocouple straight into my multimeter K-junction, but it may be a little off centre, and so a few degreed colder than the polymer. But 30 C below seems unlikely.

Of course, the whole idea of a melting point for a polymer is a rather elastic concept (if that's the right metaphor) anyway...

# posted by Adrian Bowyer : March 15, 2009 11:29 PM

degreed - degrees...

# posted by Adrian Bowyer : March 15, 2009 11:29 PM

Great test!

Could this same method work using plastic Milk bottles I beleve they are made from Hdpe.
The next qestion would then be if it is possible to recycle.
By extrudeing objects from strips, roughtly how many 2ltr drinks containers would you extimate would be needed to extrude a set of reprap parts?

Thoughts of local reclying in my own street, poping into my head now.

# posted by BodgeIt : March 16, 2009 12:26 AM

with coloured lid removed :-

2ltr Milk container is 44g
3.4 ltr Mild container 70g

HDPE Reprap parts xxxg

Subscribe to Posts [Atom]

I guess parts like the screw thread for the lid would not be easy to use this would need to be deducted from the above weights.
# posted by BodgeIt : March 16, 2009 12:37 AM

Interesting stuff!

This is not just about feedstock, it's about independence :) It means that people might be able to bootstrap a machine without needing a specific filament.

Maybe the melting point changes because PET absorbs water.
"PET is hygroscopic, meaning that it naturally absorbs water from its surroundings. However, when this 'damp' PET is then heated, the water hydrolyzes the PET, decreasing its resilience."
http://en.wikipedia.org/wiki/Polyethylene_terephthalate#Drying

I guess that hydrolysis would change the chemical and material properties of PET...
Under the #Crystals heading, there are also some details that might explain the clouding.
# posted by Erik de Bruijn : March 16, 2009 7:53 AM

From memory, Darwin's RP parts weigh about 1 kg if you build them solid, about one-third that if you build them with a honeycomb interior.

Mendel should be lighter yet.

I don't know how the hydrolysis will affect the usability and strength of the parts, though I can say that the cloudy bit I took out of the nozzle seems pretty tough.
# posted by Adrian Bowyer : March 16, 2009 10:42 AM

*This comment has been removed by the author.*
# posted by BodgeIt : March 16, 2009 12:21 PM

Interesting lets say we only get 60% of usable HDPE from a milk bottle and we use the honeycomb interior.

A full Darwin print run would only need 8 x 6 pint milk bottles or 13 2 pint milk bottles.
# posted by BodgeIt : March 16, 2009 12:22 PM

Correction: Forrest's just reminded me that the weight of the solid Darwin parts is about 1.4 kg.
# posted by Adrian Bowyer : March 16, 2009 8:14 PM

**Post a Comment**

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I Power Blogger

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

| | | |
|---|---|---|
| Application No: | 13/530,191 | Confirmation No.: 7197 |
| Inventor(s): | J. Samuel Batchelder, William J. Swanson, and S. Scott Crump | |
| Filed: | June 22, 2012 | |
| Art Unit: | 1742 | |
| Examiner: | Tentoni, Leo B. | |
| For: | Ribbon Filament and Assembly for Use in Extrusion-Based Digital Manufacturing Systems | |
| Petitioners: | Electronic Frontier Foundation | |

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# THIRD-PARTY PREISSUANCE SUBMISSION UNDER 37 C.F.R. § 1.290 CONCISE DESCRIPTION OF RELEVANCE

**Cite No. 2 – Engineering Toolbox reference**

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

Dear Examiner Tentoni:

Listed on accompanying Form PTO/SB/429 are documents that may be considered material to the patentability of this application pursuant to 37 C.F.R. § 1.290. Copies of the patents or publications cited are enclosed, except as waived by 37 C.F.R. § 1.290(d)(3).

In accordance with 37 C.F.R. § 1.290(d)(2), Petitioners' undersigned representative submits the following concise description of relevance for the Engineering Toolbox reference, Cite No. 2 on Form PTO/SB/429:

The reference notes on page 1 that the Young's modulus of polyethylene terephthalate (PET) is 2 – 2.7 x $10^9$ N-$m^2$ (2 – 2.7 gigapascals). Riegel at 686. This modulus range falls within the range of about 1.0 gigapascal to about 5.0 gigapascals disclosed in ¶¶ 0007–0008, 0041 of the Specification and recited by Claims 1-20 of the instant Application. Further, this modulus range for polyethylene terephthalate falls within the range of about 1.5 gigapascals to 3.0 gigapascals disclosed in ¶ 0041 of the

Specification. As such, prior art involving polyethylene terephthalate could be relevant to the instant Application.

Should Examiner or the Office find that the above statement of relevance, or any portion thereof, is non-compliant with some requirement of 37 C.F.R. § 1.290, Petitioners respectfully request the third-party submission be entered if the error is of such minor character that it does not raise an ambiguity as to the content of the submission. *See* 70 Fed. Reg. 42,150, 42,168 (July 17, 2012).

Respectfully submitted,

ELECTRONIC FRONTIER FOUNDATION

By its counsel,

Kit Walsh
Clinical Instructional Fellow, Cyberlaw Clinic,
Berkman Center for Internet and Society
Harvard Law School
23 Everett Street, 2nd Floor
Cambridge, MA 02138
Phone: (617) 495-7547
Fax: (617) 495-7641

Date: April 11, 2013

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# Elastic Properties and Young Modulus for some Materials

## The Young Modulus (Tensile Modulus) for common materials as steel, glass, wood and more



To describe elastic properties of linear objects like wires, rods, or columns which are stretched or compressed, a convenient parameter is the ratio of the stress to the strain, a parameter called the Young's modulus of the material. Young's modulus can be used to predict the elongation or compression of an object as long as the stress is less than the yield strength of the material.

| Material | Young's Modulus - *E* - ($10^9$ N/m$^2$) | Ultimate Tensile Strength - $S_u$ - ($10^6$ N/m$^2$) | Yield Strength - $S_y$ - ($10^6$ N/m$^2$) |
|---|---|---|---|
| ABS plastics | 2.3 | 40 | |
| Acrylic | 3.2 | 70 | |
| Aluminum | 69 | 110 | 95 |
| Bone | 9 | 170 (compression) | |
| Boron | | | 3100 |
| Brasses | 100 - 125 | 250 | |
| Bronzes | 100 - 125 | | |
| Carbon Fiber Reinforced Plastic | 150 | | |
| Cast Iron 4.5% C, ASTM A-48 | | 170 | |
| Concrete, High Strength (compression) | 30 | 40 (compression) | |
| Copper | | 220 | 70 |
| Diamond | 1,050 - 1,200 | | |
| Douglas fir Wood | 13 | 50 (compression) | |
| Glass | 50 - 90 | 50 (compression) | |
| Magnesium | 45 | | |
| Marble | | 15 | |
| Nylon | 2 - 4 | 75 | 45 |
| Oak Wood (along grain) | 11 | | |
| Pine Wood | | 40 | |
| Polycarbonate | 2.6 | 70 | |
| Polyethylene HDPE | 0.8 | 15 | |
| Polyethylene Terephthalate PET | 2 - 2.7 | 55 | |
| Polyimide | 2.5 | 85 | |
| Polypropylene | 1.5 - 2 | 40 | |
| Polystyrene | 3 - 3.5 | 40 | |
| Rubber | 0.01 - 0.1 | | |
| Silicon Carbide | 450 | | 3440 |

| | | | |
|---|---|---|---|
| Titanium Alloy | 105 - 120 | 900 | 730 |
| Tungsten | 400 - 410 | | |
| Tungsten Carbide | 450 - 650 | | |
| Wrought Iron | 190 - 210 | | |

- 1 $N/m^2$ = 1 Pa = $1.4504x10^{-4}$ psi

Note! Use the pressure unit converter on this page to switch the values to other units.

## Strain

Strain can be expressed as

*strain = dL / L (1)*

*where*

*strain = (m/m) (in/in)*

*dL = elongation or compression (offset) of the object (m) (in)*

*L = length of the object (m) (in)*

## Stress

Stress can be expressed as

*stress = F/A (2)*

*where*

*stress = ($N/m^2$) ($lb/in^2$, psi)*

*F = force (N) (lb)*

*A = area of object ($m^2$) ($in^2$)*

## Young's Modulus (Tensile Modulus)

Young's modulus or Tensile modulus can be expressed as

*E = stress / strain = (F / A) / (dL / L) (3)*

*where*

*E = Young's modulus ($N/m^2$) ($lb/in^2$, psi)*

## Elasticity

Elasticity is a property of an object or material which will restore it to its original shape after distortion.

A spring is an example of an elastic object - when stretched, it exerts a restoring force which tends to bring it back to its original length. This restoring force is in general proportional to the stretch described by Hooke's Law.

## Hooke's Law

One of the properties of elasticity is that it takes about twice as much force to stretch a spring twice as far. That linear dependence of displacement upon stretching force is called Hooke's law which can be expressed as

*$F_s$ = -k dL (4)*

*where*

*$F_s$ = force in the spring (N)*

*k = spring constant (N/m)*

*dL = elongation of the spring (m)*

## Yield strength

Yield strength, or the yield point, is defined in engineering as the amount of strain that a material can undergo before moving from elastic deformation into plastic deformation.

## Ultimate Tensile Strength

The Ultimate Tensile Strength (UTS) of a material is the limit stress at which the material actually breaks, with sudden release of the stored elastic energy.

## Related Topics

- Material Properties Material properties as densities, heat capacities for gases, fluids and solids ....
- Mechanics The branch of physics that deals with the kinetics and dynamics of objects

## Related Documents

- Speed of Sound Calculation formulas for the velocity of sound in gas, fluid or solid
- Young Modulus of Elasticity for Metals Elastic properties and Youngs modulus for common metals as cast iron, carbon steel and more
- Thermoplastics - Physical Properties Physical properties of some common thermoplastics as ABS, PVC, CPVC, PE, PEX, PB and PVDF
- Stress in Bolts Calculating the stressed area in bolts
- Modulus of Rigidity Shear Modulus or Modulus of Rigidity is the coefficient of elasticity for a shearing or torsion force
- Stress in Thick-Walled Tubes or Cylinders Radial and tangential stress in thick-walled tubes or cylinders - internal and external pressure
- Stress and Strain Stress is force per area - strain is deformation of a solid due to stress



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